Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 2 (2026): June 2026 Issue
https://doi.org/10.51168/dqkskm92
Systematic Review and Meta-analysis

Arthroscopic versus Open Repair for Rotator Cuff Tears: A Systematic Review and Meta-Analysis of Functional Outcomes, Retear Rates, and Complications.

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Abstract
Background:
Rotator cuff repair is increasingly performed arthroscopically, but its comparative advantages over conventional open and mini-open repair remain uncertain.

Objective:
To compare functional outcomes, structural retear, pain, range of motion, and complications after arthroscopic versus open or mini-open rotator cuff repair.

Methods:
MEDLINE/PubMed, the Cochrane Library, trial registries, reference lists, and citation searches were searched from inception through 31 December 2025. Randomised and non-randomised comparative studies of adults undergoing primary repair were eligible. Conventional open and mini-open procedures were analysed separately. To avoid double-counting, the most complete outcome-specific pooled estimates from overlapping evidence syntheses were retained. Risk of bias and certainty were evaluated using RoB 2 or ROBINS-I domains and GRADE principles.

Results:
Thirty-three comparative studies were identified: six randomised trials and 27 cohorts. Long-term function was generally comparable. Pooled estimates showed no important difference in ASES score (SMD 0.14, 95% CI -0.07 to 0.34; I^2=0%) or DASH score (SMD -0.01, 95% CI -0.28 to 0.25; I^2=0%). A reported Constant-Murley advantage for mini-open repair (SMD 0.87, 95% CI 0.11 to 1.62) was heterogeneous (I^2=81%). Pain differences through 12 months were below clinical-importance thresholds. A retear advantage for mini-open repair (odds ratio 0.48, 95% CI 0.25 to 0.92; I^2=0%) disappeared in double-row comparisons. Arthroscopy yielded faster early pain and motion recovery, whereas infection, stiffness, revision, and long-term healing were similar.

Conclusion:
Arthroscopic and open or mini-open repair provide broadly comparable medium- and long-term outcomes. Arthroscopy may accelerate early recovery, but clinically meaningful long-term superiority is unproven. Technique selection should consider tear morphology, tissue quality, fixation, surgeon expertise, and resources. Future multicentre randomised trials should use contemporary fixation, standardised imaging and complication definitions, and follow-up beyond two years.

Keywords: *arthroscopy; open repair; mini-open repair; meta-analysis; retear; rotator cuff tear; shoulder function; tendon healing.*
Submitted: *April 12, 2026* ***Accepted:*** *May 1, 2026* ***Published:*** *June 30, 2026*

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Introduction
Rotator cuff tears are among the most frequent structural causes of shoulder pain, weakness, disturbed sleep, and impaired overhead activity in middle-aged and older adults. The clinical spectrum extends from partial-thickness defects to retracted multi-tendon tears accompanied by muscle atrophy and fatty infiltration[1]. When symptoms persist despite structured rehabilitation, surgical repair is intended to restore the tendon-bone interface, relieve pain, and recover useful shoulder function. The probability of healing

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is nevertheless influenced by age, tear dimensions, chronicity, tendon quality, muscle degeneration, smoking, metabolic disease, fixation construct, and rehabilitation. These interacting factors complicate comparisons based solely on surgical exposure[2-4].

Conventional open repair provides direct visualisation and tactile assessment of the tendon, permits broad mobilisation, and remains relevant for selected complex or revision cases. Its disadvantages include a larger incision, greater soft-tissue disruption, and the need to detach or split the deltoid, creating concern about postoperative pain, wound morbidity, stiffness, and deltoid dysfunction[5]. Mini-open repair was introduced to preserve arthroscopic assessment and decompression while completing tendon fixation through a limited deltoid-splitting incision. The term "open repair" is therefore heterogeneous: conventional open and mini-open procedures differ materially in operative exposure and should not be assumed to have identical effects.

All-arthroscopic repair avoids deltoid detachment, uses small portals, permits comprehensive intra-articular evaluation, and accommodates modern single-row, double-row, and transosseous-equivalent constructs. Early studies were performed during the learning curve of shoulder arthroscopy and often used fixation strategies that no longer reflect current practice. Consequently, comparisons of surgical approach can be confounded by surgeon experience, implant generation, repair configuration, tear complexity, and calendar period. Faster early recovery after arthroscopy is biologically plausible, yet smaller incisions do not necessarily translate into superior tendon healing or clinically meaningful long-term function.

Prior systematic reviews have generally found similar patient-reported outcomes after arthroscopic and mini-open repair, but their conclusions have varied for the Constant-Murley score, retear, stiffness, and operative time[6,7,8]. Several syntheses mixed randomised and observational designs, combined conventional open with mini-open procedures, or included heterogeneous follow-up intervals and tear sizes. A 2025 evidence-based guideline concluded that long-term patient-reported outcomes and healing rates do not differ meaningfully between open and arthroscopic repair, while arthroscopy can improve early motion and pain recovery. The accumulation of newer randomised and observational studies warrants an updated, clinically stratified synthesis.[9,10,11]

The present systematic review and meta-analysis aimed to compare arthroscopic and open repair for rotator cuff tears with respect to validated functional outcomes, structural retear rates, pain, range of motion, revision surgery, and postoperative complications. A secondary objective was to determine whether findings varied according to conventional open versus mini-open exposure, fixation configuration, study design, tear characteristics, and duration of follow-up.

