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Arthroscopic Onlay Suprapectoral Bicipital Tenodesis Using Suture Anchor; A Prospective Cohort Study

Antonious Wagdy Aziz[1], Mohammed Rabie Abdallah[2], Alaa Mohy Eldin Soliman[3]

[1] epartment of orthopaedics, Helwan university Egypt
[2] Assistant professor of orthopaedics Department of orthopaedics, Helwan university Egypt
[3] Professor of orthopaedics Department of orthopaedics, Cairo university Egypt

Corresponding Author: Antonious Wagdy Aziz

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Abstract

Background: *The long head of the biceps (LHB) tendon was assumed to be a common source of anterior shoulder pain. The inflammatory pathogenesis was considered to be the commonest. Different modalities of treatment were assigned, including conservative, physical therapy, and surgical. Biceps tenotomy and tenodesis were considered the commonest surgical techniques .* ***Methods:*** *We performed a prospective cohort study on 23 patients who presented with anterior shoulder pain due to pathology in the LHB from June 2019 to December 2021. participants were recruited for arthroscopic suprapectoral tenodesis and followed up at two endpoints; six and 12 months. To detect the clinical and functional outcomes, we used the Constant-Murley score, which included four domains pain, strength, range of motion, and Activities of daily living. Also, we calculated the incidence of the Popeye sign, which represented the rupture of LHB .* ***Results:*** *Patients could have a significant improvement in the Constant-Murley score postoperatively at both six and 12 months compared with the preoperative values, with a postoperative mean of 82.3 (78 - 88) at six months and 85.13 (80 - 91) at 12 months. Also, they achieved significant improvement in each of its components; pain, ADL, stability, and motility at six months compared with the baseline values. Additionally, only three patients developed the Popeye sign .* ***Conclusion:*** *The suprapectoral tenodesis was an effective procedure in the treatment of the pain of the LHB tendon with few side effects. It could significantly improve the Constant-Murley score at both six months and one year .*

Keywords: *LHB - suprapectoral tenodesis - Constant-Murley score*

1. Introduction

The long head of the biceps (LHB) tendon originated from the supraglenoid tubercle, and the superior labrum with multiple variations in the origin was identified [1]. It was assumed to be a common source of anterior shoulder pain [2–4]. The pathologies of the LHB tendon were categorized into inflammatory or degenerative, instability, and superior labrum anterior-to-posterior (SLAP) lesions [5,6]. All of them presented with shoulder pain; however, they varied in pathogenesis and management [5]. The inflammatory ones were considered to be the commonest [6]. Bicipital tendinopathy could be primary, which had a low incidence; tendons appeared thick, irregular, and scarred to their bed through hemorrhagic adhesions [5,7]. It could also be secondary, which had a high incidence; it was associated with subacromial impingement and rotator cuff disease [5,8].

Different methods of treatment of the LHB tendon were established. First, the conservative treatment included rest and the use of non-steroidal anti-inflammatory drugs (NSAIDs). Second, the physical therapy regimens focused on the source of contributing pathology [2,5]. Third, the injection of steroids through using ultrasound could be diagnostic and therapeutic. It ensured the position of the steroid inside the bursa [2,6]. Forth, it involved different manners, including iontophoresis, electrical stimulation, and dry needling [6]. Some authors preferred the conservative treatment as a first line of

management, while others preferred steroid injection and physical therapy as the first line [2,5,6]. Fifth, it involved surgical treatment [2,5].

For the surgical treatment there were different indications for doing the surgical treatment. They concluded the younger age patients who were involved in sports or manual laborers, also those who had any of the following; tear in the LHB tendon, instability, tenosynovitis or bursitis, pain in the bicipital groove, failure of the conservative management and SLAP lesions [2,6]. Also, surgical techniques showed multiple variabilities; LHB decompression, subacromial decompression, LHB tendon tenotomy, and LHB tendon tenodesis; with the commonest two surgical techniques, tenotomy, and tenodesis [2,5].

