



Research Article

Online ISSN (3219-2789)

Functional Outcomes Following Reverse Total Shoulder Arthroplasty with versus Without Subscapularis Tendon Repair

Mohammed Hatem Salal Al-Sabti^{1*}, Ali Sabah Mohammed², Mohammad Saeed Mohammad²

¹Department of Surgery, College of Medicine, University of Baghdad, Baghdad, Iraq; ²Ghazi Al-Hariri Teaching Hospital, Medical City, Baghdad, Iraq

Received: 8 July 2026; Revised: 26 August 20xx; Accepted: 1 September 2026

Abstract

Background: Reverse total shoulder arthroplasty (RTSA) is one of the most important procedures in the management of several shoulder pathologies. Following advances in these procedures, the question was raised whether repairing the subscapularis tendon provides superior functional results compared to leaving it unrepaired following RTSA, with contemporary clinical studies providing conflicting findings. **Objective:** To compare the clinical and functional outcomes of reversed total shoulder arthroplasty (RTSA) performed with versus without subscapularis tendon repair in Iraqi patients. **Methods:** Twenty-eight patients scheduled for RTSA, in whom the decision to repair the subscapularis tendon was made intraoperatively according to the operating surgeon's judgment, were evaluated at baseline preoperatively and at 6-month and 12-month intervals postoperatively using the Constant-Murley score and shoulder range of motion. The final analysis included 12 patients in the tendon repair group and 16 patients in the non-repair group. **Results:** Both groups demonstrated significant improvements in Constant-Murley Score (CMS) and shoulder range of motion throughout follow-up (all $p < 0.001$). No significant between-group differences were observed at baseline, 6 months, or 12 months for any functional or range-of-motion outcome ($p > 0.05$). However, repeated-measures analysis showed significantly faster recovery trajectories in the repair group for CMS, forward flexion, abduction, and internal rotation (time/group interaction, all $p < 0.001$), whereas external rotation improved similarly regardless of repair status ($p = 0.595$). **Conclusions:** Subscapularis repair in RTSA, when technically feasible, may facilitate earlier functional recovery without significantly altering 12-month clinical outcomes.

Keywords: Rotator cuff; Shoulder replacement arthroplasty; Subscapularis; Tendon injury.

النتائج الوظيفية بعد جراحة تجميل الكف العكسي الكامل مع إصلاح وتر تحت لوح الكف مقابل بدونه

الخلاصة

الخلفية: جراحة تجميل الكف العكسي الكلي (RTSA) هي واحدة من أهم الإجراءات في علاج أمراض الكف. بعد التقدم في هذه الإجراءات، طرح سؤال حول ما إذا كان إصلاح وتر تحت لوح الكف يوفر نتائج وظيفية أفضل مقارنة بتركه دون إصلاح بعد RTSA، مع تقديم الدراسات السريرية المعاصرة نتائج متضاربة. **الهدف:** مقارنة النتائج السريرية والوظيفية لتجميل الكف الكلي المعكوس (RTSA) الذي يجري مع إصلاح وتر تحت لوح الكف مقابل عدم إصلاح وتر تحت لوح الكف لدى المرضى العراقيين. **الطرائق:** تم تقييم ثمانية وعشرين مريضاً تم جدولتهم لعلاج الكف، حيث تم اتخاذ قرار إصلاح وتر تحت لوح الكف أثناء العملية وفقاً لحكم الجراح الجراحي، في البداية قبل العملية وبفاصل 6 أشهر و 12 شهراً بعد العملية باستخدام درجة كونستانت-مورلي ونطاق حركة الكف. شمل التحليل النهائي 12 مريضاً في مجموعة إصلاح الأوتار و 16 مريضاً في مجموعة عدم الإصلاح. **النتائج:** أظهرت كلتا المجموعتين تحسناً كبيراً في درجة مورلي الثابتة (CMS) ونطاق حركة الكف طوال فترة المتابعة (جميعها $p < 0.001$). لم تلاحظ فروق ذات دلالة إحصائية بين المجموعات عند الأساس 6 أشهر أو 12 شهراً لأي نتيجة وظيفية أو مدى الحركة ($p > 0.05$). ومع ذلك، أظهر تحليل القياسات المتكررة مسارات تعافي أسرع بشكل ملحوظ في مجموعة الإصلاح لمتلازمة CMS، والانثناء للأمام، والانحناء، والدوران الداخلي (تفاعل زمني/مجموعة، جميعها $p < 0.001$)، في حين تحسنت الدوران الخارجي بشكل مماثل بغض النظر عن حالة الإصلاح ($p = 0.595$). **الاستنتاجات:** قد يسهل إصلاح وتر تحت لوح الكف في RTSA عندما يكون ممكناً تقنياً، التعافي الوظيفي مبكراً دون تغيير كبير في النتائج السريرية لمدة 12 شهراً.