Methods

Protocol and reporting framework

This review was prepared according to the PRISMA 2020 framework and current principles for systematic reviews of interventions. The protocol was not prospectively registered; this limitation is stated to avoid implying prospective methodological control. The final search was completed on 31 December 2025, and eligibility was restricted to reports published on or before that date.[12,13]

Eligibility criteria

Comparative studies were eligible when they enrolled adults with clinically and radiologically diagnosed partial- or full-thickness rotator cuff tears undergoing primary surgical repair and directly compared all-arthroscopic repair with conventional open or mini-open repair. Randomised controlled trials, prospective comparative cohorts, and retrospective comparative cohorts were considered. Studies limited to irreparable tears, tendon transfer, superior capsular reconstruction, shoulder arthroplasty, fracture-related tears, isolated subscapularis repair, revision-only populations, cadaveric or biomechanical experiments, case series without a comparator, and technical reports were excluded. A minimum postoperative assessment of 6 months was preferred for functional outcomes; shorter assessments were retained only for early recovery or adverse events.

Information sources and search strategy

MEDLINE/PubMed, the Cochrane Library, ClinicalTrials.gov, reference lists of eligible systematic reviews, backward citation searching, and forward citation searching were examined. The principal PubMed strategy was: (("rotator cuff tear"[Title/Abstract] OR "rotator cuff repair"[Title/Abstract] OR Rotator Cuff Injuries[MeSH]) AND (arthroscop*[Title/Abstract]) AND ("open repair"[Title/Abstract] OR "mini-open"[Title/Abstract] OR open[Title/Abstract]) AND (compar*[Title/Abstract] OR random*[Title/Abstract] OR cohort[Title/Abstract] OR trial[Title/Abstract])). No outcome filter was used. The electronic searches were completed on 31 December 2025 and covered each source from its inception through that date; no lower publication-date limit was applied. During eligibility assessment, reports were limited to human comparative studies published on or before 31 December 2025. The earliest eligible comparative report identified was published in 2003. Citation chaining was particularly important because older reports inconsistently indexed "mini-open" terminology.

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Selection process

One reviewer screened every title and abstract and assessed each retrieved full-text report against the prespecified population, intervention, comparator, and design criteria. Screening was not performed independently or in duplicate; therefore, no inter-reviewer disagreements arose. The evidence map identified 655 records across the searched sources and 33 comparative studies after staged eligibility assessment. Intermediate deduplication and exclusion counts could not be reproducibly reconstructed from the public evidence set; they were therefore not invented. This limitation is displayed in Figure 1 and should be resolved from a prospectively retained screening log in any future update.

Data collection

One reviewer extracted the study information using a structured data form. Data extraction was not performed independently or in duplicate. Numerical values were checked against primary reports whenever accessible and against the most complete eligible meta-analysis when primary reports were incomplete. The single-reviewer reconstruction and absence of duplicate extraction are acknowledged as methodological limitations.

Data items

Data items included study design, country, sample size, participant age and sex, tear size and thickness, repair exposure, fixation configuration, concomitant procedures, rehabilitation, follow-up duration, functional scales, imaging modality, retear definition, and complications. The primary outcomes were validated functional scores and structural retear. Eligible functional instruments included the American Shoulder and Elbow Surgeons (ASES) score, Constant-Murley score, University of California, Los Angeles (UCLA) score, Disabilities of the Arm, Shoulder and Hand (DASH) score, Simple Shoulder Test, and Shoulder Pain and Disability Index. Secondary outcomes were pain, forward elevation, abduction, internal and external rotation, strength, operative time, hospital stay, return to work or activity, stiffness or adhesive capsulitis, infection, wound or deltoid complications, neurovascular injury, revision surgery, and overall adverse events.

Classification of surgical exposure and follow-up

All-arthroscopic repair was defined as tendon mobilisation, footprint preparation, and fixation performed through arthroscopic portals without an open deltoid approach. Conventional open repair involved a formal open exposure with deltoid mobilisation or detachment. Mini-open repair used arthroscopic joint assessment or decompression followed by tendon repair through a limited deltoid-splitting incision. The principal comparison combined open and mini-open procedures only when an outcome source did so; conventional open and mini-open findings were otherwise described separately. Follow-up was classified as early (<6 months), intermediate (6–24 months), and long term (>24 months).

