



Research Article

Comparison of Functional Outcomes Between Arthroscopic and Open Tenodesis in the Management of Biceps Long Head Tendonitis

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Abstract

Background: Arthroscopic suprapectoral biceps tenodesis (ABT) and open subpectoral biceps tenodesis (OBT) are utilized for treating long head of the biceps tendon (LHBT) pathology. The clinical advantage of one approach over the other is not well characterized. **Objective:** To compare arthroscopic long head of biceps tenodesis and open subpectoral techniques concerning their functional outcome. **Methods:** The study included 20 patients aged between 20 and 40 years old with long head of biceps tendonitis not responding to conservative management. Patients were randomly allocated into two groups of 10, with Group 1 receiving open tenodesis and Group 2 receiving arthroscopic tenodesis. The outcome was then measured with each case receiving a 1-year follow-up based on the American Shoulder and Elbow Surgeons' scoring system (ASES). **Results:** The mean ASES score at 3 months after operation time among the open group (86.7) did not significantly differ from the mean ASES score of the arthroscopic group (83.6). The mean ASES score at 6 months post-operation time among the open group (90.1) did not significantly differ from the mean ASES score of the arthroscopic group (89.5). The mean ASES score at 1-year post-operation time among the open group (91.1) did not significantly differ from the mean ASES score of the arthroscopic group (91.3). **Conclusions:** Patients undergoing both procedures can be expected to experience similar improvements in clinical outcomes without differences regarding treatment failure or functional performance. Arthroscopic group patients may experience an increased incidence of residual pain in the early postoperative period.

Keywords: Arthroscopy, Shoulder pain, Tendonitis, Tenodesis.

مقارنة النتائج الوظيفية بين التهاب الوتر بالمنظار والعنيدة المفتوحة في إدارة التهاب الأوتار طويل الرأس في العضلة ذات الرأسين

الخلاصة

الخلفية: يتم استخدام وتر العضلة ذات الرأسين فوق الفم بالمنظار (ABT) ووتر العضلة ذات الرأسين تحت الصدر المفتوح (OBT) لعلاج أمراض الرأس الطويل لوتر العضلة ذات الرأسين (LHBT). الميزة السريرية لنهج واحد على الآخر ليست مميزة بشكل جيد. **الهدف:** مقارنة الرأس الطويل بالمنظار للعضلة ذات الرأسين والتقنيات تحت الصدرية المفتوحة فيما يتعلق بنتائجها الوظيفية. **الطرائق:** شملت الدراسة 20 مريضاً تتراوح أعمارهم بين 20 و 40 عاماً يعانون من التهاب أوتار العضلة ذات الرأسين الطويل الذي لا يستجيب للإدارة المحافظة. تم تقسيم المرضى بشكل عشوائي إلى مجموعتين من 10، حيث تلقت المجموعة 1 الوتر المفتوح والمجموعة 2 تلقت الوتر بالمنظار. تم قياس النتيجة مع تلقي كل حالة متابعة لمدة عام واحد بناءً على نظام تسجيل جراحي الكتف والكوع الأمريكيين (ASES). **النتائج:** لم يختلف متوسط درجة ASES بعد 3 أشهر من وقت العملية بين المجموعة المفتوحة (86.7) بشكل يعده به عن متوسط درجة ASES لمجموعة تنظير المفاصل (83.6). لم يختلف متوسط درجة ASES في 6 أشهر بعد الجراحة بين المجموعة المفتوحة (90.1) بشكل كبير عن متوسط درجة ASES لمجموعة تنظير المفاصل (89.5). لم يختلف متوسط درجة ASES في وقت ما بعد العملية لمدة عام بين المجموعة المفتوحة (91.1) بشكل كبير عن متوسط درجة ASES لمجموعة تنظير المفاصل (91.3). **الاستنتاجات:** من المتوقع أن يعاني المرضى الذين يخضعون لكلا الإجراءين من تحسينات مماثلة في النتائج السريرية دون اختلافات فيما يتعلق بفشل العلاج أو الأداء الوظيفي. قد يعاني مرضى مجموعة تنظير المفاصل من زيادة حدوث الألم المتبقي في الفترة المبكرة بعد الجراحة.

