

Patient-reported outcomes of arthroscopic rotator cuff repair with biceps tenodesis versus arthroscopic isolated rotator cuff repair: A prospective cohort study

Adnan Aladarii¹, Khalil Amalki¹, Moroj Alzahrani²; Alya Rajab³, Soud Al mutairi⁴, Bader Alotaibi², Hussam Isa², Doaa Mohorjy⁵, Sami Al-dubai⁶

¹Department of Orthopaedic, king Abdullah medical city, Makkah, Saudi Arabia; ²Faculty of medicine, Umm Al-Qura University, Makkah, Saudi Arabia; ³Faculty of Medicine, Taif University, Taif, Saudi Arabia; ⁴Faculty of Medicine Al jouf University, skaka, Saudi Arabia; ⁵Department of Biostatistics & Technology -Research Center, king Abdullah medical city, Makkah, Saudi Arabia; ⁶Saudi Board of Preventive Medicine, Ministry of Health, Al Madinah, Saudi Arabia

Abstract. *Background and aim:* The long head of the biceps (LHB) tendon is associated with rotator cuff pathology. Combined LHB tenodesis and arthroscopic rotator cuff repair (RCR) improves patient function. This study aimed to compare the patient-reported outcomes of arthroscopic RCR with versus without LHB tenodesis. *Methods:* This prospective cohort study compared the patient-reported outcomes of American Shoulder and Elbow Surgeons (ASES) scores and University of California at Los Angeles Shoulder Rating (UCLA) scores of patients with complete rotator cuff tears who underwent RCR with or without LHB tenodesis. The study included 102 patients, of whom 66 (64.7%) underwent arthroscopic RCR with LHB tenodesis (biceps tenodesis group) and 36 (35.3%) underwent RCR without LHB tenodesis (non-biceps tenodesis group). Patients were evaluated at 3, 6, 9, and 12 months postoperative. *Results:* The mean (standard deviation) patient age was 54.5 (9.8) years. Patients in the biceps tenodesis group did not show significantly greater improvement at the 12-month follow-up than those in the non-biceps tenodesis group (mean ASES score, 41.32 vs. 39.96; $P < 0.001$; mean UCLA score, 12.35 vs. 11.59; $P < 0.001$). ASES and UCLA scores increased significantly over the study in both groups. There were no significant intergroup differences in either score during the study, indicating equal procedural performance. *Conclusions:* ASES and UCLA scores increased significantly over the study but did not differ significantly between groups. This study demonstrated that routine arthroscopic RCR with LHB tenodesis has no additional benefit over RCR without LHB tenodesis. (www.actabiomedica.it)

Key words: Arthroscopic, RCR, LHB tenodesis, ASES, UCLA

Introduction

Arthroscopic rotator cuff repair (RCR) and biceps tenodesis or tenotomy are two popular shoulder therapies. These techniques evolved from independent procedures for RCR with subacromial decompression to being performed in combination with biceps surgery and frequent tenodesis. Many studies investigated

the function of the long head of the biceps (LHB) tendon in normal shoulders; however, consensus is lacking regarding its main function (1). In the presence of a rotator cuff tear, the LHB plays a notable role in maintaining shoulder stability because it depresses the humeral head during movement (2). The biceps synovial sheet is connected to the synovial lining of the rotator cuff. Therefore, rotator cuff inflammation may lead to

the development of bicep tenosynovitis, which may appear clinically similar to rotator cuff tears (3). In addition, novel research shows that more than half of all rotator cuff tears lead to LHB pathology or instability. This is because the biceps pulley, which is connected to the rotator cuff, is among the main structures that stabilise the biceps tendon in the bicipital groove (4,5). Rotator cuff injuries frequently result in LHB injuries, which can significantly contribute to discomfort and functional impairment (5). Studies investigating the addition of biceps tenotomy or tenodesis to RCR revealed that this combination may enhance shoulder function (6,7). A recent study that compared tenodesis and tenotomy suggested that biceps tenodesis has better functional outcomes, including less pain and fewer complications such as muscle deformation. It also results in higher patient satisfaction rates and is more cost-effective (7). Daniel et al. reported no significant differences between patients who underwent RCR with versus without LHB tenodesis or tenotomy in terms of patient-reported outcome measures (PROMs) using American Shoulder and Elbow Surgeons (ASES) scores, RCR revision or failure rates, or 2-year-postoperative complication rates (8). Keith et al. found no significant differences in PROMs between patients who underwent arthroscopic RCR with versus without biceps tenodesis at the 2-year follow-up (9). Although considerable research has been conducted on RCR with versus without LHB tenodesis, the link between patient outcomes and the addition of a procedure to fix the LHB simultaneously during RCR remains unclear. This study aimed to assess the PROMs (ASES and University of California at Los Angeles Shoulder Rating [UCLA], which includes pain score and functional assessment of the shoulder) between patients who underwent RCR with LHB tenodesis and those who received only RCR. We were able to do this using two well-known, validated, and disease-specific postoperative PROMs for the rotator cuff (ASES and UCLA scores) at 3, 6, 9, and 12 months postoperative (10). We hypothesised that patients who underwent RCR with LHB tenodesis would have lower initial scores and show greater improvements in postoperative patient-reported outcomes. This study aimed to compare the patient-reported outcomes of arthroscopic RCR with versus without LHB tenodesis.