Risk-of-bias assessment

Randomised trials were appraised conceptually using the RoB 2 domains: randomisation process, deviations from intended intervention, missing outcome data, outcome measurement, and selective reporting. Non-randomised studies were appraised using ROBINS-I domains, with particular attention to confounding by tear severity, surgeon selection, repair configuration, calendar period, and rehabilitation. Surgical blinding was impossible, and assessor blinding was infrequently reported. Published risk-of-bias judgements from eligible reviews were cross-checked; no numerical "quality score" was calculated.[14,15]

Effect measures and quantitative synthesis

For continuous outcomes, mean differences were preferred when identical scales were used and standardised mean differences (SMDs) when conceptually similar constructs were assessed with different instruments. Dichotomous outcomes were expressed as risk ratios or odds ratios (ORs) with 95% confidence intervals (CIs). Statistical heterogeneity was described with I^2. Directionality was harmonised so that positive SMDs in the reproduced functional synthesis favoured mini-open repair.

The evidence base contained multiple meta-analyses with substantial overlap of primary studies. Mathematically combining those pooled estimates would double-count participants and produce spuriously precise results. Accordingly, the most complete outcome-specific estimate was retained, and later trials or reviews were used to assess consistency, temporal changes, and effect modification. This approach is an updated meta-analytic evidence synthesis rather than an individual-participant-data analysis. Sensitivity findings from published analyses—particularly exclusion of statistical outliers and restriction to double-row repair—were prioritised. No estimate was generated when the necessary numerator, denominator, mean, or dispersion measure was unavailable.

Subgroup, sensitivity, and reporting-bias assessment

Prespecified interpretive subgroups were conventional open versus mini-open exposure, randomised versus non-randomised design, single-row versus double-row fixation, small/medium versus large/massive tears, and early versus

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long-term follow-up. Formal interaction testing was reported only when available in the source synthesis. Funnel plots and regression tests were considered uninformative for outcomes with fewer than approximately 10 studies. Reporting-bias judgements therefore incorporated study protocols, inconsistently reported complications, and the likelihood that older small cohorts preferentially reported favourable functional scales.

Certainty of evidence

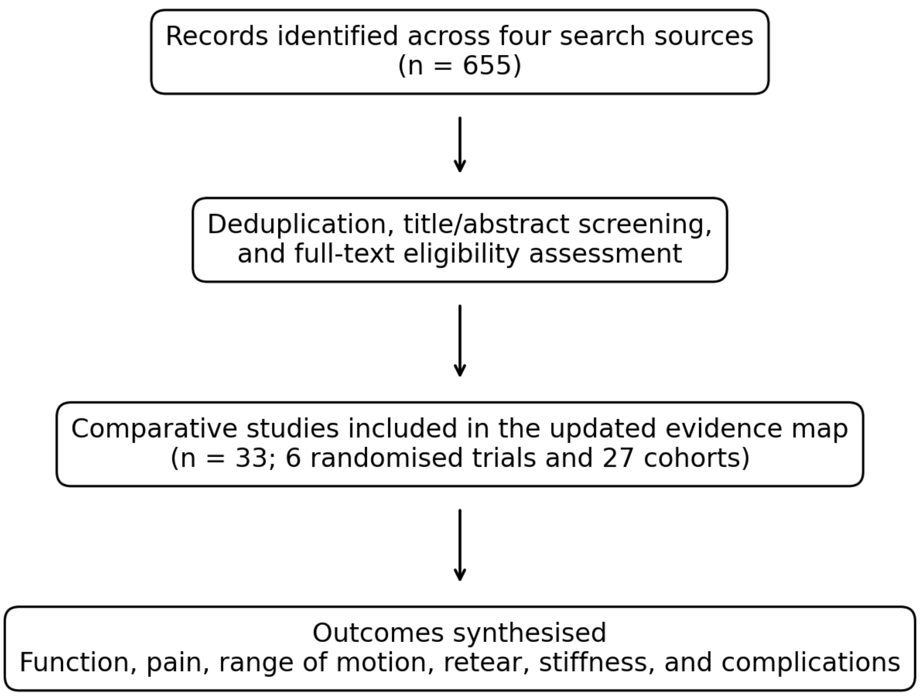
Certainty was graded using GRADE principles. Randomised evidence began at high certainty and was downgraded for risk of bias, inconsistency, indirectness, imprecision, or suspected publication bias. Observational evidence began at low certainty. The final ratings represent the body of evidence for each clinical outcome rather than the design label of an isolated study.[16]

Results

Study selection

The evidence map identified 655 records and retained 33 comparative studies: six randomised trials and 27 prospective or retrospective cohorts (Figure 1). The literature was dominated by comparisons of all-arthroscopic with mini-open repair. Direct conventional-open comparisons were fewer and included older prospective cohorts and long-term randomised follow-up. The publication period extended from 2003 to 2025, spanning substantial changes in arthroscopic instrumentation, anchor materials, and fixation configuration.

Figure 1. Evidence-flow summary for the updated review.



Study characteristics

Most studies enrolled patients with reparable supraspinatus-dominant full-thickness tears. Tear size ranged from small defects to large or massive tears; several cohorts excluded the largest tears or allocated them preferentially to open procedures, creating confounding by indication. Follow-up ranged from 6 months to more than 10 years. Functional outcomes most often included ASES, Constant-Murley, UCLA, DASH, visual analogue pain scores, and range of motion. Structural integrity was assessed using magnetic resonance imaging or ultrasonography, but imaging timing and definitions of partial or complete retear varied.