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INTRODUCTION

Shoulder pain is considered one of the most common presentations of patients seeking musculoskeletal healthcare providers. It might originate from different pathologies around the shoulder joint, as there lie several important structures for shoulder joint dynamics confined in anatomically complicated spaces involving

the subacromial space and in close relation with the joint capsule [1]. Thus, shoulder pain can originate from impingement, rotator cuff tears, or proximal biceps tendinopathy, which, in turn, includes a spectrum of disorders ranging from mild tendinopathy to complete tendon rupture and mostly affects the long head of the biceps tendon (LHBT) [2]. Biceps tendonitis is a form of these disorders that affect the proximal biceps tendon

and presents as anterior shoulder pain, which might be isolated or associated with other shoulder pathologies [1,2]. Specification of this diagnosis for shoulder pain should involve special provocative tests like Speed's and Yergason's tests, with the support of MRI studies [3]. Treatment includes an initial trial of conservative management involving both systemic non-steroidal medications and local steroid injection, as well as lifestyle modifications and physiotherapy [4]. Failure of conservative treatment might indicate the need for operative tenodesis or tenotomy for refractory cases [4]. Biceps tendon tenotomy is associated with an increased rate of cosmetic deformity, including "Popeye's deformity" [5]. Arthroscopic suprapectoral tenodesis is the operative method of choice in case of available facilities, with the open subpectoral approach being a more invasive but feasible method [5]. In regard to tenodesis, both methods carry similar rates of association with residual bicep groove pain; however, little evidence has actually compared and proved a certain superiority in the functional outcome of one method over the other [6]. In the current study, the functional outcomes of both arthroscopic suprapectoral and open subpectoral approaches are compared in a sample of Iraqi patients suffering from biceps tendonitis.

METHODS

Study design and setting

In this prospective cohort study, 20 patients aged 20-40 years, diagnosed with biceps tendonitis and having experienced at least 6 months of failed conservative management, were included. The study started on the 1st of January 2023; the patient recruitment period ended on the 1st of January 2024. All the follow-up was completed, and the study was adjourned on the 1st of January 2025. The study took place at the facility's orthopedics department, and all the evaluations and interventions were done by a single team led by an attending senior orthopedic surgeon and fellow residents. The Iraqi Board of Medical Specialization approved the study protocol; written informed consent was provided by the participants to enroll in the study (Approval no.: 1970). Written informed consent was obtained from all participants for all the interventions as well as the use of their provided information for research purposes.

Inclusion Criteria

Adult patients of both sexes aged 20-40 years suffering from shoulder pain due to diagnosed biceps tendonitis who failed at least 6 months of conservative treatment, along with physical therapy.

Exclusion Criteria

Patients who refused to participate in the study; patients outside the studied age range; patients with associated

regional conditions, including old fractures, rotator cuff issues, and superior labrum anterior to posterior (SLAP) tears; and patients suffering from systemic comorbidities, including diabetes mellitus, hypertension, and immunocompromised patients.

Sample size

Convenient sampling methods were utilized in the current study; all patients who presented to the surgical team during the study period and successfully met the inclusion criteria were involved in the current study.

Interventions and outcome measurement

All patients underwent thorough history taking and conventional physical examination in addition to Speed's test, Yergason's test, and full examination of impingement and rotator cuff power special tests, X-ray and MRI studies, and were then randomly allocated by the computer to undergo either open subpectoral biceps tenodesis (Group 1, n=10) or arthroscopic suprapectoral biceps tenodesis (Group 2, n=10). Functional outcomes were measured using the American Shoulder and Elbow Surgeons' scoring system because of its easy applicability [7]. A preoperative baseline functional survey was done for each patient, and then a follow-up survey was done at 3-month, 6-month, and 12-month durations for each patient.

American Shoulder and Elbow Surgeons (ASES) scoring system

The ASES questionnaire (supplementary file) is a functional scoring system designed to evaluate two domains regarding shoulder function: pain (7 questions) and activities of daily living (10 questions) [7]. The score of each domain is quantified and calculated using a special formula demonstrated in Figure 1, and then the final score is calculated by the summation of both domain scores. The original questionnaire underwent a language modification to suit Arabic-speaking patients included in the study center [7].

Scoring Guide:

Pain Questionnaire:

Question 7 Value: _____ Points

Pain Score: $5 \times (10 - \text{Question 7 Value})$

Pain Score: _____ Points

Activities of Daily Living (ADL) Questionnaire:

ADL Raw Score: Summation of points

ADL Raw Score: _____ Points

ADL Score: $\frac{5 \times (\text{raw score})}{3}$

ADL Score: _____ Points

Final ASES Score:

Final Score: Pain Score + ADL Score

Final score: _____ Points

Figure 1: American Shoulder and Elbow Surgeons' scoring calculation [7].

