Musculoskelet Surg (2016) 100 (Suppl 1):S85–S88
DOI 10.1007/s12306-016-0435-y

ORIGINAL ARTICLE

Lacertus fibrosus augmentation for distal biceps brachii rupture repair: surgical technique

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Received: 1 May 2016 / Accepted: 3 November 2016

Abstract
Background Repair of distal biceps tendon ruptures has become widely accepted. Unfortunately, care of retracted-degenerated injuries remains a challenge for orthopedic surgeons. Complication rates appear to increase when surgery is performed in chronic cases compared to those operated acutely. Multiple techniques for chronic reconstruction with the use of grafts have been described. Recently Morrey, from the Mayo Clinic, proposed a direct anatomic repair of retracted distal biceps tendon ruptures in extreme flexion (60°–90°) to avoid grafting.
Materials and methods The authors propose and describe a new surgical technique using the lacertus fibrosus (LF) as augmentation-elongation for retracted-degenerated distal biceps tendon tears. We present four cases with chronic ruptures with 2-year follow-up. The mean age was 45 years old (33–51), the time of surgery was 13 weeks (4–24) after the trauma, dominant arm was involved in two cases.
Results The mean MEPS was 95/100 at 2-year follow-up. With this technique we increase the length of the tendon up to 2.5 cm. The major complication in our study was transient sensitive radial nerve paresthesia. We did not have any hardware mobilization or muscular herniation.
Conclusion With this study we want to present our experience in the treatment of retracted distal biceps tendon tear with lacertus fibrosus augmentation. Our surgical technique is an effective and cheap option for chronic-retracted distal biceps tendon lesions. Recovery time is quicker, and integration is faster due to the use of an autologous vascularized graft. Preoperative ultrasound scan is mandatory in order to evaluate LF integrity, thickness and size.

Keywords Chronic-retracted distal biceps tendon rupture · Lacertus fibrosus augmentation · Autograft

Introduction

There is no consensus on what timeframe constitutes an acute or chronic rupture of the distal biceps tendon, with opinions ranging from 3 weeks to 3 months. Late presentation may be due to a delayed diagnosis, or simply the desire on the part of the patient to avoid surgery. Chronic diagnosis may be correlated to partial lesion. Kulshreshtha et al. [1] demonstrated the anatomic separation between the two heads. The shorter one inserts distally on the tuberosity and is likely to be a primary contributor to elbow flexion, while the long head fibers attach furthest from the center of rotation and would therefore be more important in supination. Morrey defined acute injuries as being repaired within 3 weeks from the injury, and chronic after 3 weeks [2].

The decision of tendon grafting is often made when the tendon stump is simply not long enough to reach the tuberosity. However, it is not clear how much the elbow can be flexed to repair the tendon. Most of the authors [3–7] attempt direct repair only when <70° of flexion is required.

Multiple techniques for chronic reconstruction utilizing an autograft or allograft have been described, with no technique appearing superior to an other.

With this study we want to present our experience in the treatment of retracted distal biceps tendon tear with lacertus fibrosus (LF) autograft. We will present our results and describe the surgical technique.

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Materials and methods

A retrospective study was performed at the department of orthopedic surgery of the Faenza (Ospedale per gli Infermi) in patients operated for chronic rupture of the distal biceps tendon. Inclusion criteria were:

- full thickness-retracted distal biceps tendon tear,
- time of surgery more than 4 weeks from injury,
- follow-up more than 2 years.

We present the results of four cases treated from 2012 to 2014. At the final follow-up we performed a clinical and radiological evaluation of the elbow. Mayo Elbow Performance Score (MEPS) was used on all the patients.

All patients are male and all of them described a sharp trauma with an eccentric extension load, while the elbow was flexed.

We performed a preoperative ultrasound scan in order to confirm the distal biceps tendon rupture and to evaluate the integrity, thickness and size of the LF.

