

Prospective study of three surgical procedures for long head biceps tendinopathy associated with rotator cuff tears

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Summary

Purpose: simple tenotomy in the treatment of long head biceps (LHB) lesion offers good results, as well as tenotomy/tenodesis. **Materials and methods:** we prospectively evaluated 252 patients, divided into 3 groups, treated with rotator cuff repair associated with LHB tenotomy or 2 different types of tenodesis in cases where there had been a partial lesion of the LHB or instability of the bicipital groove. We ascertained whether there was residual pain and the presence of the "Popeye sign" in the post-operative stage. **Results:** patients who underwent tenotomy alone achieved an improvement on the Visual Analogue Scale (VAS), Simple Shoulder Test (SST) and modified UCLA shoulder rating compared to patients who underwent LHB tenodesis. A positive Popeye sign is poorly perceived by patients. **Conclusion:** we considered the LHB tenotomy as treatment of choice for the rotator cuff surgical repair when there was an evident LHB lesion.

Key words: long head biceps, rotator cuff, tenodesis, tenotomy.

Introduction

Long head biceps (LHB) pathology is recognized as one of the causes of pain in shoulder diseases^{1,2}. The LHB tendon, so closely related to other common structures, may be subject to macroscopic and microscopic pathological changes³ throughout its course (at the biceps anchor, inside the joint, or at the bicipital groove) evolving into tenosynovitis, tendinosis, delamination, pre-fracturing and eventually rupture⁴. LHB tendinopathy can be divided into primary and secondary causes.

Primary tendinopathy refers to isolated tendon damage in the bicipital groove without associated shoulder pathology^{4,5}. It is rare, occurring in just 5% of patient with biceps pathology⁶. It's a disease that typically affects young athletes, gymnasts, swimmers, and throwing athletes as a result of mechanical stresses on the tendon and bicipital groove abnormalities^{7,8}.

The secondary tendinopathy is typically associated with pathologies of the shoulder, such as rotator cuff tears, SLAP lesions and impingement syndrome, it's much more frequent than primary tendinopathy^{6,8}, because the biceps tendon sheath is an extension of the synovial lining of the gleno-humeral joint which is intimately related to the rotator cuff, any process that involves these structures may also involve others⁹.

Conservative management is usually the first-line treatment of LHB pathology and consists of rest, ice, non-steroidal anti-inflammatory drugs, physical therapy, corticosteroid injection and electrical stimulation (Bi-phasic oscillatory waves therapy and Hyperthermia)⁹.

Surgical exploration and potential treatment is warranted if the pathology is identified (by US or MRI imaging) or symptoms persist for longer than 3 months without improvements using conservative therapy¹⁰.

The surgical treatment of choice for LHB lesions is still debated and candidates included simple tenotomy, and tenodesis, because both techniques offer good results^{6,11-16}.

In this study we present the results of 3 groups of patients treated with rotator cuff repair associated with LHB tenotomy or 2 different types of LHB tenodesis, in cases where there had been a partial lesion of the LHB or instability of the bicipital groove.

Materials and methods

We prospectively evaluated 252 patients, who were treated with arthroscopic surgery by the same operator for a LHB disease associated with a rotator cuff injury, during the period from July 1 2004 to June 30 2009.

The patients were divided into 3 groups: patients who underwent a LHB tenotomy (group 1), patients who underwent a LHB tenodesis to the rotator interval (group 2), patients who underwent a LHB tenodesis to the subscapularis (group 3). All patients underwent LHB tenotomy or tenodesis and rotator cuff repair possibly associated with acromioplasty and/or plastic of the acromioclavicular joint (mini-Mumford).

Inclusion criteria

Patients were included in this study only if they met the following criteria:

- Clinical and US/MRI diagnosis of rotator cuff tear;
- Clinical evidence of LHB tendinopathy (tenderness

to palpation in the bicipital groove and a positivity to the palm-up test or to the O'Brien test);

- On the basis of intra-operative assessment, in the case of a LHB partial injury or an instability at the bicipital groove;
- Resistance to conservative management (non-steroidal anti-inflammatory drugs, physical therapy, steroid injection, hyperthermia, bi-phase oscillatory waves).