Patients and Methods

This prospective cohort study compared patient-reported outcomes (using online ASES and UCLA scoring questionnaires) of RCR with biceps tenodesis with those of isolated RCR at King Abdullah Medical City, Makkah, between January 2017 and March 2023. The inclusion criteria for the initial dataset were full-thickness rotator cuff tears (range, 1–4 cm) and age > 18 years. Patients were excluded if they previously underwent ipsilateral shoulder surgery, a rotator cuff tear > 4 cm, or a simultaneous acromioclavicular joint or labral repair procedure, or if there was radiographic evidence of moderate or severe glenohumeral joint osteoarthritis, calcific rotator cuff tendinosis, or adhesive capsulitis. We determined the required sample size using G*Power 3.1.5 software (Heinrich-Heine-Universität Düsseldorf) using the repeated-measure analysis technique. The calculation considered an effect size of 0.196, power of 80%, and two-tailed α of 0.05. This estimate suggests that the comparison would require a sample of 96 participants (minimum of 36 per group). The patients were divided into two groups: those who underwent RCR alone (non-biceps tenodesis group) and those who underwent RCR combined with LHB tenodesis (biceps tenodesis group).

Data collection procedure

The investigator collected data from the patients using an online questionnaire. We reviewed the clinical records within the hospital's TrakCare medical system, contacted each patient by phone to enquire about their postoperative pain and function, and, if necessary, arranged and conducted a clinical examination. The data were collected according to the planned schedule at 3, 6, 9, and 12 months postoperative.

Study instruments

This study used ASES and UCLA shoulder scores to evaluate postoperative pain and shoulder function. The American Shoulder and Elbow Surgeons (ASES) Shoulder Score is a widely used, standardized tool designed to evaluate the functional status and pain levels of individuals with shoulder conditions. It is commonly

applied in both clinical practice and research to assess treatment outcomes and monitor recovery. It consists of two components: pain and activities of daily living. Pain is assessed by a single item using a Visual Analog Scale (VAS) or Numeric Rating Scale (NRS), where 0 represents no pain and 10 represents the worst pain. The pain score contributes 50 points to the total score. The Functional Assessment includes 10 items representing activities of daily living (ADLs) that are graded by the patient based on difficulty or limitations. Each activity is scored on a 4-point Likert scale: 0: Unable to do, 1: Much difficulty, 2: Some difficulty, 3: No difficulty. The Functional Assessment score contributes 50 points to the total score. The ASES score is the sum of the pain and functional scores, providing a range from 0 to 100, with 100 indicating no pain and full function. (10). The ASES score has significant reliability and repeatability with Cronbach alpha value of 0.86 for internal consistency, and an intraclass correlation coefficient value of 0.84 for test-retest reliability (10). The UCLA Shoulder Score is a clinical assessment tool used to evaluate shoulder functionality and the outcomes of treatment for shoulder conditions. It incorporates both subjective patient-reported measures (two items) and objective clinical evaluations (two items). Total scores range from 0 to 35 with a score of 0 indicating worse shoulder function and 35 indicating satisfying shoulder function (11). The UCLA score has significant reliability and repeatability with Cronbach alpha value of 0.85 for internal consistency, and an intraclass correlation coefficient value of 0.99 for test-retest reliability (12).