*Corresponding author: Mohammed H. S. Al-Sabti. Department of Surgery, College of Medicine, University of Baghdad, Baghdad, Iraq; Email: mohammed.h@comed.uobaghdad.edu.iq

Article citation: Al-Sabti MHS, Mohammed AS, Mohammad MS. Functional Outcomes Following Reverse Total Shoulder Arthroplasty with versus without Subscapularis Tendon Repair. *Al-Rafidain J Med Sci.* 2026;11(2):152-158. doi: <https://doi.org/10.54133/ajms.v11i2.3262>

© 2026 The Author(s). Published by Al-Rafidain University. This is an open access journal issued under the CC BY-NC-SA 4.0 license (<https://creativecommons.org/licenses/by-nc-sa/4.0/>).



INTRODUCTION

Reverse total shoulder arthroplasty (RTSA) has emerged as one of the most significant advances in shoulder surgery, as it provides a reliable definitive management option for patients suffering complex proximal humeral fractures and their sequelae, glenoid bone loss, irreparable rotator cuff tears, primary glenohumeral osteoarthritis, several inflammatory arthropathies, and revision shoulder arthroplasty [1]. The main conceptual

difference between the classic anatomical total shoulder arthroplasty (ATSA) and reverse total shoulder arthroplasty (RTSA) is that the latter alters the shoulder biomechanics by shifting the humeral center of rotation medially and distally, resulting in increased deltoid tension, allowing the deltoid muscle to compensate for the deficient native cuff function, while ATSA depends thoroughly on an intact functional rotator cuff to maintain shoulder function and stability [2]. These biomechanical advantages of RTSA, presented originally by Paul

Grammont in the 1980s, resulted in more predictable pain relief, a satisfactory range of motion, and restoration of shoulder elevation across a wide range of shoulder pathologies despite the cuff status, making RTSA one of the fastest-growing procedures in modern orthopedics [3]. Since its introduction, RTSA has undergone significant design evolution to improve functional outcomes and reduce implant-related complications [4]. The original highly medialized Grammont model was associated with adverse consequences involving instability, altered soft tissue tension, and limited external rotation, as well as scapular notching [5]. Therefore, the development of modern contemporary implant designs to avoid these shortcomings was necessary, which ultimately led to the introduction of what is known nowadays as the modern or “lateralized” RTSA [4]. This modern system was designed to incorporate global lateralization of the glenohumeral prosthesis compared to the older, highly medialized original model. The lateralization of the humeral center of rotation provided improved deltoid wrapping, reduced scapular impingement, enhanced prosthetic stability, and preserved residual cuff function [6,7]. These biomechanics of the modern RTSA raised important questions regarding surgical maneuvers that were considered routine in the older systems, and among these considerations, the repair of the subscapularis tendon remains the most debated [8]. The subscapularis muscle plays a fundamental role as a major rotator cuff component, providing anterior shoulder stability, internally rotating the glenohumeral joint, and balancing the force couples around the shoulder [9]. Therefore, the meticulous repair of the subscapularis tendon was a crucial step in ATSA and early medialized RTSA to increase postoperative stability, provide adequate anterior soft tissue cover, and maximize shoulder function [10]. With the development of the lateralized implant designs in RTSA, the necessity of subscapularis tendon repair was challenged, as the modern lateralized model provided superior deltoid mechanics and improved stability and soft tissue tension [11]. The question was then raised among surgeons whether repairing the subscapularis tendon provides superior functional results and shoulder stability compared to leaving it unrepaired following RTSA, with contemporary clinical studies providing conflicting findings [2,8,10-12]. Consequently, insufficient evidence has led to the decision to repair the subscapularis tendon being more individualized and determined intraoperatively according to the tendon quality, repairability, mobility, and the operating surgeons’ judgement [11]. Therefore, the current study aims to prospectively compare the clinical and functional outcomes of reversed total shoulder arthroplasty (RTSA) performed with versus without subscapularis tendon repair on a sample of Iraqi patients undergoing this procedure.