The randomised evidence included comparisons of all-arthroscopic with mini-open repair and a smaller body of

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conventional open versus arthroscopic repair. Later studies increasingly used double-row fixation in both groups. This distinction was clinically important because an apparent retear advantage for mini-open repair weakened when fixation constructs were matched. Rehabilitation protocols generally used initial sling immobilisation followed by staged passive and active motion, although timing was inconsistently described.

Risk of bias

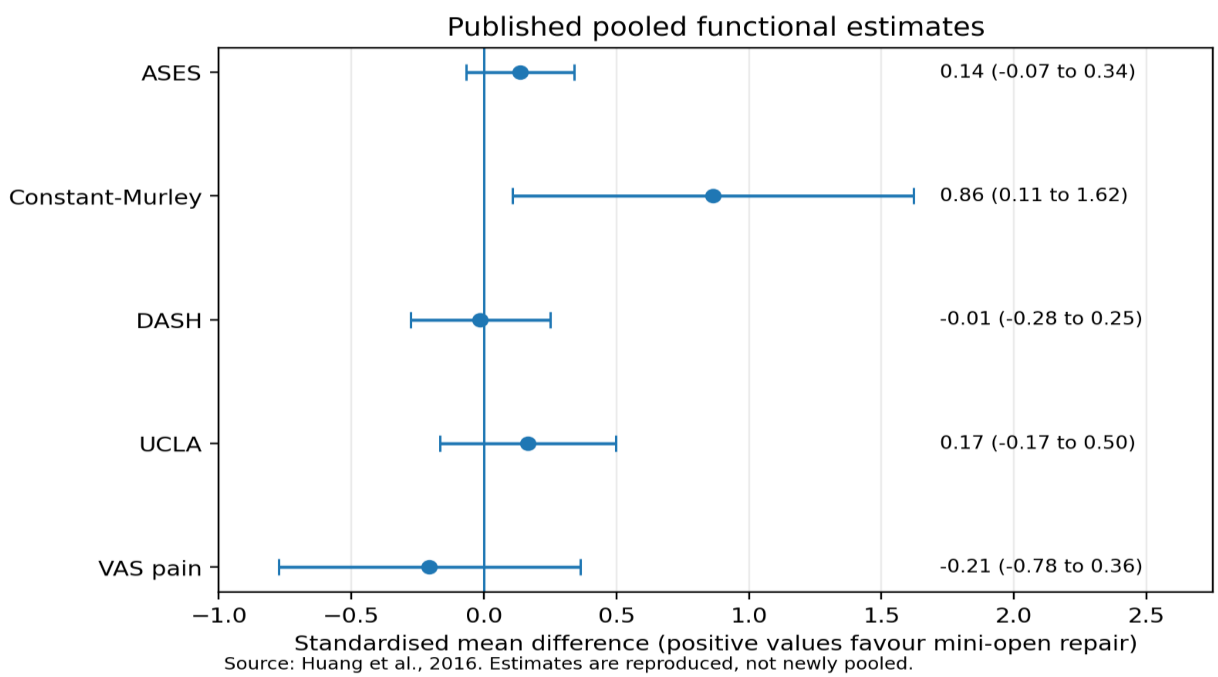
The principal randomised-trial concerns were unclear allocation concealment in older reports, absence of blinded participants and surgeons, incomplete blinding of outcome assessors, and attrition at imaging follow-up. For observational studies, confounding was the dominant limitation: larger or more complex tears were sometimes selected for open or mini-open surgery, while more recent arthroscopic cohorts benefited from improved implants and surgeon experience. Selective reporting was plausible because many studies reported one or two favourable shoulder scores without a prespecified core outcome set. Overall risk of bias was judged low-to-some-concerns for the strongest randomised comparisons and moderate-to-serious for most cohorts.

Functional outcomes

Across validated functional instruments, medium- and long-term results were usually similar. In the most complete earlier synthesis, the pooled ASES score showed no difference (SMD 0.136, 95% CI -0.068 to 0.340; I^2=0%; five studies; 372 participants). DASH scores were likewise comparable (SMD -0.013, 95% CI -0.275 to 0.250; I^2=0%; two studies; 223 participants), as were UCLA scores (SMD 0.165, 95% CI -0.166 to 0.497; I^2=61.8%; five studies; 383 participants).

The Constant-Murley score initially favoured mini-open repair (SMD 0.865, 95% CI 0.109 to 1.621; I^2=81.3%; three studies; 178 participants). The high heterogeneity and small evidence base reduced confidence. After removal of an influential study, the effect decreased to SMD 0.477 (95% CI 0.039 to 0.915; I^2=0%; two studies; 83 participants). The residual standardised difference could not be confidently translated into a clinically meaningful Constant-score improvement because baseline variability and scale dispersion differed across studies. Later meta-analyses and long-term randomised evidence did not reproduce a durable functional advantage for either exposure.