Statistical analysis

A Microsoft Excel document containing the gathered data was imported into the statistical software SPSS V26. Descriptive statistics are displayed utilizing tables and graphs. Independent 2-sample T-test and repeated measures ANOVA tests were used to determine the statistical significance between the related numerical variables. A p-value less than 0.05 was considered the cutoff point of significance.

RESULTS

Table 1: Differences between means of ASES score according to surgical approach and time of measurement (n=10 in each group)

Measurement Time	Group	Mean	p-value
ASES Pre-op	Open subpectoral	55±12.5	0.827
	Arthroscopic suprapectoral	56.2±11.6	
ASES Post 3 mo	Open subpectoral	86.7±3.3	0.051
	Arthroscopic suprapectoral	83.6±3.4	
ASES Post 6 mo	Open subpectoral	90.1±2	0.541
	Arthroscopic suprapectoral	89.5±2.3	
ASES Post 12 mo	Open subpectoral	91.1±2	0.822
	Arthroscopic suprapectoral	91.3±2	

Values were expressed as mean±SD. * Unpaired *t*-test ($p<0.05$). ASES: American Shoulder and Elbow Surgeons' scoring system.

The mean ASES score at 3 months after operation time among the open subpectoral group (86.7±3.3) did not significantly differ from the mean ASES score of the arthroscopic suprapectoral group (83.6±3.4) ($p=0.051$). The mean ASES score at 6 months post-operation time among the open subpectoral group was 90.1±2 and did not significantly differ from the mean ASES score of the arthroscopic suprapectoral group (89.5±3) ($p=0.541$). The mean ASES score at 1 year post-operation time among the open subpectoral group was 91.1±2.0 and did

The results of this interventional prospective cohort study showed that 20 patients who complained of biceps tendonitis were included in this study and divided into two groups: the first group included 10 patients treated by open subpectoral biceps tenodesis, and the second group also included 10 patients who were treated by arthroscopic biceps tenodesis. Table 1 shows that the mean ASES score at pre-operation time among the open subpectoral group (50±12.5) did not significantly differ from the mean ASES score of the arthroscopic suprapectoral group (56.2±11.6) ($p=0.827$).

not significantly differ from the mean ASES score of the arthroscopic suprapectoral group (91.3±2) ($p=0.822$). Table 2 shows that the level of ASES score was improved significantly throughout the study period ($p=0.001$) among both studied groups and in the overall studied cases. The same table showed that there were significant improvements in the ASES score between preoperative, 3-month, 6-month, and 1-year post-operation measurements ($p<0.05$) at all measurement times.

Table 2: Differences between means of ASES scores among different studied groups and time of measurements

Group	ASES	Value	p-value*
Open Method	Pre-op	55±12.53 ^a	0.001
	After 3 mo	86.7±3.27 ^b	
	After 6 mo	90.1±1.97 ^c	
	After 1 y	91.1±1.97 ^c	
Arthroscopic Method	Pre-op	56.2±11.64 ^a	0.001
	After 3 mo	83.6±3.37 ^b	
	After 6 mo	89.5±2.32 ^c	
	After 12 mo	91.3±1.95 ^c	
Total cases	Pre-op	55.6±11.79 ^a	0.001
	After 3 mo	85.1±3.6 ^b	
	After 6 mo	89.8±2.12 ^c	
	After 12 mo	91.2±1.91 ^d	

Values were expressed as mean±SD. * Two-way ANOVA ($p<0.05$). Values with different superscripts (a,b,c,d) among different times of each group are significantly different (*post hoc* analysis at $p<0.05$). ASES: American Shoulder and Elbow Surgeons' scoring system.

DISCUSSION

Proximal Long head of biceps (LHB) pathology is a common source of anterior shoulder pain. Over the past decade, LHB tenodesis has gained more utility as a treatment for anterior shoulder pain brought on by biceps tendinitis, tendinopathy, and SLAP tears. Several variations for tenodesis, such as open and arthroscopic techniques, have been documented with few comparative clinical trials, despite the fact that LHB tenodesis is a common treatment with consistent results [8]. At a mean 1-year follow-up, the current study compared arthroscopic and open LHB tenodesis

surgeries, finding that both had comparable clinical outcomes, with only one clinical failure. These results imply that arthroscopic and open tenodesis offer a secure and efficient means of treating anterior shoulder pain associated with disorders of the proximal biceps tendon. The mean ASES score at 3 months, 6 months, and 1 year after operation time among the open subpectoral group (86.7±3.3, 90.1±2, and 91.1±2, respectively) did not significantly differ from the mean ASES score of the arthroscopic suprapectoral group at 3 months, 6 months, and 1 year (83.6±3.4, 89.5±3, and 91.3±2, respectively) with $p=0.051$, 0.541, and 0.822.