METHODS

Study design and setting

The current study is a prospective observational cohort study; patients of both sexes aged ≥ 50 years suffering from different shoulder pathologies indicated for primary reverse total shoulder arthroplasty (RTSA) and scheduled for surgery were recruited to participate in the study. Baseline shoulder functional assessment was done for each patient preoperatively. Surgery was done for each patient, and the decision of subscapularis tendon repair was made intraoperatively by the operating surgeon independently based on the health status, mobility, repairability of the tendon, and surgeon’s judgement. Each patient’s shoulder function was followed up twice postoperatively at 6-month and 12-month intervals. The final analysis included the eligible enrolled patients who completed their follow-up schedule; the total number of enrolled patients was 28, the repair group included 12 patients, and the non-repair group included 16 patients. Recorded data at baseline and follow-up were used to compare the functional outcome between the subscapularis tendon repair and non-repair groups. The study commenced on the 1st of June 2024, with patient recruitment continuing for 12 months; the final follow-up visit for the last enrolled patient was completed on the 1st of June 2026. All patients were evaluated preoperatively and underwent reverse total shoulder arthroplasty under the supervision of a single orthopedic surgical team at a dedicated orthopedic surgical center. Postoperative follow-up visits and functional outcomes evaluation were completed at the same center according to a standardized follow-up protocol. Written informed consent was obtained from all participants before enrollment.

Sample size

A convenient sampling method had been employed in the current study; all patients who satisfied the inclusion criteria during the recruitment period in the study center were enrolled in the project. Patients who completed their follow-up schedule were included in the final analysis.

Inclusion criteria

Patients of both sexes, aged ≥ 50 years, indicated for primary reverse total shoulder arthroplasty, underwent the procedure and agreed to comply with the postoperative follow-up schedule to be eligible for the study.

Exclusion criteria

Patients who refused to undergo the procedure or the postoperative follow-up. Patients who did not complete

their scheduled follow-up visits. Patients with revision arthroplasty or previous shoulder surgery. Patients with active or previous shoulder pathology (infectious, inflammatory, or neuromuscular). Patients with severe bone loss require augmented or custom implants.

Surgical procedure

All enrolled patients underwent standardized preoperative procedures. Surgery was performed under general anesthesia with patients in a beach chair position. The standard deltopectoral approach was utilized, and reverse total shoulder arthroplasty was done using the Zimmer Biomet™ Comprehensive® reverse shoulder system. Repair of the subscapularis tendon was decided by the surgeon intraoperatively according to the presence, health status, mobility, and reparability of the tendon; for the repair group, the tendon was reattached to its anatomical footprint in the lesser tuberosity using a non-absorbable beaded suture passed transosseous. For the non-repair group, the tendon was left unrepaired. Care was taken to ensure full hemostasis before closure.

Functional outcomes assessment

The outcome assessment was done using the Constant-Murley Score (CMS), a validated shoulder-specific outcome assessment measure widely used after shoulder arthroplasty. The score consists of four domains: shoulder pain (max. 15 points), daily activities (max. 20 points), range of motion (max. 40 points), and shoulder strength (max. 25 points). The maximum score is 100 points, with the higher score referring to better shoulder function [13]. Shoulder range of motion in major directions was also assessed as an outcome measure representing shoulder function. Range of motion was recorded in degrees of flexion, abduction, external, and internal rotation. Patients were assessed for shoulder function at baseline preoperatively and postoperatively at 6-month and 12-month intervals using CMS and range of motion assessment.

Ethical considerations

The Iraqi Board of Medical Specialization approved the study protocol, and the participants provided written informed consent to enroll in the study.

Statistical analysis

Statistical analyses were performed using Jamovi (version 2.6.25.0, The Jamovi Project, Sydney, Australia). Continuous variables are presented as mean $\pm$ standard deviation (SD), and categorical variables as frequencies and percentages. Baseline characteristics and clinical outcomes were compared between the repair and non-repair groups using independent-samples t-tests.

Welch's t-test and the Mann-Whitney U test were used where appropriate. Changes in functional outcomes over time were evaluated using two-way repeated-measures analysis of variance (RM-ANOVA), with time (baseline, 6 months, and 12 months) as the within-subject factor and group (repair vs. non-repair) as the between-subject factor. Main effects and time $\times$ group interactions were assessed. When the assumption of sphericity was violated, the Greenhouse-Geisser correction was applied. Post hoc pairwise comparisons were performed with Bonferroni adjustment for multiple testing. Effect sizes are reported as partial eta-squared (η^2). A two-tailed p -value < 0.05 was considered statistically significant.

RESULTS

Twenty-eight patients undergoing reverse total shoulder arthroplasty (RTSA) were enrolled prospectively and followed for 12 months. Sixteen patients (57.1%) did not undergo subscapularis repair (not repaired group), and 12 patients (42.9%) underwent subscapularis repair (repaired group). The overall cohort included 18 women (64.3%) and 10 men (35.7%), with a mean age of 70.5 ± 6.98 years (range, 58–82) and a mean body mass index (BMI) of 29.0 ± 3.21 kg/m² (range, 23.9–34.7). Baseline demographic and clinical characteristics were well balanced between the two groups (Table 1).