The mean age was 45 years old (33–51), time of surgery 13 weeks (4–24) after the trauma, the dominant arm was involved in two cases. The LF was inserted at the radial tuberosity with two anchors (Twin-Fix 5.5 mm Smith & Nephew loaded with 2 Ultrabraid sutures) with the elbow flexed between 45° and 60°. We performed a dynamic intra-operative test in order to evaluate the contact between the graft and the bone; LF was still in contact with the radial tuberosity around 30° of flexion.

We protected the reconstruction with only a soft sling at 90° of flexion with intermediate pronosupination for 2 weeks. Passive motion was allowed after 2 weeks with a range 30°–140°. Active assisted range of motion and full extension was allowed 4 weeks after surgery, full extension was allowed 25–30 days after surgery. Heavy sport and weight lifting was allowed 6 months after surgery.

Surgical technique

Our preferred anesthesia was a regional block, most commonly axillary or infraclavicular. The patient was positioned supine with the arm on an arm board. A tourniquet was applied. We performed a double curved incision: In the arm was lateral and parallel to the biceps muscle, and in the forearm was medial and parallel to the flexor-pronator muscle. The lateral antebrachial cutaneous nerve was identified and protected, multiple recurrent branches of the radial artery may be encountered and should be ligated. Blunt dissection of the biceps tendon and muscle was performed as proximal as possible. Muscle electrostimulation was performed in order to check if the muscle was still contracting. The distal biceps tendon was isolated, and scar tissue was removed. Dissection was continued toward the empty fibrotic tunnel formed by brachioradialis laterally and brachialis and pronator teres medially; it was enlarged by finger dissection down to the radial tuberosity. We then isolated the LF, sharp dissection was continued to the ulnar crest and the graft was harvested. In one case (large and muscled patient), we performed a second incision parallel to the cresta ulnaris in order to dissect the LF more distally. Usually the graft was 3 cm wide and 15 long. The LF was tubolized (Fig. 1) around the remaining distal biceps tendon with Ethibond 2–0 (Ethicon, Somerville, NJ, USA). With this technique we increased the length of the tendon up to 2.5 cm. Tourniquet was removed in order to check the mobility of the tendon. Radial tuberosity was exposed and prepared, 2 Twin-Fix 5.5 mm (Smith & Nephew, London, UK) anchors were inserted at the tuberosity, these anchors were loaded with 2 sutures (Ultrabraid). Every suture was passed through the graft with the Krakow technique, and a sliding knot is made. We fixed the graft with the elbow flexed between 45° and 60°, and we checked that the radial tuberosity was fully covered by the graft. We then preformed cyclic loading tests between 30° and 90° in order to check the stability of the fixation and the bone–tendon contact. A 14-mm-diameter drain was placed subcutaneous for 2 days. The wound was closed with 2–0 absorbable subcutaneous sutures and staples for the skin. The arm was placed in a soft sling with the elbow at 90° of flexion and neutral rotation.

Results

Four patients who fulfilled the inclusion criteria were reviewed, all had good functional results (the mean MEPS was 95/100); X-rays showed a good orientation and integration of the anchors with no mobilization of the hardware. None had muscular herniation from the donor site. Two transient radial nerve paraesthesias were the major complication in our series: Patient nr1 had numbness for 1 year and patient nr4 for 6 months (Table 1).

We first tried this augmentation on cadavers and then we applied the technique in five chronic distal biceps tendon tear. We reattached the grafted tendon with 45°–60° of elbow flexion, soft sling was used for only 15 days, and full active range of motion was reached in 4 weeks after surgery.

