

SURGICAL TREATMENT OF DISTAL BICEPS TENDON RUPTURES RESULTS OF A MULTICENTRIC BOTA¹ - STUDY AND REVIEW OF THE LITERATURE

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Distal biceps tendon ruptures (DBTR) are relatively uncommon. This multicentric study, conducted on behalf of BOTA (Belgian Orthopedic Trauma Association), documents the complications and results after surgical treatment of 18 DBTR's. In the current series a repair with Mitek anchors was found to be a simple and reliable fixation that could be performed through a single anterior approach with minor risks of radial nerve damage.

If a two-incision technique following Boyd and Anderson is used, the ulna should not be exposed in order to avoid a radioulnar synostosis; splitting the extensor muscle mass is preferable to a subperiosteal ulna dissection, and the wound should always be drained to decrease the likelihood of hematoma formation.

Keywords : distal biceps tendon ruptures ; conservative treatment ; surgical repair methods.

Mots-clés : rupture tendon distal du biceps ; traitement conservateur ; techniques chirurgicales.

INTRODUCTION

Avulsions of the attachments of the biceps tendon are uncommon : the long head is affected in 96%, the short head in 1% and the distal tendon in 3% of the cases (9). Because distal biceps tendon rupture (DBTR) is so uncommon, it is unusual for any surgeon to see and treat more than a few cases during his professional life. For this reason a multicentric study was conducted on behalf of the Belgian Orthopedic Trauma Association (BOTA). Eighteen cases were collected. The purpose of this study is to report the complications and functional results in these 18 patients and to compare these data to those reported in the literature.

PATIENTS AND METHODS

Eighteen patients were operated in 6 orthopedic hospitals (U.Z. - Gent : L. De Wilde, C. Martens, R. Verdonk ; A.Z. - St. Jan Bruges : W. De Groote ; St. Blazius Dendermonde : K. Govaerts ; U.Z. - Gasthuisberg Louvain : P. Reynders ; A.S.Z. Aalst : J. Van Overschelde, F. Mertens ; Hôpital de la Citadelle Liège : J. Rondia). Eighty percent of the injuries were job-related and occurred when lifting or pulling heavy loads with the elbow flexed at 90°. All injuries in this series occurred in men. The average age of the patients at the time of injury was 50 years (range 37-65). Eleven injuries were in the dominant and 7 in the nondominant extremity. One patient was operated 3 months after injury ; all other 17 patients were operated within 2 weeks following the injury. In 12 cases the single-incision technique was used, and in 6 cases the two-incision technique originally described by Boyd and Anderson (5) was used. To secure the tendon in the radial tuberosity 4 different techniques were used : transosseous fixation with mersilene (9 cases), a Mitek anchor (6 cases), screw fixation (2 cases) and imbedding the distal biceps tendon into the brachialis muscle (1 case). In the latter case this technique was used because there was too much scar tissue in the muscle 3 months after injury.

Postoperatively all patients were immobilized in a plaster splint with the elbow flexed at 90° and the forearm in supination or neutral position for an average of 6 weeks (range : 1 to 8 weeks). Passive range of motion was allowed after an average of 3 weeks (range

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1 to 6 weeks). Active mobilization was permitted after an average of 5 weeks (range 4 to 8 weeks), followed by a progressive resistance exercise strengthening program.

RESULTS

All the patients were reviewed 4 to 6 months after surgery. The patients returned to work on an average 4 months after the injury (range: 2 to 6 months). In 10 patients the ranges of motion of the involved and uninvolved extremities were equal. Five patients lacked 5-10° extension, two patients lacked 10-20° supination, and one patient had a pronation deficit of 10°. Five patients complained of a slight loss of supination strength. Three patients had a transient motor or sensory nerve deficit (2 radial nerves and 1 median nerve). Only in 1 patient was there evidence of calcification at the tuberosity, but a radioulnar synostosis was not found in this series.

DISCUSSION

Reports of large series of distal biceps tendon ruptures (DBTR) are sparse. Usually middle-aged men with a physically demanding occupation and athletes, like weightlifters or gymnasts are affected. No case of DBTR has been reported in women. In about 70% of the cases it is a job-related injury resulting from lifting or pulling heavy loads with the elbow flexed at 90°. A degenerative process in the tendon is rarely the only reason for a rupture, although DBTR has been reported in association with anabolic steroid use (20). The rupture usually occurs at the bony attachment and seldom leaves any tendon tissue distally. Partial avulsions have been reported (4, 18) but are very rare.

The diagnosis must be made clinically. However, the diagnosis is often delayed because this condition is so infrequent. Typically the patient describes an immediate sharp pain, occurring when lifting or pulling a heavy load with the elbow flexed at 90°. Within a few hours this intense pain gradually subsides. Nevertheless a persistent ache may be present for weeks in the antecubital region. Swel-

ling and ecchymosis usually develop subsequently. The range of motion is seldom limited, but the physician can elicit weakness of supination.