Table 1: Baseline demographic and clinical characteristics by subscapularis repair status

Characteristic	Not Repaired (n=16)	Repaired (n=12)	p -value*
Age (year)	69.8 $\pm$ 7.24	71.5 $\pm$ 6.82	0.537
BMI (kg/m ²)	28.6 $\pm$ 3.4	29.5 $\pm$ 3.0	0.460
Baseline CMS (point)	33 $\pm$ 8.2	31.4 $\pm$ 7.8	0.607
Baseline forward flexion (°)	90.9 $\pm$ 15.82	88 $\pm$ 14.1	0.623
Baseline Abduction (°)	85 $\pm$ 15.07	81.8 $\pm$ 13	0.565
Baseline external rotation (°)	11.1 $\pm$ 8.03	8.8 $\pm$ 6.83	0.446
Baseline internal rotation (°)	16.1 $\pm$ 9.1	13.9 $\pm$ 8.01	0.522

Values are mean $\pm$ SD. * independent-samples Student's t-test.

There were no statistically significant differences between groups in age, BMI, or baseline Constant-Murley Score (CMS), forward flexion (FF), abduction (ABD), external rotation (ER), or internal rotation (IR) ($p > 0.05$). Both groups demonstrated substantial improvement in shoulder function and range of motion by 6 and 12 months postoperatively. At each follow-up timepoint, the repaired group showed numerically higher CMS, FF, ABD, and IR values and lower ER values compared with the not repaired group; however, none of these between-group differences reached statistical significance on an independent-samples t-test or Mann-Whitney U testing (all $p > 0.05$) (Table 2). To assess change over time (longitudinal change over 12 months) and determine whether subscapularis repair status influenced the trajectory of recovery, a two-way repeated-measures ANOVA was performed for each outcome, with Timeline (baseline, 6 months, 12 months) as the within-subject factor and Group (Repaired vs. Not Repaired) as the between-subject factor (Figure 1).

Table 2: Clinical outcomes at 6 and 12 months by subscapularis repair status

Outcome	Time (month)	Not Repaired (n=16)	Repaired (n=12)	p-value (t-test)	p-value (MWU)
CMS (point)	6	64.2±8.5	66.8±7.91	0.417	0.577
CMS (point)	12	73.8±7.5	76.5±6.91	0.337	0.486
Forward flexion (°)	6	127.9±15.65	132.1±14.04	0.469	0.390
Forward flexion (°)	12	139.9±14.58	144±13.03	0.446	0.265
Abduction (°)	6	120±15.02	124.1±13.06	0.459	0.457
Abduction (°)	12	132.1±16.09	135.9±14.25	0.523	0.457
External rotation (°)	6	23.1±8.09	20±7.14	0.307	0.401
External rotation (°)	12	29.1±6.97	26.1±6.88	0.261	0.264
Internal rotation (°)	6	30±9.07	34.2±7.83	0.214	0.170
Internal rotation (°)	12	35.9±8.08	39.9±7.01	0.185	0.209

Values are mean ± SD. CMS: Constant-Murley score; MWU: Mann-Whitney U test.