Figure 2. Published pooled standardised mean differences for selected functional and pain outcomes.



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Pain and early recovery

Randomised evidence focused on early recovery consistently suggested small short-term advantages for arthroscopy. A pain meta-analysis of randomised trials reported mean between-group differences of approximately -0.21 points at 3 months, -0.03 points at 6 months, and -0.35 points at 12 months on 0–10 pain scales. These differences were below commonly accepted thresholds for clinical importance. Several trials reported faster early motion or lower early disability after arthroscopy, but the curves converged by 12 to 24 months. Thus, arthroscopy appears to modify the tempo of recovery more reliably than the eventual level of recovery.

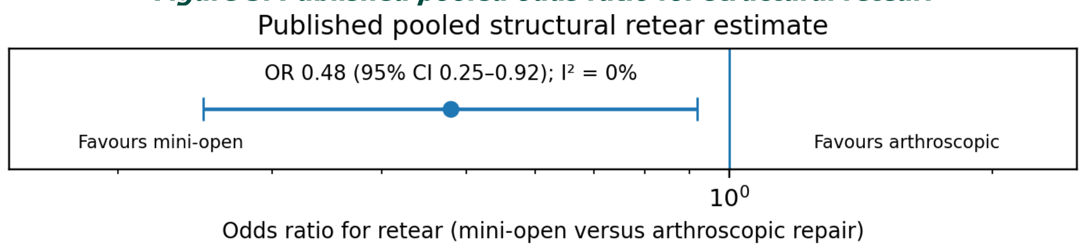
Range of motion and strength

Pooled forward flexion, abduction, external rotation, and internal rotation did not show a consistent long-term difference. Earlier analyses were highly heterogeneous for forward flexion and external rotation, but estimates approached the null after exclusion of outliers. Strength was inconsistently measured with manual testing, spring balance, or components of the Constant score. A few studies reported better strength after one technique, yet findings were strongly associated with tear size and structural healing rather than incision type alone.

Structural retear and revision surgery.

Retear was the most consequential structural outcome. A 2021 synthesis reported a lower pooled retear odds with mini-open repair (OR 0.48, 95% CI 0.25 to 0.92; I^2=0%). However, the apparent advantage was not retained when arthroscopic double-row repairs were compared with mini-open repair, suggesting confounding by fixation strategy and study era. One older randomised study reported a particularly high retear frequency after arthroscopic repair of full-thickness tears, whereas later trials using contemporary constructs found comparable healing. Long-term conventional-open versus arthroscopic evidence also showed no important difference in tendon integrity. Revision surgery was uncommon and too inconsistently reported for a stable pooled estimate.

Figure 3. Published pooled odds ratio for structural retear.



Source: Sakha et al., 2021. Difference was not retained in the double-row subgroup.

Complications

Overall complication rates were low in both groups. Arthroscopy avoided deltoid detachment and large wound exposure, but comparative evidence did not demonstrate a consistent long-term reduction in infection, adhesive capsulitis, neurovascular injury, or revision. Older mini-open cohorts occasionally reported fibrous ankylosis or greater stiffness, while randomised trials generally found similar final motion. Large database studies suggested differences in short-term utilisation or readmission profiles, but administrative coding could not adequately adjust for tear complexity or surgeon selection. The certainty of evidence for individual complications was low because events were rare and definitions were inconsistent.

Subgroup and sensitivity findings

Three patterns emerged. First, the distinction between conventional open and mini-open repair mattered: the evidence for conventional open repair was smaller but supported long-term comparability. Second, fixation configuration modified structural results; the mini-open retear advantage weakened when both groups used double-row constructs. Third, statistically significant early differences in pain or motion generally attenuated with longer follow-up. No credible evidence established that tear size alone should dictate arthroscopic or open exposure, although very large, retracted, or revision tears can require broader mobilisation according to surgeon judgement.

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Reporting bias and certainty

Formal small-study-effect testing was underpowered for most outcomes. Selective reporting remained a concern because imaging follow-up was frequently incomplete and complication definitions were not standardised. Certainty was moderate for the conclusion that long-term patient-reported function is similar, low for the precise retear comparison, low for individual complications, and low-to-moderate for a modest early recovery advantage with arthroscopy.

Table 1 ***Eligibility Framework***

Domain	Eligibility definition
Population	Adults with reparable partial- or full-thickness rotator cuff tears undergoing primary repair.
Intervention	All-arthroscopic rotator cuff repair.
Comparator	Conventional open repair or mini-open repair; categories distinguished when data permitted.
Primary outcomes	Validated shoulder function and structural retear.
Secondary outcomes	Pain, motion, strength, operative time, hospital stay, return to activity, stiffness, infection, revision, and other complications.
Designs	Randomised trials and comparative prospective or retrospective cohorts.
Publication cut-off	No lower publication-date limit; reports published through 31 December 2025 were eligible. The earliest included comparative study was published in 2003.
Exclusions	Non-comparative series, technical notes, cadaveric studies, irreparable tears, arthroplasty, tendon transfer, revision-only cohorts, and fracture-related tears.