Tenotomy involved only the release of the LHB tendon from the supraglenoid tubercle [9]. At the same time, tenodesis involved the steps of tenotomy beside the reattachment of the LHB tendon distally along its course [5,6]. The site of tenodesis was related to the insertion of the pectoralis major tendon on the proximal humerus; it could be either subpectoral or suprapectoral [6]. According to a recent systematic review and meta-analysis, there were no differences between the two sites, suprapectoral and subpectoral, on Constant-Murley Score (CMS) (P= 0.9), Visual Analogue Scale (VAS) for shoulder pain (P= 0.9) and Popeye deformity (P= 0.1) [10]. Additionally, compared with tenodesis, tenotomy had an easier technique, less duration for the operation, faster recovery, and fewer incidences of postoperative complications [6]. However, patients who underwent tenotomy had a significantly higher risk ratio (RR) for developing Popeye's deformity than tenodesis (RR= 2.46, P<0.001) [11]. On the other hand, a recent systematic review and meta-analysis showed a non-significant difference between the tenotomy and tenodesis on Constant Murley score at six months (MD= -0.67, P= 0.67) and 12 months (MD= -5.08, P= 0.27); however, tenodesis had significantly better results at two years (MD= -1.13, P<0.001) [11]. They assumed that this difference at two years was not of clinical importance and recommended any of them to treat LHB tendon pathologies [11].

In our study, we aim to detect the clinical outcomes after arthroscopic suprapectoral bicipital tenodesis using suture anchors.

Methods

Patients and methods:

We identified patients prospectively who presented with anterior shoulder pain from June 2019 to December 2021. Ethical approval was obtained from the Scientific Research Ethics committe. Also, each participant filled out an informed consent. We included the patients with the following criteria: age was 18 years old and higher, both males and females were included, and patients presented with anterior shoulder pain due to Bicipital lesions either isolated or with concomitant small or medium-sized Rotator cuff tear or subacromial impingement in the form of Tenosynovitis, Partial or full thickness tears, Subluxation. Also, we excluded patients presented with any of the following criteria Patients younger than 18 years, Bicipital lesions with associated massive rotator cuff tears, Preoperative range of motion deficit due to glenohumeral arthritis, Concomitant shoulder arthroplasty.

According to our inclusion criteria, 23 patients were included in the study. All patients were a candidate for suprapectoral bicipital tenodesis and followed up at two endpoints; six months and one year.

Preoperative management:

All patients were examined clinically preoperatively. Also, they were assessed on the CMS. Moreover, they were a candidate for magnetic resonance imaging (MRI) on the affected shoulder to detect the bicipital pathology and any concomitant shoulder lesion.

Operative interference:

Patients were recruited for the suprapectoral biceps tenodesis. The operation was done under general anesthesia. Then, we followed the steps of suprapectoral biceps tenodesis published by Lansdown et al. [12]. Patients were settled on the beach chair position, and the targeted shoulder was sterilely prepped and draped.

Exposure of LHB tendon and arranging for tenodesis

We used a 30° arthroscope of the standard posterior portal to perform the glenohumeral diagnostic arthroscopy. Then, we systematically evaluated the intra-articular structures and ensured the pathology of LHB by inspection of the extra-articular part of the tendon (Fig.1). Next, whenever we decided to do

biceps tenodesis, we performed tenotomy by changing the arthroscopic entry to the subacromial space and released biceps from the transverse humeral ligament (Fig.2).

Placing the anchor and finishing the tenodesis

We inserted the all-suture anchor through the anterolateral portal (2 cm inferolateral to the anterior stranded portal) distally to the fibrocartilage end of the groove. We might use a single or double-loaded anchor. Also, we used the bird peak penetrator, passed it from the medial to the lateral end of the tendon, and created a loop medially to the tendon. We passed the bird peak penetrator for the second time with the attached limb through the loop and created a knop to stabilize the tendon. Moreover, we did this procedure again if we selected the double-loaded implant. We tied the knots to protect the biceps while we withdrew the cannula. (Fig.3 and 4)

We remained the tendon without cutting till we finished the tenodesis so that we got the proper tension. After that, we cut suture limbs and truncated the proximal stump of the LHB tendon using a radiofrequency ablation device (Fig 5). The free proximal stump (approximately 3-4 cm in length) was removed using the posterior portal with the tissue grasper.

Postoperative management and follow-up:

After the surgery and for four weeks, we placed the patient's arm in an abduction arm sling. Also, we recommended doing exercises of the pendulum and elbow and wrist range of motion. Additionally, we instructed the patients to stop doing any active biceps exercise for six weeks postoperatively. At the period of six to 12 weeks postoperatively, patients could start gentle strength training could be started. At 12 weeks, patients could do their activities. We clinically evaluated the patients postoperatively through the CMS at two endpoints; six months and one year.

