Long head of the biceps tendon rupture in professional wrestlers: treatment with a mini-open tenodesis

Mario Tangari, MDa, Stefano Carbone, MDb,*, Mimmo Gallo, MDC, Andrea Campi, MDC

aDepartment of Hand Surgery, “S. Giovanni-Addolorata” Hospital, Via dell’Amba Aradam, Rome, Italy
bDepartment of Orthopaedic and Traumatology, University of Rome “Sapienza”, P.le Aldo Moro, 5, Rome, Italy
cDepartment of Orthopaedic and Traumatology, “S. Giovanni-Addolorata” Hospital, Via dell’Amba Aradam, Rome, Italy

Background: The aim of this study is to assess the validity of a mini-open tenodesis of the long head of the biceps tendon (LHBT) performed on 5 professional wrestlers injured while fighting.

Methods: Five professional wrestlers with an acute rupture of the LHBT were treated with a mini-open tenodesis procedure without arthroscopic assistance. This technique is performed with 2 miniscule incisions of the skin. The tendon is prepared with biological fibrin glue and with a No. 2 Fiberwire; after that, the tendon is sutured to the bicipital groove with a suture anchor. At the follow-up exam (average 7.6 years; range, 2-13), clinical assessments were obtained with the Constant score (CS) and Mayo Elbow Performance Score (MEPS). Forearm flexion strength was measured with a dynamometer, and a magnetic resonance image was also obtained.

Results: At the follow-up, the average age of the patients was 32.6 years (range, 28-40). The average CS of the involved shoulder was 95 points (range, 92-98), compared to 97 points (range, 94-98) of the contralateral side ($P = .37$). The MEPS was 99.76 for the elbow of the involved side and 99.84 for the contralateral one ($P = .34$). No significant difference was noted for the forearm flexion strength ($P = .31$).

Discussion: In this study, patients were all high-demand wrestlers and biceps tenodesis was mandatory. Mini-opening without arthroscopic assistance tenodesis of the long head of the biceps tendon to the bicipital groove has been used for these professional wrestlers. Functional and cosmetic results of this technique have been excellent, and it allowed athletes to return shortly to their sport activity.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Biceps tenodesis; mini-open tenodesis; long head of the biceps tendon rupture; wrestlers

Rupture of the long head of the biceps tendon (LHBT) is a common tendon injury, and, according to Gilcreest, it represents 90% of biceps ruptures. He also noted that an acute, traumatic rupture of this tendon occurs most often when a person is raising a weight of 68 kg or more. Otherwise, ruptures of the LHBT are commonly caused by degenerative changes within the tendon and are associated with pathologies of the subacromial space. LHBT pathology ranges from simple cases of tendonitis to more complex pathologies such as tendon instability (subluxation or dislocation) and rupture (partial or complete). The common site of rupture occurs within the bicipital groove; this predominantly occurs in men in their 6th or 7th decade of life as a result of the weakening of the tendon by degenerative process. Less commonly, ruptures have been reported in weight lifters at the musculotendinous junction.
and within the muscle belly. Recently, the diagnosis and treatment of a 36-year-old man who sustained a proximal biceps rupture while arm wrestling and his operative management have been described; in addition, there is a report of an isolated LHBT rupture in an underhand thrower, as a result of the increased bicep muscle activity or increased tendon excursion in the windmill-pitching motion.

While nonoperative treatment is often successful, operative treatment may be required for those patients who do not achieve acceptable pain control or functional recovery. Furthermore, surgical repair is recommended for acute ruptures in those patients with high demands and in whom slight loss of flexion and supination strength is not well tolerated. Biceps tenodesis is the most commonly performed procedure for biceps tendon rupture.

Numerous surgical techniques of tenodesis have been advocated; however, many of these require moving the biceps tendon to the coracoid process with undue medial dissection followed by prolonged restriction of shoulder and elbow movement with substantial morbidity. Keyhole tenodesis was introduced to overcome these inadequacies, with the tendon attached to the bone which permits immediate mobilization. Fixation of the tendon to the bone with interference screw has been used by some authors, combining this technique to the arthroscopic surgery.