Surgical procedure

The choice of whether to perform RCR with or without LHB tenodesis was based on preoperative symptoms, such as pain in the bicipital groove on the front of the shoulder, signs of a torn rotator cuff on X-ray, and LHB tenosynovitis or other pathology of LHB and rotator cuff tears on preoperative magnetic resonance imaging. It was also based on the intraoperative appearance of the LHB, such as inflammation, tearing of the LHB pulley, partial tearing of the LHB, or a superior labrum anterior and posterior lesion. Preoperatively, we discussed the benefits and drawbacks

of each procedure with the patients to ascertain their preferences. The surgeon used the RCR method at their discretion and tailored it to each patient's specific tear characteristics. All tears were anchored to the bone using the double-row technique. Double-row repairs utilise transosseous-equivalent configurations with knotted anchors in the medial row and knotless anchors (2.8-mm Q-FIX Suture Anchor with MAGNUMWIRE suture, Smith and Nephew anchors) in the lateral row. The surgeons simultaneously performed LHB tenodesis and arthroscopic RCR by using standard ports anteriorly, posteriorly, and laterally. To maintain the length-tension relationship, we performed tenodesis of the LHB tendon prior to its release from the supraglenoid tubercle. First, the suture anchor site was located and prepared at the proximal end of the bicipital groove. Next, an anchor suture (HEALICOIL PK 4.5-mm suture anchor with two ULTRABRAID 2 sutures, Smith and Nephew anchors) with four sutures was attached. Next, two sutures of different colours were threaded through the biceps tendon to secure it at the tenodesis site. To ensure stable tendinous fixation at the anchor site, each suture that grasped the tendon to its corresponding coloured suture in the anchor was tied using a triad knot, and then two half-hitches were added. A radiofrequency device was used for arthroscopic ablation to separate the LHB from the supraglenoid tubercle. An arthroscopic shaver was used to debride the remaining tendon near the tenodesis site. During the first 4 weeks postoperative, doctors advised the patients to remove the abduction arm sling only for daily hygiene and dressing routines, followed by outpatient physiotherapy and a home exercise regimen that included gentle passive movements in the scapular plane and pendulum exercises. The rehabilitation protocol progressed to active-assisted range of motion (ROM) exercises during weeks 4–6, followed by active ROM exercises during weeks 6–8. The sling was discarded at the 6-week mark and a focused strengthening programme initiated at the 12-week mark. At the 12-month follow-up, magnetic resonance imaging performed to check for retears or fixation failure identified no cases of recurrence of retears. Only one patient with a rotator cuff tear and biceps tenodesis required surgical revision due to anchor suture dislodgement at 6 months; the patient was observed for

the other 6 months and completed the 12 months of follow-up.

Statistical analysis

The statistical analyses were performed using the Statistical Package for the Social Sciences software (version 25; IBM Corporation, Armonk, NY, USA). Numerical data (age, ASES score, UCLA score, and body mass index [BMI]) are expressed as mean (standard deviation), while categorical variables (sex, smoking status) are expressed as frequency (percentage). Repeated-measures analysis of variance was used to assess changes in outcomes over the study period. Statistical significance was set at $P < 0.05$.

Results

Participants' sociodemographic and clinical characteristics

One hundred and two patients met the inclusion criteria and were included in the analysis at the 12-month follow-up. The mean (standard deviation) patient age was 54.5 (9.8) years. More than half of the patients were female (53.9%); 72.5% underwent surgery on the right side; 28.4% had hypertension; and 32.4% had diabetes mellitus. Of all patients, 66 (64.7%) underwent arthroscopic RCR with LHB tenodesis and 36 (35.3%) underwent arthroscopic RCR without it. The mean BMI was 30.36 (5.1) kg/m². The participants' characteristics are presented in Table 1. Table 2 shows the baseline differences in sociodemographic and clinical characteristics between the biceps tenodesis and non-biceps tenodesis groups. There were no significant intergroup differences in patient age, sex, number of patients with diabetes or hypertension, BMI, UCLA score, or ASES score ($P > 0.05$).