Exclusion criteria

Patients were excluded from this study if they presented:

- Previous shoulder surgery;
- Shoulder fractures;
- Systemic diseases such as cancer or rheumatoid arthritis;
- Cognitive limitation.

Pre-operative and post-operative clinical evaluations were performed using the VAS (0-10), SST (0-12) and modified UCLA (0-35) evaluation boards (Tab. 1). In the post-operative period the seat of any residual pain was also studied, in order to determine if it could be attributed to the outcomes of tenotomy, and the possible objective presence of the "Popeye sign", comparing it with the patient's subjective perception of the same sign. The minimum follow-up was 12 months, maximum was 48 months (average 30 months).

Group 1 included 202 patients of the study, 94 males and 108 females, mean age 61.4 years at the time of surgery.

Group 2 included 20 patients, 13 males and 7 females, mean age 55.4 years at the time of surgery.

Group 3 included 30 patients, 18 males and 12 females, mean age 55.3 years at the time of surgery.

	Worst score	Best score	Features	Rest
VAS	10	0	Subjective self-completion evaluation of pain	
SST	0	12	Subjective self-completion clinical and functional evaluation with 12 closed questions; every affirmative answers corresponds to a point	
UCLA	0	35	Objective clinical and functional evaluation; it examines pain, functionality, active forward flexion, external rotation isometric strength and patient satisfaction	Results: 0-20: poor 21-27: modest 28-33: good 34-35: excellent

Table 1. Evaluation boards used in this study, scores and main features.

Results

Group 1. These patients had the following average scores in the pre-operative stage: VAS = 7.2, SST = 6.1; Modified UCLA = 14.1. In the post-operative evaluation the average VAS score for these patients was 0.4, the average SST

score was 11.2 and the average Modified UCLA score was 33.3. According to the Modified UCLA evaluating board, 1 patient reported a poor result, 5 patients reported a modest result, 66 patients reported a good result, 130 patients reported an excellent result. Of all the patients in group 1, 40 (20%) had a clinically positive "Popeye sign", but only 16 (7.9%) had noted it; 14 patients (6.9%) reported a significant residual pain in the anterior region of the shoulder.

Group 2. These patients had the following average scores in the pre-operative phase: VAS 7.5; SST 6; Modified UCLA 14. In the post-operative evaluation the average VAS score for these patients was 1, the average SST score was 11.4 and the average Modified UCLA score was 33.3. In accordance with the Modified UCLA evaluation board, no patient reported poor or modest results, 9 patients reported a good result, 11 patients reported an excellent result. Of all the patients belonging to this group, 3 (15%) had a positive "Popeye sign", of whom only 1 had noticed it; and 4 patients (20%) reported a residual pain in the anterior region of shoulder.

Group 3. These patients had the following average scores in the pre-operative stage: VAS 7; SST 6.2; Modified UCLA 13.9. In the post-operative evaluation the average VAS score for these patients was 0.6, the average SST score was 11.5 and the average Modified UCLA score was 33.4. In accordance with the Modified UCLA evaluation board, no patient reported poor or modest results, 16 patients reported a good result, 14 patients reported an excellent result. No patient in this group had a positive "Popeye sign"; 5 patients (16.67%) reported residual pain in the anterior region of the shoulder.

Discussion

In this study the most used surgical procedures for LHB tendinopathy associated with rotator cuff tear was tendinotomy (80% of cases). This is due to the average age of the patients (55-60 years) and the low demands for future physical activity.

Indeed, according to our experience and the literature¹⁷⁻¹⁹, we recommend tenotomy in older patients, with a low level of physical activity, no cosmesis concern, and fat arm size. On the other hand, we recommend tenodesis for younger patients with high functional demands, cosmesis concern, thin or normal arm size.

Results highlight that patients subjected to tenotomy alone obtained excellent values in the VAS evaluation board concerning perceived pain, according to Gill et al.¹², equally significant are the values obtained in the SST and Modified UCLA, especially in relation to pre-operative scores.