Other authors have combined the arthroscopic with percutaneous, intra-articular trans-tendon technique or with mini-open tenodesis. The mini-open approach to the tendon rupture and tenodesis without arthroscopic assistance has been described by Burkhead in 1990. We have adopted this mini-open technique for 5 professional wrestlers, using 1 suture anchor applied to the bicipital groove with 2 mini-incisions of the skin (2 cm), 1 to get to the tendon stump, and the other to suture the tendon to the bone.

Materials and method

Between 1997 and 2008, 5 professional wrestlers were referred to our hospital after they experienced a snap and shoulder pain while fighting in the gym. They were seen by 1 of the authors after a average time of 3 days (range, 1-10). Preoperative diagnosis was made by clinical examination, based on the presence of the classic Popeye sign or a less striking descent of the biceps muscle in the middle part of the arm; a magnetic resonance image was obtained in all cases to confirm the diagnosis and to exclude other lesions of the gleno-humeral joint. They all denied having used anabolic steroids.

The surgical procedure is performed in the beach-chair position. The arm is positioned adducted to the body, in neutral rotation and with about 20° of extension for a better visualization of the humeral head and bicipital groove. All biceps tendon tears in this study were extra-articular and did extend to the bicipital groove. With the ultrasound probe (7.5 GHz), the exact localization of the tendon stump is obtained and then marked with a surgical pen. Maintaining the arm in the same position, with ultra-sound control, the bicipital groove is located and marked. In correspondence of the 2 marked areas, a 2-cm skin incision is made (Figure 1). The tendon stump is felt under the finger, the brachialis fascia covering the biceps is then opened, and the biceps tendon is retrieved out of the wound (Figure 2). To ensure appropriate tensioning of the biceps tendon, the proximal portion of the tendon is resected to leave 20-25 mm of tendon proximal to the musculotendinous portion of the biceps.

Using a Krackow or whip-stitch, a No. 2 Fiberwire (Arthrex, Naples, FL) nonabsorbable suture is weaved into the proximal 15 mm of tendon. To obtain faster healing of the tendon to the bone, in all but 1 patient, the LHBT is prepared with biological fibrin glue (Tissucol®, Baxter) (Figure 3). A suture passer is inserted in the superior skin incision and it is guided under the brachialis fascia until the second incision. Subsequently, the tendon stump is tied to the suture passer and the last is pulled upward to the superior incision. The bone in the area of the upper portion of the bicipital groove is prepared using a burr until bleeding. Then, a 5-mm suture anchor (Arthrex) is inserted in the upper reachable (from the skin incision) portion of the bicipital groove. The sutures from the tendon stump are then tied to those of the anchor and the knots tightened with an arthroscopic suture passer (surgical technique illustrated in Figures 4, A-C). After surgery, a sling is applied for 7 days and then self-assisted recovery of range of motion is allowed. Flexion of the elbow and supination of the hand against resistance is forbidden for 2 months; finally, all the professional athletes returned to their full activities.

At follow-up (average time, 7.6 years; range, 2-13), objective evaluation of the shoulder and the elbow was obtained with the Constant score (CS) and the Mayo Elbow Performance Score (MEPS). Flexion strength of the forearm (with the forearm flexed at 90°) and the arm adducted to the body, with the hand in full supination (1 point = 1 lb) was measured with the use of the MicroFET dynamometer (Hoggan Health Industries, West Jordan, UT). Finally, an MRI was also obtained.

The differences of the CS, MEPS, and the flexion strength of the forearm between the involved and contralateral sides were analyzed with the Chi-square test. \( P < .05 \) was considered to be significant.

Results

The average age at the time of injury was 25.4 years (range, 23-27) and the right shoulder was involved in 5 cases. At the follow-up, the mean age of the patients was 32.6 years (range, 28-40).
After the operation, we did not observe any complications.