Discussion

Hamer [11] first described LF augmentation for biceps repair, but he did not present any case. Most of the authors treat chronic distal biceps tendon tears with allograft, recently Morrey [2] proposed a direct reinsertion with extreme flexion of the elbow (up to 90°), care must be

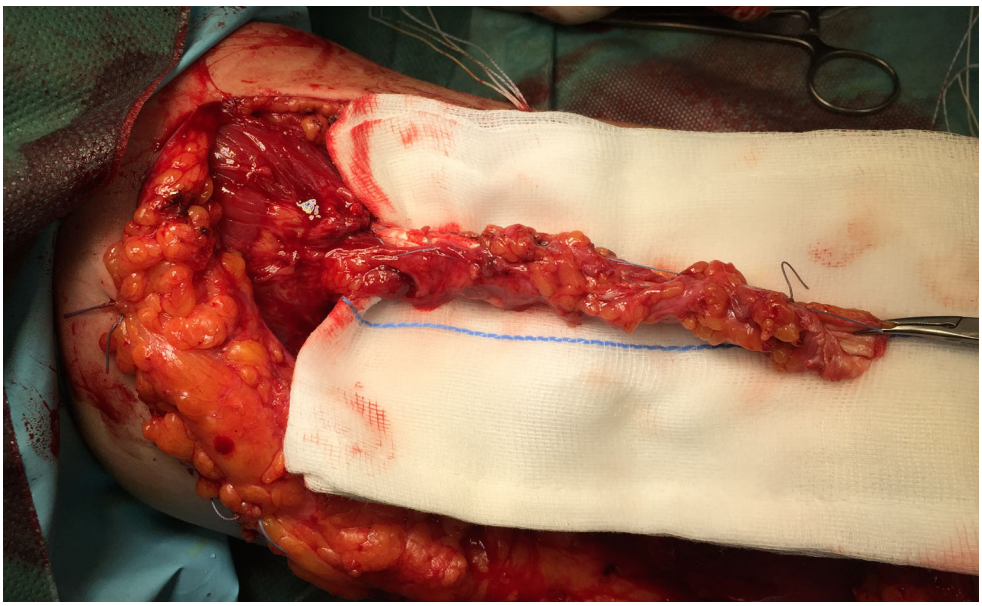

Fig. 1 Graft tubolized around the distal biceps tendon, ready for insertion at the radial tuberosity

Table 1 Results

Patient	Sex	Age	Side of lesion	Dominant hand	Surgery (weeks)	Follow-up (months)	MEPS	Complication
1 TD	M	48	Left	Right	4	33	100	Radial nerve paresthesia 1 year
2 AN	M	48	Left	Left	8	32	100	–
3 AA	M	51	Left	Right	24	84	80	–
4 OB	M	33	Right	Right	16	28	100	Radial nerve paresthesia 6 months

taken to protect the suture with a long immobilization time (6 weeks). They revised 23 patients (22 men, 1 woman), subjectively 20 patients were "very satisfied" and 3 patients were "satisfied".

Some authors [8–10] describe LF anatomy, and this tissue is always present with different characteristics in width thickness and length. They believe that the presence of an intact bicipital aponeurosis limits retraction of the tendon, increasing the chance of direct repair regardless the time of the injury.

It seems that the graft is only a connection between the muscle and the radial tuberosity that is used to reduce the immobilization time compared to the direct repair in extreme flexion. Landa et al. [12] in 2008, with a cadaveric study, demonstrated that LF termino-terminal sutures increase the mechanical strength in distal biceps tendon repair.

LF presents some individual characteristics such as length and width, there are no correlations between LF and gender and laterality. A deep layer of LF was consistently observed with an average of 0.9 cm width. The mean central length is 8.6 cm [13].

Conclusions

Our surgical technique with autoplastic LF is a cheap technique compared to allograft augmentation. It does not require a long immobilization time, and it does not present any host vs graft reaction. Recovery is quicker compared to the techniques described in other papers, and integration is faster due to the use of an autologous vascularized graft. With this technique we increase the length of the tendon up t o 2.5 cm.

We reattach the grafted tendon with 45°–60° of elbow flexion, full active range of motion is reached in 30 days after surgery.

We did not have any muscular herniation or any hardware mobilization.

We recommend a pre-op ultrasound scan to evaluate LF integrity, shape and size. We also suggest to keep allograft available in the OR if LF is to small or thin.

Compliance with ethical standards

Conflict of interest None.

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