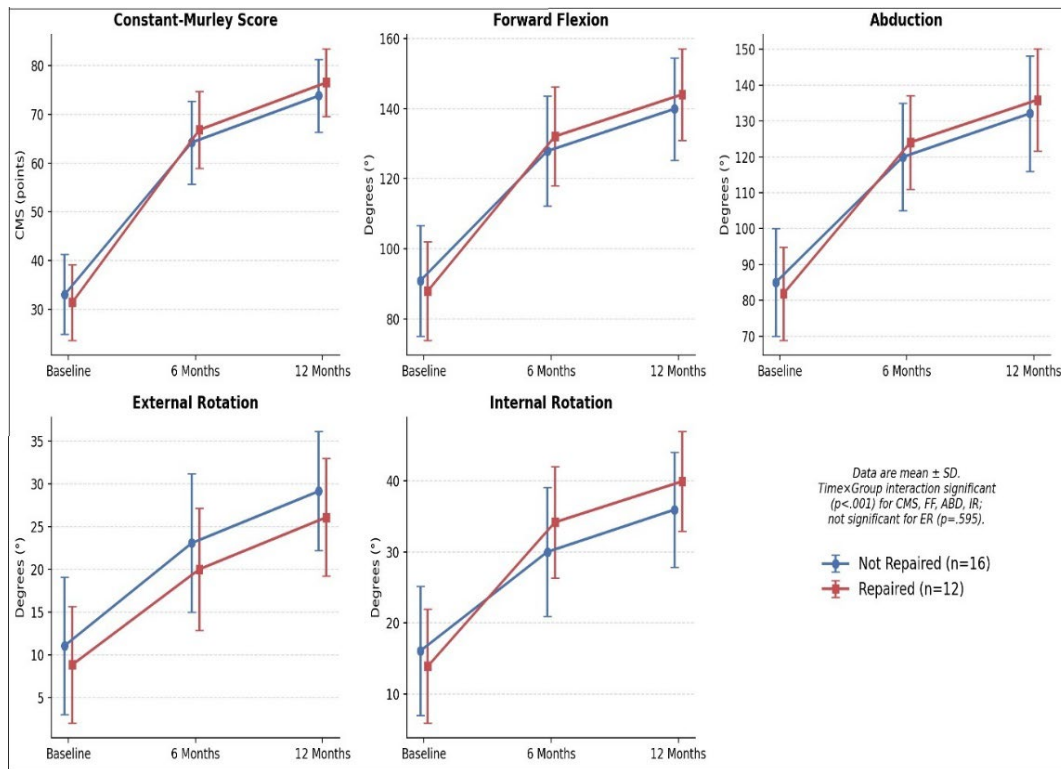


Figure 1: Clinical and functional outcome over 12-month follow-up by subscapularis repair status. The trajectories of CMS and range-of-motion parameters (forward flexion, abduction, external rotation, and internal rotation) from baseline to 12 months for the Repaired and Not Repaired groups.

Mauchly's test indicated a violation of the sphericity assumption for ER and IR ($p < 0.001$); Greenhouse–Geisser–corrected results are therefore reported for all outcomes for consistency (Table 3).

Table 3: Repeated-measures ANOVA summary (Greenhouse–Geisser corrected)

Outcome	Effect	p-value	Partial η^2	Sphericity (Mauchly p)
CMS	Time	<0.001	0.995	0.342
	group	0.679	0.007	
	Time × group	<0.001	0.365	
Forward flexion	Time	<0.001	0.984	0.123
	group	0.743	0.004	
	Time × Group	0.001	0.249	
Abduction	Time	<0.001	0.988	0.674
	Group	0.777	0.003	
	Time × Group	<0.001	0.324	
External rotation	Time	<0.001	0.957	<0.001
	Group	0.323	0.038	
	Time × Group	0.595	0.015	
Internal rotation	Time	<0.001	0.964	<0.001
	Group	0.522	0.016	
	Time × Group	<0.001	0.377	

CMS: Constant-Murley score.

A highly significant main effect of Timeline was observed for all five outcomes (all $p < 0.001$, partial $\eta^2 = 0.957–0.995$). The main effect of the group was not significant for any outcome (all $p > 0.05$). A significant timeline × group interaction was found for CMS ($p < 0.001$, partial $\eta^2 = 0.365$), FF ($p = 0.001$, partial $\eta^2 = 0.249$), ABD ($p < 0.001$, partial $\eta^2 = 0.324$), and IR ($p < 0.001$, partial $\eta^2 = 0.377$), indicating that the pattern of recovery over time differed according to subscapularis repair status for these outcomes. In contrast, the interaction was not significant for ER ($p = 0.595$, partial $\eta^2 = 0.015$), suggesting a parallel recovery trajectory for external rotation regardless of repair status. Post hoc simple-effects comparisons of group within each timeline level did not reach statistical significance at baseline, 6 months, or 12 months for any outcome (all $p > 0.05$). Post hoc pairwise comparisons for the main effect of Timeline (collapsed across group) confirmed that all outcomes improved significantly between every pair of

timepoints—baseline to 6 months, baseline to 12 months, and 6 to 12 months (all $p < 0.001$) (Table 4).

Table 4: Post hoc pairwise comparisons for the main effect of Timeline (Bonferroni-corrected, collapsed across group)

Outcome	Comparison	Result	p-value*
CMS	Baseline vs 6 mo	-33.30±0.504	<0.001
	Baseline vs 12 mo	-42.95±0.392	<0.001
	6 mo vs 12 mo	-9.65±0.444	<0.001
Forward Flexion	Baseline vs 6 mo	-40.5±0.774	<0.001
	Baseline vs 12 mo	-52.5±1.111	<0.001
	6 mo vs 12 mo	-12±1.023	<0.001
Abduction	Baseline vs 6 mo	-38.6±0.886	<0.001
	Baseline vs 12 mo	-50.6±0.816	<0.001
	6 mo vs 12 mo	-12.0±0.761	<0.001
External Rotation	Baseline vs 6 mo	-11.58±0.473	<0.001
	Baseline vs 12 mo	-17.66±0.391	<0.001
	6 mo vs 12 mo	-6.07±0.678	<0.001
Internal Rotation	Baseline vs 6 mo	-17.09±0.484	<0.001
	Baseline vs 12 mo	-22.94±0.563	<0.001
	6 mo vs 12 mo	-5.84±0.825	<0.001

Values are presented as mean±SE. *One-way ANOV with Bonferroni post hoc text.