Given that SST and VAS are completed directly by the patient, while the Modified UCLA is completed by the surgeon who reports the patient's answers, we believe that the data suggest a real effectiveness of this procedure, both in the resolution of the pain and in recovery of the function. Furthermore, the role of the LHB during normal shoulder activity is marginal²⁰ but it may cause a limitation due to the pain, in the case of a patient's disease.

The finding of a positive "Popeye sign" was 20% in agreement with data reported by Osbahr et al.⁴ and Walch¹⁴; pa-

tients were considered to be positive when they showed an obvious deformity during the surgeon's observation and this may explain the differences with other works in the literature¹³. In particular, a positive "Popeye sign" in the female sex is obviously rare and only found in particularly thin women. The percentage of 20% is much lower than that found in daily practice in those with spontaneous acute LHB injuries. Similarly to Osbahr et al.²¹, we believe that the injury that occurs during a violent contraction of the biceps can actually determine the descent of the stump in the furrow; in contrast, the stump dissected under anesthesia during surgery retracts with a limited voltage, falling a little in the bicipital groove, subsequently leaving, in most cases, the length of the biceps muscle essentially unchanged. The lack of retraction of the tendon may also be justified by various theories explaining the LHB autotenodesis in the wake: the greater width of the tendon in the pre-inferior area at the entrance of the wake²², the synovial sheath kinking (LHB is intra-articular but extra-synovial) according to the mechanism of the "Chinese finger trap", the presence of the vascular pedicle (Vincula tendinum) from the anterior circumflex artery terminal branch²⁰. On the other hand, determining the "Popeye sign" as positive by the surgeon does not match the actual perception of this deformity by the patient: in fact, this is poorly perceived by the patients (about 25% perceive it)¹³, while they complain about it even less. Comparing the results of the groups 2 and 3, which sometimes even substantially overlap, demonstrates that a greater percentage of these groups have complained of a residual pain in the front of shoulder; which may be explained by the pull exerted by the biceps on the structures it is in tenodesis with.

The choice of treatment of the tendon between LHB tenodesis and tenotomy is widely debated in the literature. Boileau et al.²³ conducted a retrospective study of seventy-two irreparable rotator cuff tears treated arthroscopically with biceps tenotomy (39 cases) or tenodesis (32 cases). The clinical results did not differ between the tenotomy and tenodesis groups (mean constant shoulder score 61.2 ± 18 points and 72.8 ± 12 points, respectively). The authors reported that the Popeye sign was not a significant clinical outcome of tenotomy in patient satisfaction.

Longo et al.⁶ provides an overview of LBH tendinopathy and current treatments, they concluded that there were no significant differences in functional scores or patient satisfaction between the two techniques. Tenodesis was associated with a higher rate of bicipital pain.

Şentürk et al.²⁴ compare clinical and isokinetic results of patients who underwent biceps tenotomy (10 patients) or tenodesis (10 patients) showed similar result. No Popeye deformity was seen in the tenotomy group.

Strengths of our study include the high sample size of Group 1, which our research was based on, using 3 different rating scales [2 subjective scales (VAS, TSS) and 1 objective scale (modified UCLA)] and conducting all interventions using the same operator. On the other hand, the study was limited by the small size of groups 2 and 3 in which the tenodesis was performed (a limitation that we aim to overcome by expanding the case studies in subsequent years) and for not having used more objective methods, such as the dynamometer²⁴,

in the analysis of weakness of the biceps muscle before and after surgery and between tenodesis and tenotomy.

On the basis of our experience, in old patients with no cosmesis concern, where LHB is positive in various pre-operative clinical tests or presents obvious pathologies in the intra-operative stage, the LHB tenotomy is considered as a treatment of choice for rotator cuff surgical repair. Indeed, it is a rapid surgical act, easy to run and "low cost", able to ensure good clinical outcomes without increasing the time of surgery or the operating budget and, compared to the tenodesis, it requires a shorter rehabilitation period²⁵. We are considering the development of a multicentre study so as to overcome the operator effect dependence, increase the series with younger patients, and confirm the results obtained.

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