Changes in ASES overall and during study

There was an overall significant increase in mean ASES scores between the 3- and 12-month follow-up points in both groups, with a difference of 40.97 in the biceps tenodesis group ($P < 0.001$) versus 40.5 in the non-biceps tenodesis group ($P < 0.001$). No

Table 1. Patients' baseline demographic and clinical characteristics (N=102)

	n	%
Sex		
Female	55	53.9
Male	47	46.1
Side		
Left	28	27.5
Right	74	72.5
Other pathology		
No	83	81.4
Yes	19	18.6
HTN		
No	73	71.6
Yes	29	28.4
DM		
No	69	67.6
Yes	33	32.4
Surgery type		
Rotator cuff repair with LHB tenodesis	66	64.7
Rotator cuff repair without LHB tenodesis	36	35.3
	Mean	SD
Age, years	54.5	9.8
Body mass index, kg/m ²	30.36	5.1
ASES score, mean	43.07	16.9
UCLA score, mean	18.2	6.1

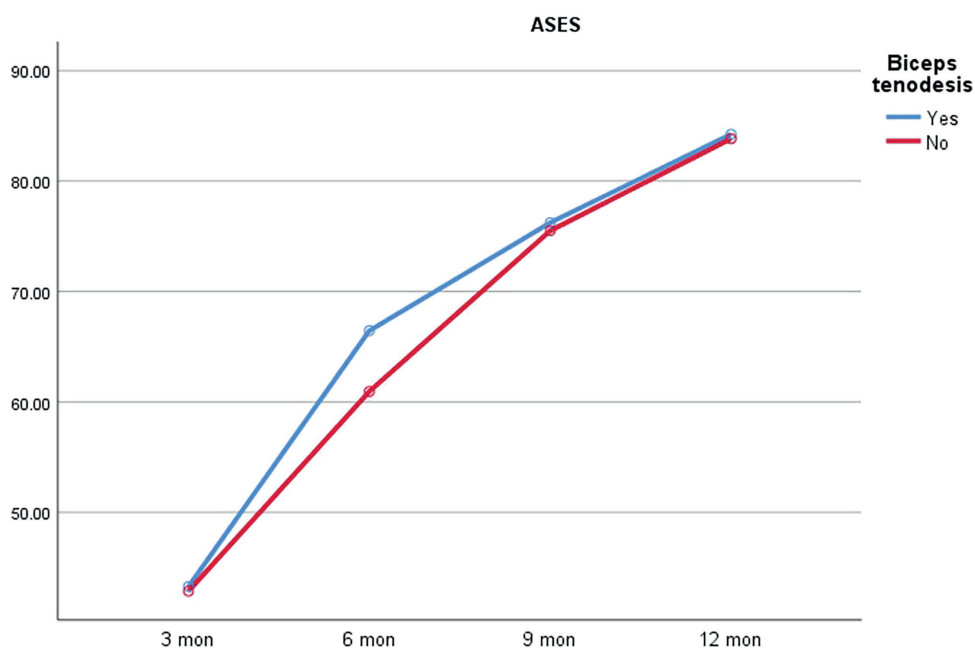
Abbreviations: ASES, American Shoulder and Elbow Surgeons; DM, diabetes mellitus; HTN, hypertension; LHB, long head of the biceps; UCLA, University of California at Los Angeles Shoulder Rating.

overall difference in ASES scores was noted between the biceps tenodesis and non-biceps tenodesis groups ($P > 0.05$), indicating that the procedures performed equally well (Figure 1). There was an overall significant increase in mean UCLA scores between the 3- and 12-month follow-up points, with a difference of 12.24 in the biceps tenodesis group ($P < 0.001$) versus 12.4 in the non-biceps tenodesis group ($P < 0.001$). There was no intergroup difference in mean UCLA scores over the study period ($P > 0.05$), indicating that the procedures performed equally well (Figure 2).

Table 2. Descriptive data and functional scores at 3-month follow-up (N=102)

Variable	Arthroscopic rotator cuff repair with LHB tenodesis (n=66)	Arthroscopic rotator cuff repair without LHB tenodesis (n=36)	P value
Age, years, mean (SD)	55.9 (7.9)	53.9 (12.3)	0.38
Sex	40 (60.6)	15 (41.7)	0.06
Female	26 (39.4)	21 (58.3)	
Male			
Side	16 (24.2)	12 (33.3)	0.32
Left	50 (75.8)	24 (66.7)	
Right			
Other pathology	52 (78.8)	31 (86.1)	0.36
No	14 (21.2)	5 (13.9)	
Yes			
Hypertension	49 (74.2)	24 (66.7)	0.41
No	17 (25.8)	12 (33.3)	
Yes			
Diabetes	45 (68.2)	24 (66.7)	0.87
No	21 (31.8)	12 (33.3)	
Yes			
BMI, kg/m ² , mean (SD)	30.5 (5)	29.5 (5.2)	0.35
ASES score, mean (SD)	43.2 (17.1)	42.8 (16.8)	0.90
UCLA score, mean (SD)	18.1 (5.8)	18.7 (6.8)	0.64

Abbreviations: ASES, American Shoulder and Elbow Surgeons; BMI, body mass index; SD, standard deviation; UCLA, University of California at Los Angeles Shoulder Rating.

**Figure 1.** Change in mean ASES scores during study period.

Abbreviation: ASES, American Shoulder and Elbow Surgeons.

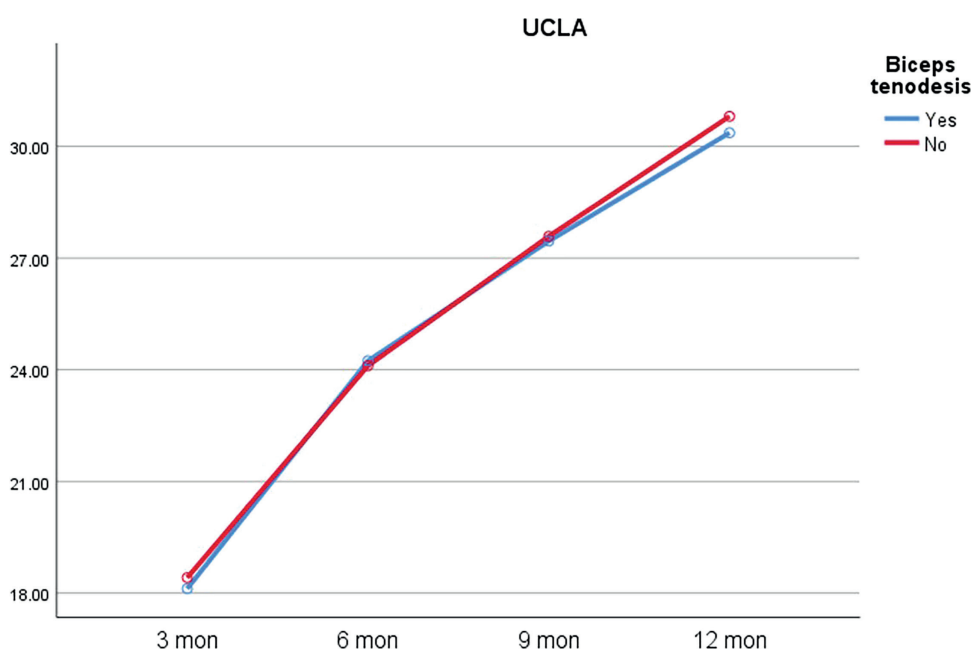


Figure 2. Change in mean UCLA scores during study period.

Abbreviation: UCLA, University of California at Los Angeles Shoulder Rating.

Conclusions

This study aimed to assess the effect of LHB tenodesis on the functional outcomes of RCR using ASES and UCLA scores, the most responsive PROMs following RCR that include pain and functional outcome assessments (11). A rotator cuff tear usually begins as an injury to the biceps pulley system and gradually progresses from a partial to full rotator cuff rupture since approximately 90% of patients with rotator cuff tears also have pulley lesions (13). When a rotator cuff tear is present, the LHB performs compensatory functions. Individuals with symptomatic rotator cuff tears typically experience premature activation and increased LHB activity, potentially leading to anterior shoulder pain (14). Chen et al.(15) linked anterior shoulder pain associated with rotator cuff tears to LHB instability since this problem occurs in 30–80% of rotator cuff tear cases. Furthermore, some studies reported that arthroscopic biceps tenodesis or tenotomy can reduce pain in cases of irreparably large rotator cuff tears in conjunction with biceps lesions (16). Previous research indicated that recovery after arthroscopic RCR with or without LHB tenodesis plateaus at 12 months

postoperative with no difference in recovery speed (17). As a result, we conducted further comparisons at 6, 9, and 12 months to measure functional recovery during that period. In this study, the patients showed unrestricted shoulder mobility at 8–12 weeks postoperative, at which point the postoperative wound soreness and oedema had subsided. We decided to initiate the functional assessment at 3-month follow-up as the baseline assessment to avoid confounding factors of immobilisation and improve the outcome scoring measure sensitivity (11). At the 3-month follow-up point, there was no statistically significant intergroup difference in the ASES and UCLA scores, which assess features such as pain and forward flexion function among other outcomes. Our analysis revealed no statistically significant intergroup differences, supporting the findings of previous studies that reached the same conclusion (4,8,9,17,22,23). The 3-, 6-, 9-, and 12-month assessments revealed no statistically significant intergroup differences in ASES or UCLA scores (Table 3). However, the biceps tenodesis group performed slightly better than the non-biceps tenodesis group. The ASES scores of the biceps tenodesis and non-biceps tenodesis groups improved from the first

Table 3. Changes in ASES and UCLA scores over study period

		Follow-up point				<i>P</i> value
		3 months	6 months	9 months	12 months	
ASES score, mean	Biceps group	43.27	66.45	76.23	84.24	< 0.001
	Non-biceps group	42.86	60.94	75.50	83.83	< 0.001
	P value	> 0.05	> 0.05	> 0.05	> 0.05	
UCLA score, mean	Biceps group	18.12	24.24	27.45	30.36	< 0.001
	Non-biceps group	18.42	24.11	27.58	30.81	< 0.001
	P value	> 0.05	> 0.05	> 0.05	> 0.05	

Abbreviations: ASES, American Shoulder and Elbow Surgeons; UCLA, University of California at Los Angeles Shoulder Rating.

to final assessments by 13.66 and 13.51 points, respectively. The minimal clinically important difference in ASES score, 6.1–26.3 points, surpasses the findings of other studies and is considered a clinically significant improvement (18). From the first to final assessment, the UCLA scores of the biceps tenodesis and non-biceps tenodesis groups improved significantly (by 12.56 and 12.39 points, respectively), which is greater than the minimal clinically important difference range of 2.5–4.5 points needed for clinical significance (1). Therefore, we found that LHB tenodesis did not contribute to shoulder functional enhancement up to 12 months postoperative. We attributed this slight increase in function to the relief of anterior shoulder pain, which accounts for 50% of the total ASES score and is typically associated with rotator cuff tears. The functional outcomes of RCR using LHB tenodesis or tenotomy are similar, with tenodesis offering some advantages over tenotomy (19). We prefer tenodesis because of the arthroscopic nature of the technique and reduced risk of postoperative complications, including the Popeye deformity of the biceps muscle and cramping arm pain (7). Ihsan et al. also found that RCR and LHB tenodesis maintained the strength of the bending elbow and supination while lowering pain in the biceps groove compared with preoperative assessments (20). Researchers discovered that patients who underwent RCR with LHB tenotomy or tenodesis had lower ASES scores preoperatively but better overall ASES, visual analogue scale, and Western Ontario Rotator Cuff Index scores at 12 months postoperative.(5) This study examined only grade I or II

rotator cuff tears that were <4 cm long. We performed this procedure to reduce the pain-relief effect of LHB tenodesis, which is reportedly effective for severe tears beyond surgical repair (16). Szabó et al. showed that LHB can cause pain in people with rotator cuff injuries. They discovered that adding LHB tenotomy or tenodesis to RCR can help reduce shoulder pain, improve ROM, and increase patient satisfaction (21). Most of that study's findings support the addition of LHB tenotomy or tenodesis to RCR; however, it did not define whether this effect applies to small or large rotator cuff tears. Gialanella et al. investigated the effects of bicep tenodesis on functional outcomes after RCR. Their study included 93 participants; of them, 25 underwent both RCR and biceps tendon tenodesis or tenotomy, whereas 68 underwent only RCR. Constant scores, ROM, pain, and UCLA scores were assessed at admission, 3 months after rehabilitation, and 6 months postoperative. Patients undergoing RCR with LHB tenodesis or tenotomy showed reduced functional outcome scores at 6 months postoperative (22). Baumgarten et al.(9) compared PROMs of patients who underwent arthroscopic RCR with versus without LHB tenodesis and observed no significant intergroup differences in functional outcomes. Gode-nèche et al.(23) discovered that individuals with healthy biceps who underwent RCR with LHB tenodesis or tenotomy had the same PROM scores as those with unhealthy biceps tendons who underwent RCR and biceps tenodesis or tenotomy. This study was limited by its single-centre design and justified sample size, lack of evaluating all rotator cuff tear types, and failure

to include a preoperative functional assessment. This study demonstrated that RCR with or without LHB tenodesis showed significantly improved functional outcomes; however, no significant intergroup differences were noted. We suggest that a comprehensive assessment tool, such as health-related quality of life measures and the Constant-Murley score, could enable a comprehensive assessment of shoulder function in future studies. RCR with LHB tenodesis did not significantly improve functional outcomes as measured by the ASES and UCLA scoring systems at 3, 6, 9, and 12 months postoperative versus RCR alone. An overall significant increase in ASES and UCLA scores was noted over the study period in both groups; however, no significant intergroup difference was observed. We conclude that routine LHB tenodesis during RCR does not significantly improve functional outcomes.

Ethic Approval: This study has been approved by king Abdullah medical city Institution Board IRB with IRB approval number 23-1130 KReSP, and protocol (Version 3.0 Dated 17-July-2017)

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors' Contribution: A.A, K.A (concept, design and draft and critical revise and accountable for publishing the article; M.A. A.R. S.A,B.A (data collection, interpretation and acquisition) D.M, S.A(analysis, interpretation of data for the article)

Declaration on the Use of AI: All authors, declare that they have not use any AI (none).

Consent for Publication: All participant has been consented for participation in the study after approval of the KAMC IRB with approval number 23-1130 KReSP which is registered at the national biomedical ethics committee, King Abdulaziz city for science and technology.

- All authors of this research paper have directly participated in the planning, execution or analysis of this study.
- All authors of this paper have read and approved the final version of submitted.
- All contents of this manuscript have not been copyrighted or published previously.

- All contents of this manuscript are not now under consideration for publication elsewhere.
- All contents of this manuscript will not be copyrighted, submitted, or published elsewhere, while acceptance by the journal under consideration.

Acknowledgments: The authors would like to thank the participants involved in the study as well as Dr. Abdulhakeem Alqarni and Dr. Ali Alahmari. From Orthopaedic department for facilitating the data collection. Also, we would like to thank Editage (www.editage.com) for English language editing.

References

1. Sarmento M. Long head of biceps: from anatomy to treatment. *Acta Reumatol Port.* 2015;40(1):26–33. PMID: 25351662.
2. Diplock B, Hing W, Marks D. The long head of biceps at the shoulder: a scoping review. *BMC Musculoskelet Disord.* 2023 Mar 28;24(1):232. doi: 10.1186/s12891-023-06346-5.
3. Murthi AM, Vosburgh CL, Neviaser TJ. The incidence of pathologic changes of the long head of the biceps tendon. *J Shoulder Elbow Surg.* 2000;9(5):382–5. doi: 10.1067/mse.2000.108386
4. Chen CH, Hsu KY, Chen WJ, Shih CH. Incidence and severity of biceps long head tendon lesion in patients with complete rotator cuff tears. *J Trauma.* 2005;58(6):1189–93. doi: 10.1097/01.ta.0000170052.84544.34
5. Lafosse L, Reiland Y, Baier GP, Toussaint B, Jost B. Anterior and posterior instability of the long head of the biceps tendon in rotator cuff tears: a new classification based on arthroscopic observations. *Arthroscopy.* 2007;23(1):73–80. doi: 10.1016/j.arthro.2006.08.025
6. Frost A, Zafar MS, Maffulli N. Tenotomy versus tenodesis in the management of pathologic lesions of the tendon of the long head of the biceps brachii. *Am J Sports Med.* 2008;37(4):828–33. doi: 10.1177/0363546508322179
7. Aldon-Villegas R, Perez-Cabezas V, Chamorro-Moriana G. Efficacy of management of associated dysfunctions on rotator cuff and long head of the biceps: systematic review. *J Orthop Surg Res.* 2021 Aug 16;16(1):501. doi: 10.1186/s13018-021-02621-0
8. Nemirov DA, Herman Z, Paul RW, et al. Evaluation of rotator cuff repair with and without concomitant biceps intervention: a retrospective review of patient outcomes. *Am J Sports Med.* 2022;50(6):1534–40. doi: 10.1177/03635465221085661
9. Baumgarten KM, Chang PS, Foley EK. Patient-determined outcomes after arthroscopic rotator cuff repair with and without biceps tenodesis utilizing the PITT technique. *J Shoulder Elbow Surg.* 2019;28(6):1049–55. doi: 10.1016/j.jse.2019.01.024
10. Michener LA, McClure PW, Sennett BJ. American Shoulder and Elbow Surgeons Standardized Shoulder Assessment

- Form, patient self-report section: reliability, validity, and responsiveness. *J Shoulder Elbow Surg.* 2002 Nov-Dec;11(6): 587–94. doi: 10.1067/mse.2002.127096
11. Abed V, Kapp S, Nichols M, et al. ASES and UCLA are responsive patient-reported outcome measures after rotator cuff repair: a systematic review and meta-analysis. *Am J Sports Med.* 2024;52(12):3173–8. doi: 10.1177/03635465231213870
 12. Thamyongkit S, Wanitchanont T, Chulsomlee K, et al. The University of California-Los Angeles (UCLA) shoulder scale: translation, reliability and validation of a Thai version of UCLA shoulder scale in rotator cuff tear patients. *BMC Musculoskelet Disord.* 2022 Jan 18;23(1):65. doi: 10.1186/s12891-022-05018-0
 13. Hawi N, Liodakis E, Garving C, Habermeyer P, Tauber M. Pulley lesions in rotator cuff tears: prevalence, etiology, and concomitant pathologies. *Arch Orthop Trauma Surg.* 2017;137(8):1097–105. doi: 10.1007/s00402-017-2721-z
 14. Kido T, Itoi E, Konno N, Sano A, Urayama M, Sato K. Electromyographic activities of the biceps during arm elevation in shoulders with rotator cuff tears. *Acta Orthop.* 1998;69(6):575–9. doi: 10.3109/17453679808999258
 15. Yamaguchi K, Riew DK, Galatz LM, Syme JA, Neviaser RJ. Biceps activity during shoulder motion: an electromyographic analysis. *Clin Orthop Relat Res.* 1997;336:122–9. doi: 10.1097/00003086-199703000-00017
 16. Boileau P, Baqué F, Valerio L, Ahrens P, Chuinard C, Trojani C. Isolated arthroscopic biceps tenotomy or tenodesis improves symptoms in patients with massive irreparable rotator cuff tears. *J Bone Jt Surg.* 2007;89(4):747–57. doi: 10.2106/jbjs.e.01097
 17. Mijic D, Kurowicki J, Berglund D, et al. Effect of biceps tenodesis on speed of recovery after arthroscopic rotator cuff repair. *JSES Int.* 2020;4(2):341–6. doi: 10.1016/j.jseint.2019.12.010
 18. Malavolta EA, Yamamoto GJ, Bussius DT, et al. Establishing minimal clinically important difference for the UCLA and ASES scores after rotator cuff repair. *OTSR.* 2022;108(2):102894. doi: 10.1016/j.otsr.2021.102894
 19. Leroux T, Chahal J, Wasserstein D, Verma NN, Romeo AA. A systematic review and meta-analysis comparing clinical outcomes after concurrent rotator cuff repair and long head biceps tenodesis or tenotomy. *Sports Health.* 2014;7(4): 303–7. doi: 10.1177/1941738114539627
 20. Ihsan Kilic A, Hapa O, Ozmanevra R, Demirhan Demirkiran N, Gursan O. Biceps tenodesis combined with rotator cuff repair increases functional status and elbow strength. *J Orthop Surg.* 2021;29(3):230949902110569. doi: 10.1177/23094990211056978
 21. Szabó I, Boileau P, Walch G. The proximal biceps as a pain generator and results of tenotomy. *Sports Med Arthrosc Rev.* 2008;16(3):180–6. doi: 10.1097/jsa.0b013e3181824f1e
 22. Gialanella B, Grossetti F, Mazza M, Danna L, Comini L. Functional recovery after rotator cuff repair: the role of biceps surgery. *J Sport Rehabil.* 2018;27(1):83–93. doi: 10.1123/jsr.2015-0055
 23. Godenèche A, Kempf JF, Nové-Josserand L, et al. Tenodesis renders better results than tenotomy in repairs of isolated supraspinatus tears with pathologic biceps. *J Shoulder Elbow Surg.* 2018;27(11):1939–45. doi: 10.1016/j.jse.2018.03.030

Correspondence:

Received: 5 December 2024

Accepted: 1 April 2025

Adnan A Aladrai* (MSc, Dr Ph, MD, MRCS, Frcs Ortho&Trauma)

Orthopaedic department, king Abdullah medical city, Makkah, 24246, Saudi Arabia.

E-mail: adnan_aladrai@yahoo.com

ORCID: 0009-0005-9042-7212