DISCUSSION

The principal finding of this study is that both patients who underwent subscapularis repair and those who did not experienced significant improvements in shoulder function and range of motion during the first 12 months following RTSA. Although no significant between-group differences were observed at baseline, 6 months, or 12 months, recovery trajectories differed according to repair status for the Constant-Murley Score (CMS), forward flexion, abduction, and internal rotation. Patients who underwent subscapularis repair demonstrated higher rates of postoperative improvement in these outcomes, whereas external rotation improvement was comparable in both groups. These findings suggest that subscapularis repair may improve postoperative functional recovery. The role of subscapularis repair following RTSA remains controversial in the literature. Historically, subscapularis muscle repair has been proposed because of its role as the primary internal rotator and an important anterior stabilizer of the shoulder joint, with the expectation that repair may improve joint stability and internal rotation [14,15]. Thus, early studies reported reduced postoperative instability after repair. Edwards *et al.* [15] demonstrated a markedly lower dislocation rate among repaired shoulders, leading many surgeons to routinely repair the tendon whenever feasible. However, later studies using modern lateralized implant designs have questioned the necessity of routine repair. Roberson *et al.* [16] in 2018 found no significant differences in dislocation rates, functional outcomes, or range of motion between repaired and unrepaired patients undergoing lateralized RTSA and suggested that repair of the subscapularis tendon after lateralized reverse shoulder arthroplasty may not be necessary. Similarly, a meta-analysis by Matthewson *et al.* [17] in 2019 suggested that any protective effect of repair on instability is largely dependent on prosthesis design rather than repair status alone. The findings of the current study are consistent with this evolving evidence,

suggesting that subscapularis repair is unlikely to be the primary determinant of the clinical outcome in RTSA. Regarding functional recovery, our findings are consistent with previous comparative studies demonstrating that subscapularis repair may provide modest functional advantages without producing markedly superior outcomes. A recent prospective randomized trial by Engel *et al.* [18] in 2023 reported significantly higher constant scores and improved internal rotation in repaired patients at 12 months. On the other hand, a retrospective comparative study by Vourazeris *et al.* [19] initially observed superior functional outcomes after repair despite finding no significant difference in internal rotation and reported that RTSAs with or without subscapularis repair have similar clinical outcome scores, range of motion, strength, and rates of instability at 3 years of follow-up. Similarly, the meta-analysis by Corona *et al.* [20] in 2021 concluded that subscapularis repair was associated with improved Constant and American Shoulder and Elbow Surgeons (ASES) scores, although differences in individual range-of-motion parameters were generally inconsistent. Despite the absence of significant differences at any individual postoperative assessment, repaired patients consistently demonstrated numerically greater improvements over time. This suggests that subscapularis repair may facilitate earlier functional recovery rather than substantially improving ultimate postoperative performance. External rotation represented the only outcome for which recovery patterns were comparable between groups. The non-significant difference indicates that both repaired and unrepaired patients experienced similar improvements throughout follow-up. Biomechanically, this finding is reasonable because the subscapularis functions as an internal rotator and adductor, and its repair has been hypothesized to increase resistance to external rotation [20,21]. Previous clinical and cadaveric studies have similarly demonstrated either reduced external rotation or increased muscular forces required to achieve external rotation after subscapularis repair [8,22]. Although repaired patients in this cohort consistently demonstrated slightly lower external rotation values, these differences were not statistically significant, suggesting that repair does not meaningfully compromise postoperative external rotation in clinical practice. In this study, although patients were followed prospectively, treatment allocation to the repair and no repair groups was nonrandomized, and the decision to repair or not repair the subscapularis was determined intraoperatively based on tissue quality and surgeon judgment. Our results support the conclusions of the recent systematic review and meta-analysis by Elbeshbeshy *et al.* [23] (2025), which recommended repairing the subscapularis when technically feasible while acknowledging that its effects on shoulder function, range of motion, and complications remain uncertain. Likewise, Werner *et al.* [24] emphasized that prosthesis lateralization substantially

modifies the biomechanical importance of the subscapularis, underscoring the need to interpret studies within the context of implant design. From a clinical perspective, our findings suggest that surgeons should not expect substantially superior 12-month functional outcomes solely on the basis of subscapularis repair. Nevertheless, repair may provide an advantage by promoting a faster rate of postoperative recovery in shoulder function and selected planes of motion without adversely affecting external rotation. This distinction is clinically relevant because earlier functional improvement may facilitate rehabilitation and enhance patient satisfaction during the recovery period, even when long-term outcomes ultimately converge.