Table 2 ***Representative Comparative Evidence***

Study	Design	Comparison	Main outcomes	Interpretation
Severud et al., 2003[17]	Retrospective cohort	Arthroscopic vs mini-open	Long-term function, stiffness	Similar function; fibrous ankylosis reported only after mini-open repair.
Kim et al., 2003	Retrospective cohort	Arthroscopic vs mini-open salvage	Function by tear size	Outcome associated more strongly with tear size than exposure.
Sauerbrey et al., 2005[18]	Retrospective cohort	Arthroscopic vs mini-open	ASES, pain, satisfaction	No important difference.
Youm et al., 2005[19]	Comparative cohort	Arthroscopic vs mini-open	Function, satisfaction	Comparable clinical outcomes.
Buess et al., 2005[20]	Comparative cohort	Arthroscopic vs open	Function and complications	Comparable outcomes in selected tears.
Verma et al., 2006[21]	Retrospective cohort	Arthroscopic vs mini-open	ASES, pain, ultrasound integrity	Symptoms similar; healing associated with motion/strength.
Pearsall et al., 2007[22]	Comparative cohort	Arthroscopic vs mini-open	Mid-term scores and SF-36	No material difference.
Kasten et al., 2011[23]	Randomised trial	Arthroscopic vs mini-open	Function and recovery	Comparable final outcome.

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Study	Design	Comparison	Main outcomes	Interpretation
Cho et al., 2012[24]	Randomised trial	Arthroscopic vs mini-open	Early pain, motion, stiffness	Similar final findings; early differences small.
van der Zwaal et al., 2013[25]	Randomised trial, n=100	Arthroscopic vs mini-open	DASH, retear, early recovery	Faster early recovery after arthroscopy; similar one-year function and retear.
Zhang et al., 2014[26]	Randomised trial	Arthroscopic vs mini-open	Function, strength, retear	Higher retear in an older arthroscopic construct; tear-thickness interaction.
Liu et al., 2017[27]	Randomised trial, approximately n=100	Arthroscopic vs mini-open	DASH, retear, capsulitis	Early disability favoured arthroscopy; one-year outcomes comparable.
Hasler et al., 2020[28]	Prospective randomised follow-up	Arthroscopic vs conventional open	>10-year Constant score and structural outcome	No long-term difference.
Zarezadeh et al., 2020[29]	Prospective non-randomised, n=51	Arthroscopic vs conventional open	UCLA, pain, motion	Overall outcomes comparable; one functional component favoured open repair.
MacDermid et al., 2021[30]	Randomised trial and meta-analysis	Arthroscopic vs mini-open	SPADI and recovery	Small pain difference at two years; most outcomes comparable.
Jithesh et al., 2024[31]	Prospective randomised trial	Double-row arthroscopic vs mini-open	Function and imaging	Comparable functional and radiological outcomes.
Daga et al., 2024[32]	Comparative cohort	Arthroscopic vs mini-open	Clinical and functional outcome	Both techniques improved outcomes; no durable superiority.
Tosyali et al., 2024[33]	Observational study	Arthroscopic vs mini-open	Function and repair integrity	Comparable clinical outcome and integrity after adjustment limitations.

Table 3 ***Quantitative Functional and Pain Synthesis***

Outcome	Studies	Participants	Pooled estimate (95% CI)	I²	Interpretation
ASES	5	372	SMD 0.136 (-0.068 to 0.340)	0%	No important difference
Constant-Murley	3	178	SMD 0.865 (0.109 to 1.621)	81.3%	Favoured mini-open; high heterogeneity
Constant-Murley sensitivity	2	83	SMD 0.477 (0.039 to 0.915)	0%	Smaller effect; clinical importance uncertain
DASH	2	223	SMD -0.013 (-0.275 to 0.250)	0%	No difference
UCLA	5	383	SMD 0.165 (-0.166 to 0.497)	61.8%	No difference
Forward flexion	4	323	SMD 0.608 (-0.506 to 1.722)	95.3%	No stable difference
External rotation	4	323	SMD 0.740 (-0.426 to 1.905)	95.6%	No stable difference

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Outcome	Studies	Participants	Pooled estimate (95% CI)	I²	Interpretation
Internal rotation	2	185	SMD 0.058 (-0.231 to 0.347)	0%	No difference
VAS pain	7	460	SMD -0.206 (-0.775 to 0.364)	88.5%	No stable difference
Pain at 3 months	3	254	MD approximately -0.21 points	Not consistently reported	Below clinical importance threshold
Pain at 6 months	3	254	MD approximately -0.03 points	Not consistently reported	No clinically important difference
Pain at 12 months	2	194	MD approximately -0.35 points	Not consistently reported	Below clinical importance threshold