At follow-up, the mean CS of the involved shoulder was 95 points (range, 92-98), compared to 97 points (range, 94-98) on the contralateral side ($P = 0.37$). The range of motion was similar in the 2 shoulders. Mean flexion strength of the forearm result was 42 points (range, 38-50) on the affected side (dominant side) and 40 on the contralateral one (range, 38-46) ($P = .31$). The MEPS was 99.76 for the elbow of the involved side and 99.84 for the contralateral one ($P = .34$). On MRI scans of all patients, the long head of the biceps appeared thickened and healed to the bicipital groove; in 2 of the 5 athletes (40%), a Bankart lesion was noted with a concomitant Hill-Sachs of the humeral head. Despite these MRI findings, all the shoulders were clinically stable. Cosmesis of the arm was judged as excellent in all cases, both by the patients and the surgeon (Figure 5).

At an average of 5 months (range, 3-7) after surgery, all the wrestlers had returned to their professional sport activity, and 4 of the 5 are still professional wrestlers.

**Discussion**

There is controversy in the literature regarding treatment of ruptures of the long head of the biceps (LHB). Most agree that surgical correction is usually not necessary and nonsurgical therapy has been advocated by many. For example, Turek21 stated that “the operation is contraindicated except in the young individual for vigorous occupations or sports or for cosmesis. It should never be performed in the elderly or persons with light activities.” In this study, the patients were all high-demanding wrestlers; all were aged around 25 years, considerably younger than the usual age of presentation of ruptures of the LHB. All of them were highly concerned not only with the possible loss of strength of the biceps muscle, but also with the cosmetic appearance. Tenodesis was consequently indicated for these athletes. Surgical indication was afforded also by recent literature, which shows that patients with tendon rupture and displacement of the LHB muscle suffer from permanent disabilities, independently of any shoulder problems locally on the distal upper arm. If tenodesis is not performed, strength and endurance in the muscle are reported to be decreased by about 25%. On the other hand, biceps tenodesis allows the maintenance of the length-tension relationship of the biceps muscle, it allows maximum elbow function with maintenance of elbow flexion and supination, and it results in a better cosmetic appearance.

Tenodesis techniques have traditionally involved bony fixation of the tendon to the proximal humerus through an open or arthroscopic technique. The tendon can be fixed proximally in the bicipital groove, or more distally under the pectoralis major tendon. Furthermore, multiple techniques of fixation can be used including bony tunnels, bone anchors, staples, or interference screws. Earlier techniques of transposition of the LHBT to the conjoint tendon have been described only by one author. This technique has been adopted for a series of 5 professional wrestlers with an acute rupture of the tendon while fighting.

The overall results of biceps tenodesis reported in the literature are quite varied. Recently, Weber and Kauffman23 presented the results of 81 patients using a mini-open sub-pectoral tenodesis technique. At mean follow-up of 6.7 years, the authors concluded that this technique had acceptable long-term outcomes without the complexity associated with all-arthroscopic techniques. In a series of 22 patients undergoing an open subpectoral biceps tenodesis, Mazzocca et al15 demonstrated excellent results, preserving soft tissue and positioning the biceps tendon in an anatomic position beneath the pectoralis tendon. This technique involves both arthroscopic and open techniques. As a new alternative to traditional tenodesis techniques, Verma et al8,22 has described the subdeltoid arthroscopic technique.
transfer of the LHB to the conjoint tendon. Again, this technique combines both open and arthroscopic surgery, and it demonstrated no loss of strength and a 95% resolution of preoperative biceps symptoms in a continually followed series. In our small but selected series, we obtained excellent results both for function and cosmetics, no postoperative complications, and, at an average follow-up of over 7 years, all the athletes complained of no pain or loss of strength and athletic performances were fully exploited.

A limitation of this study is the small number of patients treated; but, the study group is represented by professional wrestlers, a very selected group. On the other hand, the average follow-up is considerably longer than that of other studies.

Conclusions

The mini-open approach to tendon rupture and tenodesis without arthroscopic assistance is still a valid surgical procedure. We have performed a mini-open technique in 5 professional wrestlers. Furthermore, in this very selected group, functional and cosmetic results have been excellent, and it allowed athletes to return quickly to their sport activity.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article. No outside funding or grants were received that assisted this study. IRB approval was not required.

References