Study Limitations

Several limitations should be acknowledged. The relatively small sample size may limit statistical power to detect significant differences. Second, treatment allocation was not randomized; the decision to repair the subscapularis depended on intraoperative tissue quality and surgeon preference. Finally, the single-center design may limit the generalizability of these findings to other patient populations and surgical practices.

Conclusion

In this prospective observational cohort study, both repaired and unrepaired patients demonstrated substantial improvements in shoulder function and range of motion during the first year after RTSA. Although subscapularis repair did not produce significantly superior functional outcomes at any individual postoperative time point, it was associated with significantly faster recovery of the Constant-Murley Score, forward flexion, abduction, and internal rotation. External rotation improved similarly regardless of repair status. These findings suggest that subscapularis repair, when technically feasible, may provide an early functional advantage without substantially altering 12-month outcomes.

Conflict of interests

The authors declared no conflict of interest.

Funding source

The authors did not receive any source of funds.

Data sharing statement

The data that supports the findings of this study can be viewed at <https://zenodo.org>: Functional Outcomes Following Reverse Total Shoulder Arthroplasty With Versus Without Subscapularis Tendon Repair DOI: <https://doi.org/10.5281/zenodo.21507035>. Data are available

under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/) (CC-BY 4.0).

REFERENCES

1. Kozak T, Bauer S, Walch G, Al-Karawi S, Blakeney W. An update on reverse total shoulder arthroplasty: current indications, new designs, same old problems. *EFORT Open Rev.* 2021;6:189-201. doi: 10.1302/2058-5241.6.200085.
2. Dragonas CG, Mamarelis G, Dott C, Waseem S, Bajracharya A, Leivadiotou D. Anatomic total shoulder arthroplasty versus reverse total shoulder arthroplasty in patients aged over 70 without a full-thickness rotator cuff tear: A systematic review and meta-analysis. *J Shoulder Elb Arthroplast.* 2023;7:24715492231206685. doi: 10.1177/24715492231206685.
3. Tobin JG, Thomas SK, Elwell JA, Roche CP, Rogalski BL, Eichinger JF, et al. Anatomic total shoulder arthroplasty revised to reverse total shoulder arthroplasty: clinical and radiographic outcomes compared to primary reverse total shoulder arthroplasty. *J Shoulder Elbow Surg.* 2025;34:1525-31. doi: 10.1016/j.jse.2024.09.019.
4. Berton A, Gulotta LV, Longo UG, De Salvatore S, Piergentili I, Bandini B, et al. Medialized versus lateralized center of rotation in reverse total shoulder arthroplasty: A systematic review and meta-analysis. *J Clin Med.* 2021;10. doi: 10.3390/jcm10245868.
5. Kim SC, Kim IS, Jang MC, Yoo JC. Complications of reverse shoulder arthroplasty: a concise review. *Clin Shoulder Elb.* 2021;24:42-52. doi: 10.5397/cise.2021.00066.
6. Moussa MK, Bruchmann MG, Tedah D, Prabhakar A, Suarez-Jimenez LJM, Nassar A, et al. Clinical and radiological outcomes of a highly lateralized reverse shoulder arthroplasty in patients with a height of 160 cm or less versus a height of 170 cm or more. *Semin Arthroplasty JSES.* 2025;35:62-70. doi: 10.1053/j.sart.2024.09.002.
7. Cogan CJ, Ho JC, Entezari V, Iannotti JP, Ricchetti ET. The influence of reverse total shoulder arthroplasty implant design on biomechanics. *Curr Rev Musculoskelet Med.* 2023;16:95-102. doi: 10.1007/s12178-023-09820-8.
8. Preuss FR, Fossum BW, Peebles AM, Eble SK, Provencher MT. Subscapularis repair in reverse total shoulder arthroplasty: a systematic review and descriptive synthesis of cadaveric biomechanical strength outcomes. *JSES Rev Rep Tech.* 2022;2:437-441. doi: 10.1016/j.xrrt.2022.05.006.
9. Chang LR, Anand P, Varacallo MA. Anatomy, Shoulder and Upper Limb, Glenohumeral Joint. StatPearls. Treasure Island (FL): StatPearls Publishing LLC., 2026.
10. Bethell MA, Hurley ET, Welch J, Cabell G, Levin J, Lassiter TE, et al. Subscapularis repair for reverse shoulder arthroplasty: a systematic review and meta-analysis. *J Shoulder Elbow Surg.* 2023;32:2631-240. doi: 10.1016/j.jse.2023.06.011.
11. Ulery D, Mancuso AJ, Edgerton T, Butler J, Singleton A, Miller RM. Does shoulder stability differ with or without subscapularis repair after primary reversing total shoulder arthroplasty? A systematic review. *JSES Rev Rep Tech.* 2022;2:135-39. Doi: : 10.1016/j.xrrt.2022.01.003.
12. Corona K, Cerciello S, Ciolli G, Proietti L, Ambrosi R, et al. Clinical outcomes and joint stability after lateralized reverse total shoulder arthroplasty with and without subscapularis repair: A meta-analysis. *J Clin Med.* 2021;10:3014. doi: 10.3390/jcm10143014.
13. Miralles-Muñoz FA, Sebastián-Forcada E. Constant-Murley score categorization to assess outcomes after reverse shoulder arthroplasty following complex proximal humeral fracture. *J Orthop Sci.* 2025;30:1047-1052. doi: 10.1016/j.jos.2025.03.011.
14. Werthel JD, Schoch BS, Hooke A, Sperling JW, An KN, Valenti P, et al. Biomechanical effectiveness of tendon transfers to restore active internal rotation in shoulder with deficient subscapularis with and without reverse shoulder arthroplasty. *J Shoulder Elbow Surg.* 2021;30:1196-1206. doi: 10.1016/j.jse.2020.08.026.
15. Edwards TB, Williams MD, Labriola JE, Elkousy HA, Gartsman GM, O'Connor DP. Subscapularis insufficiency and the risk of shoulder dislocation after reverse shoulder arthroplasty. *J*