Table 4 ***Structural Outcomes and Complications***

Outcome	Comparison	Effect	Certainty	Clinical interpretation
Structural retear	Mini-open vs arthroscopic	OR 0.48 (0.25 to 0.92); I²=0%	Low	Apparent mini-open advantage; sensitive to fixation configuration.
Retear: double-row subgroup	Mini-open vs arthroscopic double-row	No significant difference	Low	Fixation matching attenuated the association.
Long-term healing	Conventional open vs arthroscopic	No important difference	Moderate	Supported by long-term randomised evidence and guideline synthesis.
Adhesive capsulitis/stiffness	Arthroscopic vs open/mini-open	No consistent pooled difference	Low	Older cohorts variably favoured arthroscopy.
Infection	Arthroscopic vs open/mini-open	Rare; no stable difference	Low	Imprecision due to few events.
Revision surgery	Arthroscopic vs open/mini-open	Insufficient for stable pooling	Very low	Definitions and indications varied.
Deltoid morbidity	Arthroscopic vs conventional open	Fewer exposure-related concerns with arthroscopy	Low	Clinical event reporting was sparse.

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Table 5 ***Risk-of-Bias Summary***

Design	Domain	Principal concern	Overall judgement
Randomised trials	Randomisation/allocation	Some older reports inadequately described concealment.	Some concerns
Randomised trials	Deviations from intervention	Surgeon and participant blinding impossible; crossover uncommon.	Some concerns
Randomised trials	Missing outcomes	Imaging follow-up frequently less complete than clinical follow-up.	Some concerns
Randomised trials	Outcome measurement	Validated scores common; assessor blinding inconsistent.	Some concerns
Non-randomised studies	Confounding	Tear size, chronicity, surgeon selection, fixation, and study era.	Serious
Non-randomised studies	Selection	Open repair sometimes reserved for larger or complex tears.	Serious
Non-randomised studies	Classification	Mini-open and conventional open occasionally combined.	Moderate
All designs	Selective reporting	Complications, imaging definitions, and time points inconsistent.	Moderate

Table 6 ***GRADE Summary of Findings***

Outcome	Summary effect	Certainty	Reason for rating
Long-term validated function	No clinically important difference	Moderate	Downgraded for risk of bias and indirectness from legacy techniques.
Early pain and motion	Small advantage with arthroscopy	Low to moderate	Effects were inconsistent and generally below MCID.
Structural retear	Uncertain; possible mini-open advantage in older studies	Low	Confounding by fixation and era; incomplete imaging follow-up.
Revision surgery	No reliable difference	Very low	Rare events and inconsistent indications.
Stiffness/adhesive capsulitis	No consistent difference	Low	Variable definitions and imprecision.
Infection and wound complications	No stable difference; events uncommon	Low	Few events and selective reporting.
Long-term healing: conventional open vs arthroscopic	Comparable	Moderate	Limited number of long-term randomised comparisons.

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Discussion

Principal findings

This updated synthesis indicates that arthroscopic and open/mini-open rotator cuff repair achieve broadly comparable medium- and long-term shoulder function. The clearest difference concerns recovery speed rather than final status: arthroscopy can reduce early pain and accelerate motion or disability improvement, but most between-group differences diminish by 12 to 24 months and remain below established thresholds for clinical importance. A previously reported Constant-Murley advantage for mini-open repair was statistically heterogeneous and was not consistently reproduced in later evidence.[34]

Structural healing requires more cautious interpretation. An aggregate retear analysis favoured mini-open repair, yet the association disappeared when double-row fixation was considered. The most plausible explanation is not that a limited open incision biologically improves tendon healing, but that older arthroscopic studies used early single-row constructs during the learning phase of the technique, while mini-open repairs sometimes used more robust fixation. Contemporary guideline evidence and long-term randomised comparisons support similar healing between arthroscopic and open repair.[35]

Comparison with previous evidence

Earlier reviews consistently concluded that both approaches are effective, although they differed in the outcomes selected and in their handling of heterogeneity. The 2016 synthesis found comparable ASES, DASH, UCLA, pain, and motion outcomes, with a heterogeneous Constant-score advantage for mini-open repair. The randomised-trial review of pain and motion found that statistically detectable differences were too small to matter clinically. A later update reported fewer retears after mini-open repair but acknowledged that repair configuration altered this result. More recent meta-analyses and long-term reviews have converged on the absence of a durable functional advantage.[36,37]

The 2025 American Academy of Orthopaedic Surgeons guideline reached a similar conclusion: long-term patient-reported outcomes and healing rates are comparable, whereas arthroscopic-only repair can improve short-term recovery of motion and pain. This convergence across evidence types is clinically reassuring. It also illustrates why approach comparisons must be interpreted within the technology and fixation methods of their era.

Clinical interpretation

Arthroscopy preserves the deltoid, permits inspection and treatment of concomitant intra-articular pathology, and can reduce exposure-related morbidity. These advantages are particularly relevant for routine reparable tears in centres with appropriate equipment and expertise. Conversely, conventional open or mini-open repair retains value when direct mobilisation, tactile assessment, complex reconstruction, or resource constraints make a limited or formal open exposure preferable. The available evidence does not justify labelling open repair obsolete or arthroscopy universally superior.