Several of these findings warrant further discussion. In accordance with Deng *et al.* and van Deurzen *et al.*, these results agree with several studies and meta-analyses regarding this comparison [10,11]. Furthermore, a number of studies compared the subjective and objective outcomes after open and arthroscopic tenodesis; at a minimum of 3.2 years after the procedure, no significant differences were observed in patient-reported outcomes, biceps apex difference, bicipital groove tenderness, or strength [8,9,11]. One outcome score that is commonly used to assess shoulder function generally is the ASES score. Studies showed that it has a minimal clinical difference of 11.0 points and confirmed its validity and reliability [11]. The present study demonstrated a comparable postoperative ASES score following open and arthroscopic tenodesis, aligning favorably with previous literature suggesting good or excellent outcomes. Patients who received arthroscopic tenodesis exhibited lower shoulder forward elevation in terms of range of motion than those who had open tenodesis. All other ranges of motion parameters were equivalent [10]. Despite using interference screws as a fixation approach, other studies that have compared open subpectoral biceps tenodesis to all-arthroscopic suprapectoral biceps tenodesis have found similar results [9,10,12]. In a study by Gombera *et al.*, researchers compared 23 patients who received all-arthroscopic suprapectoral biceps tenodesis with 23 patients who had open subpectoral biceps tenodesis. This group, like our patient sample, did not include concurrent labral and rotator cuff repair. They discovered that there was no significant difference between their groups' ASES or patient satisfaction levels. Additionally, they discovered no significant variance in the arthroscopic and open return-to-play rates, which were 78.3% and 69.6%, respectively. In the open group, they recorded two mild complications: one case of brachial plexopathy managed and resolved by close monitoring and one case of postoperative erythema that resolved with PO antibiotics [13]. Following biceps tenodesis, persistent pain may indicate the existence of undetected extra-articular "bicipital tunnel" lesions. According to some research, these extra-articular biceps lesions may be the source of chronic pain after biceps tenodesis [14]. According to Taylor *et al.*, extra-articular bicipital tunnel lesions that would not have been observed on diagnostic arthroscopy were present in 47% of individuals with persistent biceps tenodesis symptoms. The approach to treatment using the subpectoral position for revision is supported by the potential existence of extra-articular disease [14]. Over-tensioning is another potential cause of post-tenodesis pain, and it could have also played a role in these patients' post-primary tenodesis residual irritation. During the revision procedures for these cases, the synovium was removed from the residual tendon repaired in addition to the repaired groove to eliminate

all extraarticular lesions, and in order to avoid over-tensioning, the elbow was extended to put the tendon in a maximum length position. Additionally, it was found that there was no need to remove the tissue in the groove proximal to the revision tenodesis site [14]. The LHBT's unique anatomical characteristics, in which it has both intra- and extraarticular portions with different loading patterns, in addition to the anatomy of the bicipital groove that contributes to tendon stability and tracking, are major causes of the different pathological disorders that could be presented in this region [15]. The infrequent occurrences of primary biceps tendinitis or tenosynovitis, which are exacerbated by mild tendon subluxation or inflammation from increased friction inside the bicipital groove, are probably caused by variations in the osseous architecture of the bicipital groove. The pectoralis major tendon protects the biceps distally, and tensional strain is the primary culprit otherwise [15]. Technically, biceps tenotomy is a faster and easier treatment than tenodesis, and there are no implant expenses involved. However, research indicates that biceps tenotomy is associated with increased rates of muscular cramping and cosmetic defects. Based on available data, there appears to be minimal, if any, difference in the two methods' functional outcomes. While cramping discomfort and the "Popeye" deformity may be less common with tenodesis [16].

Limitations of the study

The limited sample size and the single-center nature of the study may represent a limitation in the evidence provided by the current study. The prospective follow-up study design is a strength point of the current study; however, a long-term follow-up is required to create superior evidence.

Conclusion

The functional outcomes of arthroscopic suprapectoral biceps tenodesis and open subpectoral biceps tenodesis are uniformly satisfactory. Patients in the arthroscopic group may be more likely to have persistent discomfort in the initial postoperative period.

Conflict of interests

The authors declared no conflict of interest.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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