Study variables and outcomes:

We followed up with patients at two endpoints; six months and one year postoperatively. We used the Constant-Murley score (CMS) as a measure for our clinical and functional outcomes as a primary outcome [13]. The original score was developed in 1987. It estimated pain, Activities of daily living (ADL), Range of Motion (ROM) / mobility, and strength of the affected shoulder. The pain and ADL were filled out by the patients, while ROM and strength were evaluated and filled out by the surgeon. Also, different modifications were applied to the questionnaire, such as measuring the pain by using the Visual Analog Scale (VAS) [14]. The total score ranged from zero representing the worst score of shoulder function, to 100, representing the best. The score of pain was 15 points, ADL was 20 points, ROM was 40 points (ten for each of the four active motions), and strength was 25 points [15]. We also identified the incidence of Popeye among patients postoperatively to represent our secondary outcome. The Popeye sign was assumed to be commonly reported after orthopedic surgery and to be a classic sign of the rupture of the LHB tendon [16].

Statistical analysis

We performed the statistical analysis using Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). We adjusted the significance of statistical analysis at $P \leq 0.05$. Descriptive statistics were performed as follows; qualitative data were presented as median (range), while quantitative data were presented as frequency (percentage). We used the two-way repeated measures ANOVA and the Bonferroni post hoc test to identify significance at different endpoints.

Results

Demographics of the patients:

Our study included 23 patients with an average age of 52 years (between 31 – 68 years). Thirteen patients (56.5%) included in the study were males, while ten patients were females. 16 patients were operated on the dominant upper limb, while seven patients were operated on on the non-dominant upper limb. Twelve patients included in the study had an associated rotator cuff tear (RCT). Three patients had associated SLAP lesions. Five patients had associated impingement syndrome, while three patients had isolated bicipital lesions. (Table 1)

Constant-Murley score (CMS)

Patients had an average preoperative CMS score of 50 (45 – 55). Fortunately, they had significant improvements at both endpoints compared with the preoperative values ($P<0.001$). At six months, they had an average of 82.3 (78 - 88), while at one year, they had an average of 85.13 (80 - 91). (Table 2)

Pain score:

Patients had an average preoperative pain score of 5.48. It was significantly improved at both endpoints. They had an average pain score of 13.26 at six months and 13.39 at one year.

ADL score:

Patients had an average preoperative ADL score of 9.04. It significantly improved at six months to 17.35. Also, at one year, the mean difference was significantly improved compared with the values of preoperative and six months to be 17.17.

Mobility score:

Patients had an average preoperative mobility score of 22.39. It significantly improved at six months to 36.78. Moreover, at one year, the mean difference was significantly improved compared with the values of preoperative and six months to be 38.74.

Strength score:

Patients had an average preoperative strength score of 13.09. It was significantly improved at six months to 14.91 and at one year to 15.83. However, there was no difference between the values of six months and one year.

Postoperative Popeye sign:

Three patients (13%) were complicated and showed the Popeye sign, while twenty patients (87%) were free.

Table (1) Demographic characteristics of the population

		Median (Range) (N= 23 patients)
Age		52 (31 - 68)
Gender	Males	13 (56.52%)
	Females	10 (43.48%)
Dominant limb	Yes	16
	No	7
Associated injuries	RCT	12 (52.18%)
	SLAP injuries	3 (13.04%)
	Impingement syndrome	5 (21.74%)
Isolated bicipital lesion		3 (13.04%)

Table (1) shows the demographic characteristics of the population. Qualitative data are presented as median (range), while quantitative data are presented as frequency (percentage). N= number of the patients.

SLAP; superior labrum antro-posterior lesion and RTA; Rotator Cuff Tear.

Table (2) Constant-Murley score

	Preoperative	Postoperative				F	P value
		6 months	P1 value	1 year	P2 value		
Mean (SD)	50 (3.22)	82.3 (3.14)	P<0.001	85.13 (3.31)	P<0.001	1010.294*	P <0.001
Range	45 - 55	78 - 88		80 - 91			
Difference between six and 12 months		P<0.001					

Table (2) shows the postoperative evaluation of the patients. Qualitative data are presented as mean (SD) and range.

SD; Standard Deviation and F; F test (ANOVA) with repeated measures, Significance between periods was done using Post Hoc Test (Bonferroni)

P; P value for comparing different study groups

P1: P value for comparing between preoperative and postoperative six months

P2: P value for comparing between preoperative and postoperative 1 year

* Statistically significant at $p \leq 0.05$

Figure 1; Confirming the disease at the LHB tendon through pulling the extra articular portion of the tendon into the joint for inspection

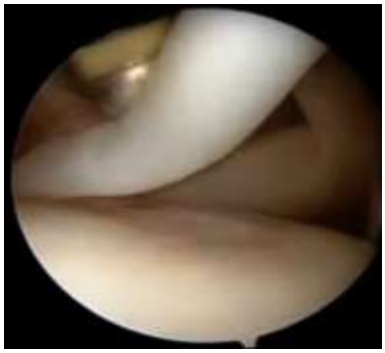

Figure 2; Releasing the biceps from the transverse humeral ligament.

Figure 3; An all-suture anchor was inserted immediately distal to the end of the fibrocartilage of the groove

Discussion

We included 23 patients in our study with an average age of 52 years old. All patients were required for suprapectoral tenodesis. Thirteen of them were males, and 16 were operated on the dominant limb. Also, 12 patients had associated RCT, three patients had associated SLAP lesions, and five patients had associated impingement syndrome. We followed up with the patients at two endpoints; six months and one year. Patients showed significant improvements in total CMS score and each of its components; pain, ADL, stability, and motility at six months compared with the baseline values. Also, only three patients developed the Popeye sign.

Constant-Murley score

Patients had significant improvements at both endpoints compared with the preoperative values. At six months, they had an average of 82.3 (78 - 88), while at one year, they had an average of 85.13 (80 - 91). We were in line with another prospective study where patients underwent arthroscopic tenodesis and had a significant improvement in the CMS after 14 months of the follow-up with a postoperative mean CMS of 89.1 and P<0.05 [17]. Also, a network meta-analysis showed a significantly bigger mean difference of CMS when doing suprapectoral tenodesis than doing arthroscopic tenotomy (MD= 2.46, CI (0.23 to 4.69)) [18]. Moreover, a prospective study done on patients who had isolated biceps lesions and allocated for suprapectoral tenodesis showed significant improvements at all intervals compared with the preoperative values (P<0.001). They had mean scores of 79.4 (15.7) at three months, 82..8 (10.2) at six months, 84.6 (9.5) at 12 months, and 84 (7) at 24 months [19].

Pain score:

Patients were significantly improved at both endpoints. They had an average pain score of 13.26 at six months and 13.39 at one year. We were in line with another prospective study where patients underwent arthroscopic tenodesis and had a significant improvement in the VAS after 14 months of the follow-up (preoperative pain score was 3.6 (3.5) while postoperative pain score was 11.2 (2.2) and P=0.000) [17].

ADL score:

Patients significantly improved at six months, with a mean score of 17.35. Also, at one year, the mean difference was significantly improved compared with the values of preoperative and six months to be 17.17. Additionally, a prospective study done on patients who had isolated biceps lesions and recruited for suprapectoral tenodesis showed significant improvements at all intervals compared with the preoperative values (P<0.001). They had mean scores of 15.6 (4.6) at three months, 17.4 (3.9) at six months, 17.2 (3.4) at 12 months, and 18 (2.5) at 24 months [19].

Mobility score:

Patients significantly improved at six months, with a mean score of 36.78. Moreover, at one year, the mean difference was significantly improved compared with the values of preoperative and six months to be 38.74. Besides, a prospective study done on patients who had isolated biceps lesions and recruited for suprapectoral tenodesis showed significant improvements at all intervals compared with the preoperative values. They had mean scores of 35.1 (6.2) at three months (P= 0.003), 37.2 (3.7) at six months (P<0.001), 38.9 (2.5) at 12 months (P<0.001) and 39.2 (2.1) at 24 months (P<0.001) [19].

Strength score:

Patients significantly improved at six months with a mean score of 14.91 and at one year with 15.83. However, there was no difference between the values of six months and one year. Also, a prospective study done on patients with isolated biceps pathology and recruited for suprapectoral tenodesis showed no differences between the preoperative values and all postoperative values at different intervals; three, six, 12, and 24 months [19].

Postoperative Popeye sign:

Three patients (13%) were complicated and experienced the Popeye sign, while twenty patients (87%) were free. We were in line with the results of the network meta-analysis, where the suprapectoral tenodesis showed better significant odds than the arthroscopic tenotomy (OR= 0.51, CI (0.21 to 1.25)) [18].

Strength points and limitations

We could evaluate the arthroscopic supraoperative technique for tenodesis and prove its efficacy for the treatment of the pain of the LHB. However, we were limited by the nature of observational studies without interventions, the single arm of the study, and the need for a larger sample size to generalize our findings.