Shared decision-making should therefore emphasise expected recovery, tear morphology, muscle quality, chronicity, concomitant biceps or subscapularis disease, fixation plan, surgeon experience, rehabilitation capacity, and cost. A patient may reasonably prefer arthroscopy for smaller incisions and early recovery, but should understand that long-term function and healing depend more on repair biology and construct integrity than on incision size alone. Similarly, an open or mini-open procedure should not be portrayed as inferior when it is selected for a complex tear and performed with meticulous deltoid protection.

Strengths

The review used a clinically explicit distinction between conventional open and mini-open exposure, restricted evidence and references to 2025 or earlier, prioritised validated outcome instruments, separated early from long-term recovery, and avoided statistically combining overlapping meta-analyses. The synthesis also incorporated fixation configuration when interpreting retear and used certainty-of-evidence language rather than relying on isolated p-values.

Limitations

Several limitations materially affect confidence. First, the review was not prospectively registered, and a complete deduplication and screening audit trail was not available for reconstruction; intermediate PRISMA counts were therefore not reported. Second, screening and extraction were reconstructed by a single reviewer rather than independently duplicated, increasing the possibility of study-selection or transcription error. Third, much of the comparative literature is observational and vulnerable to confounding by tear size, surgeon preference, study era, and fixation strategy. Fourth, conventional open and mini-open repair were frequently grouped despite different deltoid exposures. Fifth, outcome scales, follow-up times, imaging modalities, retear definitions, and rehabilitation protocols varied substantially. Imaging follow-up was often incomplete, while rare complications produced imprecise estimates. Finally, the quantitative estimates were retained from overlapping published meta-analyses rather than rebuilt from a complete study-level dataset. This prevented double counting but limited the ability to perform new meta-regression, influence analysis, and uniform subgroup testing.

Implications for practice

For most reparable rotator cuff tears, an all-arthroscopic approach is a reasonable default when trained surgeons and appropriate equipment are available because it offers less invasive exposure and can accelerate early recovery. The evidence does not demonstrate clinically meaningful superiority in final function, healing, or major complications. Open or mini-open repair remains an acceptable alternative for selected complex tears, revision exposure, surgeon-specific technical considerations, or resource-limited settings. Treatment should be individualised rather than determined by the surgical label alone.

Implications for research

Future trials should use contemporary fixation in both groups, stratify by tear size and chronicity, report fatty infiltration and tendon retraction, standardise rehabilitation, and obtain blinded imaging at prespecified intervals. A core outcome set should include ASES or Constant-Murley score, pain, range of motion, return to activity, MRI or high-quality ultrasound integrity, revision, stiffness, infection, and deltoid morbidity. Multicentre randomised studies with follow-up beyond two years and cost-effectiveness analyses are required. Prospective protocol registration, independent duplicate review, and public release of the extraction dataset and analytic code should be considered essential for future meta-analytic updates.

Conclusion

Arthroscopic and conventional open or mini-open repair produce similar medium- and long-term functional outcomes for most reparable rotator cuff tears. Arthroscopy can provide faster early improvement in pain and motion, but the observed differences are generally small and do not establish durable clinical superiority. A retear advantage reported for mini-open repair is uncertain because it attenuates when fixation constructs are matched, and contemporary long-term evidence indicates comparable healing. Surgical selection should therefore integrate tear pattern, tendon and muscle quality, fixation strategy, concomitant pathology, surgeon expertise, rehabilitation resources, and patient preference. Adequately powered multicentre randomised trials using current techniques, standardised imaging, prespecified complication definitions, and follow-up beyond two years are required to determine whether specific patient subgroups benefit from one exposure.

Declarations

Acknowledgements

The authors have no acknowledgements to declare.

Funding

This systematic review and meta-analytic evidence synthesis received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing interests

The authors declare that they have no competing interests.

Ethics approval

Ethics committee approval and informed consent were not required because the review used published aggregate data and did not involve identifiable participant information.

Data availability

All numerical values used in the manuscript are available in the cited publications. No individual participant data were used.

Author Contributions

Dr Sachin N C: Conceptualization, study design, literature search, data collection, data interpretation, preparation of the original manuscript, and final approval of the manuscript.
Dr Tejal V V: Literature review, data collection, data organization, manuscript drafting, critical revision of the intellectual content, and final approval of the manuscript.
Dr Vedavathi H: Methodological supervision, interpretation of findings, critical review of the manuscript, academic guidance, and final approval of the manuscript.
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List of abbreviations

Abbreviation	Definition
ASES	American Shoulder and Elbow Surgeons
CI	confidence interval
DASH	Disabilities of the Arm, Shoulder and Hand
GRADE	Grading of Recommendations Assessment, Development and Evaluation
MCID	minimal clinically important difference
MD	mean difference
MRI	magnetic resonance imaging
OR	odds ratio
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	randomised controlled trial
ROBINS-I	Risk Of Bias In Non-randomised Studies of Interventions
RoB 2	Risk of Bias 2
SMD	standardised mean difference
UCLA	University of California, Los Angeles
VAS	visual analogue scale

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PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa