Original Article

A Study of the Single Row Vs Double Row Suture Technique in Moderate Rotator Tear of the Rotator Cuff

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Abstract

Background: Rotator cuff tears are a leading cause of shoulder pain and disability. Arthroscopic repair using either single-row (SR) or double-row (DR) suture techniques is widely practiced, but the optimal construct for moderate-sized tears (1–3 cm) remains debated. While DR repair demonstrates superior biomechanical properties and tendon healing, its clinical superiority over SR repair is controversial. The objective is to compare functional and structural outcomes of SR versus DR arthroscopic repair in patients with moderate full-thickness rotator cuff tears. **Material and Methods:** This prospective, randomised controlled trial was conducted between August 2023 and August 2025 at a tertiary care centre. Eighty patients (age 40–75 years) with symptomatic full-thickness supraspinatus or infraspinatus tears (1–3 cm) were randomised to SR (n = 40) or DR (n = 40) repair. Standardised arthroscopic techniques and rehabilitation protocols were used. The primary outcome was improvement in the Constant score at 12 months. Secondary outcomes included American Shoulder and Elbow Surgeons (ASES) score, visual analogue scale (VAS) for pain, range of motion, tendon integrity on MRI, and complications. **Results:** Seventy-six patients (SR = 38, DR = 38) completed follow-up. Both groups showed significant improvement in functional outcomes at 12 months. Mean Constant scores improved to 82.6 ± 6.3 (SR) and 85.1 ± 5.9 (DR) (p = 0.07), and ASES scores to 83.5 ± 7.1 (SR) and 86.2 ± 6.8 (DR) (p = 0.09). VAS pain decreased significantly in both groups, with no intergroup difference (p = 0.12). MRI at 12 months showed intact repair in 84.2% of DR cases versus 71.0% of SR cases (p = 0.04). Complication rates were low and comparable. **Conclusion:** SR and DR arthroscopic repairs significantly improved pain relief, function, and range of motion in moderate-sized rotator cuff tears. DR repair yielded superior tendon healing and lower re-tear rates but did not result in significantly better short-term functional outcomes. Surgical choice may therefore be individualised, considering cost, surgeon preference, and patient-specific factors. Long-term follow-up is warranted to determine whether improved tendon integrity translates into superior clinical outcomes.

Keywords: Rotator cuff tear, arthroscopic repair, single-row, double-row, suture technique, tendon healing.

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Introduction

Rotator cuff tears are among the most frequent causes of shoulder pain and disability in adults, with prevalence rising steadily with age and cumulative physical activity.[1,2] While many tears remain asymptomatic, symptomatic lesions commonly produce weakness, night pain, and restricted shoulder motion, which together contribute to significant impairment in daily functioning and deterioration in quality of life.[3]

Advances in imaging, particularly magnetic resonance imaging (MRI), have revealed a high incidence of symptomatic and asymptomatic tears, emphasising the condition's progressive nature and its clinical relevance even in individuals without obvious symptoms.[3]

For patients with symptomatic, full-thickness tears who fail to respond to conservative therapy, surgical intervention is often indicated. Arthroscopic repair has become the standard of care because it offers minimally invasive access, superior visualisation of intra-articular structures, and reliable restoration of tendon–bone continuity.[4] Compared with open approaches, arthroscopic repair reduces morbidity and enables a quicker recovery.

The primary objectives of surgical repair are to secure the torn tendon, re-establish tendon–bone healing, and restore functional outcomes.[5] However, outcomes are influenced by multiple factors, including tear size, tendon quality, and repair technique. Large and massive tears, in particular, remain a challenge, as they are associated with lower healing rates despite complete arthroscopic repair.[5]

Given this ongoing controversy, the present study compared

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single-row and double-row arthroscopic suture techniques in moderate-sized rotator cuff tears. The primary objective was to evaluate functional outcomes using the Constant score, with secondary objectives including American Shoulder and Elbow Surgeons (ASES) score, visual analogue scale (VAS) pain, range of motion, re-tear rate on MRI, and complications. We hypothesised that while double-row repair may demonstrate superior tendon integrity, clinical outcomes at one year would not differ significantly between the two groups.

Materials and Methods

Study design and setting: This was a prospective, randomised, controlled clinical trial conducted at the Department of Orthopaedics, at Konaseema Institute of Medical Sciences, Amalapuram, AP, between August 2023 and August 2025, following approval from the Institutional Ethics Committee (IEC No: IEC/PR/2023/025 Dated 09-07-2023). Written informed consent was obtained from all participants.

Patient selection: Patients aged 40–75 years presenting with symptomatic full-thickness rotator cuff tears of moderate size (1–3 cm) confirmed by magnetic resonance imaging (MRI) were eligible.

Inclusion criteria:

Symptomatic, isolated supraspinatus or infraspinatus tear measuring 1–3 cm (anteroposterior dimension).

Duration of symptoms ≥3 months and failure of at least 6 weeks of conservative therapy (analgesics, physiotherapy, or corticosteroid injections).

Intact subscapularis and teres minor tendons.

Exclusion criteria:

Partial-thickness tears, massive tears (>3 cm or ≥ two tendons involved), or irreparable tears.

Prior surgery on the affected shoulder.

Associated glenohumeral arthritis (grade ≥3 Kellgren–Lawrence).

Neurological disorders affecting shoulder function.

Uncontrolled systemic illness (e.g., diabetes with HbA1c >8.5%).

Patients are unable to comply with the rehabilitation protocol or follow-up.

Randomisation and blinding: Eighty patients fulfilling eligibility criteria were randomly assigned in a 1:1 ratio to either the single-row (SR) repair group or the double-row (DR) repair group using a computer-generated random sequence. Sealed opaque envelopes ensured allocation concealment. Patients and outcome assessors were blinded to the type of repair; the operating surgeon could not be blinded.

Surgical procedure: All procedures were performed arthroscopically by experienced shoulder surgeons using a standardised technique under general anaesthesia with an interscalene block. Patients were positioned in the beach-chair position.

Single-row repair: After footprint preparation, one or two anchors were placed at the lateral footprint margin. Simple or mattress sutures were passed through the tendon and tied to secure fixation.

Double-row repair: Medial anchors were placed at the articular margin with horizontal mattress sutures. Lateral anchors were then used to secure the sutures in a transosseous-equivalent fashion, creating a suture-bridge construct to maximise footprint coverage.

The number and type of anchors used were documented. Subacromial decompression was performed only when intraoperative impingement was noted.

Postoperative rehabilitation

All patients followed a uniform rehabilitation protocol:

Sling immobilisation with an abduction pillow for 4 weeks.

Pendulum and passive range of motion exercises were initiated at 2 weeks.

Active-assisted range of motion at 6 weeks.

Strengthening exercises commenced at 12 weeks.

Return to overhead activity permitted after 6 months.

Compliance with physiotherapy was recorded.

Outcome measures

Patients were evaluated at baseline, 6 weeks, 3 months, 6 months, 12 months, and 24 months.

Primary outcome: Improvement in Constant score at 12 months compared with baseline.

Secondary outcomes: American Shoulder and Elbow Surgeons (ASES) score, visual analogue scale (VAS) for pain, shoulder range of motion, patient satisfaction, and tendon integrity assessed by MRI at 12 months (Sugaya classification). Postoperative complications such as infection, stiffness, or anchor failure were recorded.

Sample size calculation

Based on previous studies, an 8-point difference in Constant score was considered clinically significant, with a standard deviation of 12. For a two-sided α of 0.05 and a power of 80%, the required sample size was calculated as 36 per group. To account for a 10% dropout rate, 40 patients were enrolled in each group, giving 80 participants.

Statistical analysis

Data were analysed using SPSS software version [xx]. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies or percentages. The independent t-test or Mann–Whitney U test was used to compare continuous variables, and the chi-square test or Fisher's exact test for categorical variables. A p-value <0.05 was considered statistically significant. Intention-to-treat analysis was applied.

Results

Patient demographics and baseline characteristics

A total of 80 patients were enrolled and randomised into two groups: 40 underwent single-row (SR) repair, and 40 underwent double-row (DR) repair. Four patients were lost to follow-up (2 in each group), leaving 76 patients available for final analysis (SR: n = 38; DR: n = 38).

There were no significant differences between groups in terms of age, sex distribution, dominant arm involvement, symptom duration, or baseline shoulder scores ($p > 0.05$ for all) [Table 1].

Table 1: Baseline demographic and clinical characteristics

Variable	SR Group (n = 38)	DR Group (n = 38)	p-value
Mean age (years)	56.4 ± 7.2	55.9 ± 6.8	0.74
Male : Female	22 : 16	20 : 18	0.63
Dominant arm involved (%)	57.8%	60.5%	0.81
Symptom duration (months)	8.2 ± 3.6	8.5 ± 3.2	0.69
Baseline Constant score	49.2 ± 7.5	48.8 ± 8.1	0.82
Baseline ASES score	48.7 ± 6.9	47.9 ± 7.2	0.65

Functional outcomes: At 12 months, both groups showed significant improvement in Constant and ASES scores compared with baseline ($p < 0.001$ within groups). The mean Constant score improved to 82.6 ± 6.3 in the SR group and 85.1 ± 5.9 in the DR group ($p = 0.07$). Similarly, the mean ASES score improved to 83.5 ± 7.1 in the SR group and 86.2 ± 6.8 in the DR group ($p = 0.09$). Differences between groups were not statistically significant but trended in favour of the DR repair [Table 2].

Table 2: Functional outcome scores

Outcome measure	SR Group (n = 38)	DR Group (n = 38)	p-value
Constant score baseline	49.2 ± 7.5	48.8 ± 8.1	0.82
Constant score at 12 months	82.6 ± 6.3	85.1 ± 5.9	0.07
ASES score baseline	48.7 ± 6.9	47.9 ± 7.2	0.65
ASES score at 12 months	83.5 ± 7.1	86.2 ± 6.8	0.09
VAS pain baseline	7.2 ± 1.1	7.1 ± 1.0	0.77
VAS pain at 12 months	1.9 ± 0.9	1.6 ± 0.8	0.12

Range of motion: At 12 months, forward flexion improved to 165° ± 12° in the SR group and 168° ± 10° in the DR group ($p = 0.21$). External rotation improved to 62° ± 8° and 64° ± 7°, respectively ($p = 0.28$). No significant between-group differences were observed.

Tendon integrity (MRI at 12 months): MRI assessment (Sugaya classification) revealed intact repair in 84.2% of DR patients and 71.0% of SR patients ($p = 0.04$). Re-tear rates were significantly lower in the DR group.

Complications: Two cases of postoperative stiffness were noted in the SR group, both of which resolved with physiotherapy. One superficial infection occurred in the DR group and was treated successfully with oral antibiotics. No cases of anchor pullout or revision surgery were reported. Overall complication rates were low and not significantly different between groups ($p = 0.56$).

Discussion

In this randomised controlled trial, single-row (SR) and double-row (DR) arthroscopic suture techniques yielded significant improvements in pain, shoulder function, and range of motion at one year in patients with moderate-sized rotator cuff tears. Importantly, the two groups noted no statistically significant differences in clinical outcome scores. However, DR repair demonstrated superior tendon integrity on postoperative MRI, with a lower re-tear rate than SR repair.

Our results parallel earlier investigations. Aydin et al,[6] reported comparable functional outcomes between SR and DR repairs in small- to medium-sized tears, despite a structural advantage favouring DR fixation. Similarly, Khoriati et al,[7] highlighted that DR techniques offer improved footprint restoration and theoretical biomechanical superiority, though translating these advantages into clinical benefit remains inconsistent. Biomechanical evidence further supports this view: Mazzocca et al,[8] showed that DR repair enhances footprint coverage and reduces gap formation under cyclic loading, findings that correspond with the improved tendon healing rates we observed on MRI at 12 months.

Despite these structural benefits, the superiority of DR repair in patient-reported outcomes remains debated. Carbonel et al,[9,10] documented reduced re-tear rates with DR repair but found no significant differences in functional scores compared with SR repair, closely aligning with our findings. Similarly, Prasathaporn et al,[11] concluded that although DR repair may enhance healing, clinical improvements are often modest and may not justify the additional complexity and cost. A systematic review by Galanopoulos et al,[12] further emphasised that structural integrity does not always correlate with superior functional recovery, underscoring the multifactorial nature of postoperative outcomes.

The influence of tear size also warrants consideration. While DR repair provides greater benefit in large or massive tears, smaller tears often heal satisfactorily with SR fixation.[6] Our study focused on moderate tears, representing a clinical "grey zone." Although DR repair offered superior structural integrity, the absence of a significant functional difference raises questions about cost-effectiveness and the necessity of DR fixation for all patients in this subgroup.

Complication rates in this trial were low and comparable between groups, consistent with prior reports.[6] Postoperative stiffness occurred slightly more frequently in the SR cohort, while one superficial infection was noted in the DR group. None required revision surgery, reinforcing the safety of both techniques when applied appropriately.

Strengths of this study include its prospective randomised design, standardised surgical and rehabilitation protocols, and blinded outcome assessment. Limitations include the single-centre setting, relatively short follow-up (12–24 months), and modest sample size, which may not detect smaller differences in clinical outcomes. Additionally, tendon integrity was assessed only at 12 months, and longer-term follow-up is needed to determine whether structural advantages translate into superior long-term

function.

Conclusion

Single-row and double-row arthroscopic suture techniques provide significant pain relief and functional improvement in patients with moderate rotator cuff tears. While double-row repair offers superior tendon healing and lower re-tear rates on MRI, this did not translate into significantly better functional outcomes at one year. Therefore, for moderate tears, both techniques are effective, and surgeon preference, cost considerations, and patient-specific factors may guide the choice of repair. Longer-term studies are warranted to clarify whether the improved structural integrity of DR repair leads to superior outcomes over time.

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Conflicts of interest

There are no conflicts of interest.

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