- Shoulder Elbow Surg.* 2009;18:892-896. doi: 10.1016/j.jse.2008.12.013.
16. Roberson TA, Shanley E, Griscom JT, Granade M, Hunt Q, Adams KJ, et al. Subscapularis repair is unnecessary after lateralized reverse shoulder arthroplasty. *JBJS Open Access.* 2018;3:e0056. doi: 10.2106/jbjs.Oa.17.00056.
 17. Matthewson G, Kooner S, Kwapisz A, Leiter J, Old J, MacDonald P. The effect of subscapularis repair on dislocation rates in reverse shoulder arthroplasty: a meta-analysis and systematic review. *J Shoulder Elbow Surg.* 2019;28:989-997. doi: 10.1016/j.jse.2018.11.069.
 18. Engel NM, Holschen M, Schorn D, Witt KA, Steinbeck J. Results after primary reverse shoulder arthroplasty with and without subscapularis repair: a prospective-randomized trial. *Arch Orthop Trauma Surg.* 2023;143:255-264. doi: 10.1007/s00402-021-04024-6.
 19. Vourazeris JD, Wright TW, Struk AM, King JJ, Farmer KW. Primary reverse total shoulder arthroplasty outcomes in patients with subscapularis repair versus tenotomy. *J Shoulder Elbow Surg.* 2017;26:450-457. doi: 10.1016/j.jse.2016.09.017.
 20. Corona K, Cerciello S, Ciolli G, Proietti L, D'Ambrosi R, Braile A, et al. Clinical outcomes and joint stability after lateralized reverse total shoulder arthroplasty with and without subscapularis repair: A meta-analysis. *J Clin Med.* 2021;10. doi: 10.3390/jcm10143014.
 21. Clark JC, Ritchie J, Song FS, Kissenberth MJ, Tolan SJ, Hart ND, et al. Complication rates, dislocation, pain, and postoperative range of motion after reverse shoulder arthroplasty in patients with and without repair of the subscapularis. *J Shoulder Elbow Surg.* 2012;21:36-41. doi: 10.1016/j.jse.2011.04.009.
 22. Boulahia A, Edwards TB, Walch G, Baratta RV. Early results of a reverse design prosthesis in the treatment of arthritis of the shoulder in elderly patients with a large rotator cuff tear. *Orthopedics.* 2002;25:129-33. doi: 10.3928/0147-7447-20020201-16.
 23. Elbesheshy M, Rashid R, Hashim Z, Munir A, Kadhawi I, Magee C, et al. Does subscapularis tendon repair during primary reverse total shoulder replacement improve shoulder stability or functional outcomes: a systematic review and meta-analysis. *Semin Arthroplasty JSES.* 2025;36(1):151520.
 24. Werner BC, Wong AC, Mahony GT, Craig EV, Dines DM, Warren RF, et al. Clinical outcomes after reverse shoulder arthroplasty with and without subscapularis repair: The importance of considering glenosphere lateralization. *J Am Acad Orthop Surg.* 2018;26:e114-e19. doi: 10.5435/jaaos-d-16-00781.