Conclusion

The suprapectoral tenodesis was an effective procedure in the treatment of the pain of the LHB tendon with few side effects. It could significantly improve the CMS score at both six months and one year. Also, few patients only developed the Popeye sign.

References

1. Vangsness CTJ, Jorgenson SS, Watson T, Johnson DL. The origin of the long head of the biceps from the scapula and glenoid labrum. An anatomical study of 100 shoulders. J Bone Joint Surg Br. 1994 Nov;76(6):951–4.
2. Varacallo M, Mair SD. Biceps Tendon Dislocation and Instability. StatPearls. 2018;(November).
3. Romeo AA, Mazzocca AD, Tauro JC. Arthroscopic biceps tenodesis. Arthrosc J Arthrosc Relat Surg. 2004;20(2):206–13.
4. Boileau P, Krishnan SG, Coste JS, Walch G. Arthroscopic biceps tenodesis: A new technique using bioabsorbable interference screw fixation. Arthrosc J Arthrosc Relat Surg. 2002;18(9):1002–12.
5. Krupp RJ, Kevern MA, Gaines MD, Kotara S, Singleton SB. Long head of the biceps tendon pain: differential diagnosis and treatment. J Orthop Sports Phys Ther. 2009;39(2):55–70.
6. Patel K V., Bravman J, Vidal A, Chrisman A, McCarty E. Biceps Tenotomy Versus Tenodesis. Clin Sports Med. 2016;35(1):93–111.
7. Favorito PJ, Harding WG 3rd, Heidt RSJ. Complete arthroscopic examination of the long head of the biceps tendon. Arthrosc J Arthrosc Relat Surg Off Publ Arthrosc Assoc North Am Int Arthrosc Assoc. 2001 Apr;17(4):430–2.
8. Maier D, Jaeger M, Suedkamp NP, Koestler W. Stabilization of the long head of the biceps tendon in the context of early repair of traumatic subscapularis tendon tears. J Bone Joint Surg Am. 2007 Aug;89(8):1763–9.
9. Angelo RL. Surgical Management of Proximal Long Head Biceps Tendon Disorders. Sports Med Arthrosc. 2018;26(4):176–80.
10. van Deurzen DFP, Gurnani N, Alta TDW, Willems JH, Onstenk R, van den Bekerom MPJ. Suprapectoral versus subpectoral tenodesis for Long Head Biceps Brachii tendinopathy: A systematic review and meta-analysis. Orthop Traumatol Surg Res. 2020;106(4):693–700.
11. Ahmed AF, Toubasi A, Mahmoud S, Ahmed GO, Al Ateeq Al Dosari M, Zikria BA. Long head of biceps tenotomy versus tenodesis: a systematic review and meta-analysis of randomized controlled trials. Shoulder Elb. 2021;13(6):583–91.
12. Lansdown DA, Bernardoni ED, Verma NN. Surgical technique for arthroscopic onlay suprapectoral biceps tenodesis with an all-suture anchor. JSES Open Access. 2018;2(1):69–73.
13. Constant CR, Murley AHG. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987;No. 214(February 1987):160–4.
14. Constant CR, Gerber C, Emery RJH, Søjbjerg JO, Gohlke F, Boileau P. A review of the Constant score: modifications and guidelines for its use. J shoulder Elb Surg. 2008;17(2):355–61.
15. Vrotsou K, Ávila M, Machón M, Mateo-Abad M, Pardo Y, Garin O, Zaror C, González N, Escobar A, Cuéllar R. Constant–Murley Score: systematic review and standardized evaluation in different shoulder pathologies. Qual Life Res. 2018;27(9):2217–26.
16. Lim CH, Lee KA, Liew JW. Popeye's sign: biceps tendon rupture. BMJ Case Rep. 2020 Feb;13(2).
17. Shen J, Gao QF, Zhang Y, He YH. Arthroscopic Tenodesis Through Positioning Portals to Treat Proximal Lesions of the Biceps Tendon. Cell Biochem Biophys. 2014;70(3):1499–506.
18. Anil U, Hurley ET, Kingery MT, Pauzenberger L, Mullett H, Strauss EJ. Surgical treatment for long head of the biceps tendinopathy: a network meta-analysis. J Shoulder Elb Surg. 2020;29(6):1289–95.
19. Hufeland M, Kolem C, Ziskoven C, Kircher J, Krauspe R, Patzer T. The influence of suprapectoral arthroscopic biceps tenodesis for isolated biceps lesions on elbow flexion force and clinical outcomes. Knee Surgery, Sport Traumatol Arthrosc. 2017;25(10):3220–8.