Sonographic evaluation can be helpful but, even if the sonography is done by a very experienced physiotherapist or radiologist, it sometimes indicates a partial rupture. Awareness of this condition and a thorough clinical evaluation are the keys to an early diagnosis.

Conservative treatment of DBTR has been advocated in patients with poor general health, in elderly patients and in patients with poor skin condition. Moreover, conservative treatment might also be indicated in old ruptures or, if the patient can be satisfied with a residual loss of strength of flexion and supination. Indeed, previous studies (2, 10, 17, 20) have clearly documented that conservative treatment of DBTR always results in a 40% decrease in elbow flexion and supination power and in a 60% decrease in endurance of supination. These deficits cannot be accepted for laborers and athletes, who require full strength and endurance. For a laborer these functions are very important for using a screwdriver or a hammer. Therefore every patient who is still working or who is active in his daily life must undergo surgical reconstruction. Immediate reattachments give the best functional results, but late reinsertion also improves strength of flexion and supination, although not to normal (17). Anatomic operative repair of a DBTR leads to better results compared to conservative treatment (2, 3, 11, 14, 15, 20), although 0 to 28% of the patients have a residual loss of mobility. Several authors showed that the patients obtain good results with respect to strength and endurance. Baker and Bierwagen (2) found that all patients after surgical repair returned to normal levels of strength and endurance with regard to both flexion and supination. Others (1, 6, 14) found a full return to objective function in the dominant arms, whereas in the nondominant arms they observed deficits ranging from 14 to 36% in supination and flexion strength.

Although surgical repair has been shown to give better results than conservative treatment, the optimal method of operation is still debated. In the single-incision technique an S-shaped incision is made on the flexor side of the elbow to about

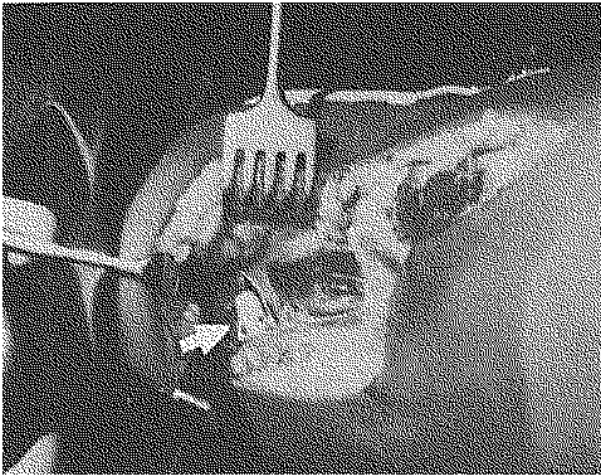


Fig. 1.

8 cm distal to the crease of the elbow. After ligation of the subcutaneous veins, the fascia is incised longitudinally ulnar to the brachialis and brachioradialis. The lateral antebrachial cutaneous nerve is identified and retracted laterally. Usually the biceps tendon is retracted above the elbow (fig. 1). Then the brachial artery and the median nerve are visualized and retracted to the ulnar side. The radial tuberosity is approached bluntly between the pronator teres and the brachioradialis. During the dissection, the deep branch of the radial nerve, which is located on the ulnar side of the brachioradialis, must be avoided. The biceps tendon is fixed to the radial tuberosity with a Mitek anchor, a screw, or mersilene sutures with the radius in maximal supination (fig. 2). When using the single-incision technique some authors (2, 11) emphasize that it is very difficult to reattach the tendon. A single incision usually requires an extensive volar dissection to expose the radius. This has caused both common radial and posterior interosseous nerve injuries (7, 16, 18, 20). In our multicentric study we found one radial nerve injury and one median nerve injury with the single-incision technique, but they were only a temporary sensory conduction disorder (neurapraxia). In the past, most surgeons liked to reconstruct the tendon with mersilene sutures or a screw and a plastic washer, but this technique needed an extensive volar dissection through a single incision. The recent use of Mitek

anchors might provide a real advantage (4, 13, 17, 21), because only one cortex needs to be drilled and limited exposure is sufficient (fig. 2 and 3).

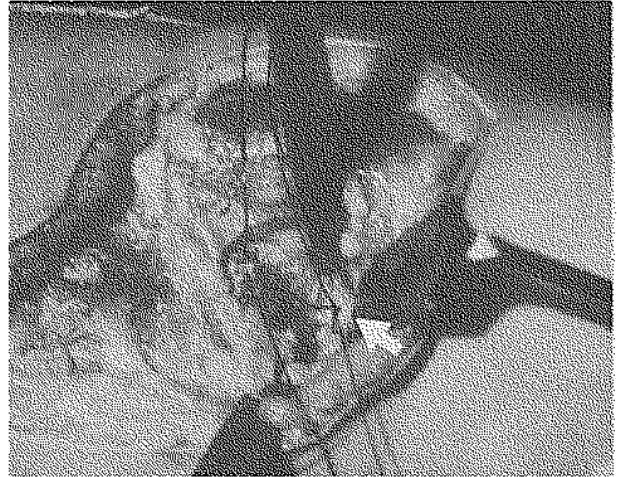


Fig. 2.

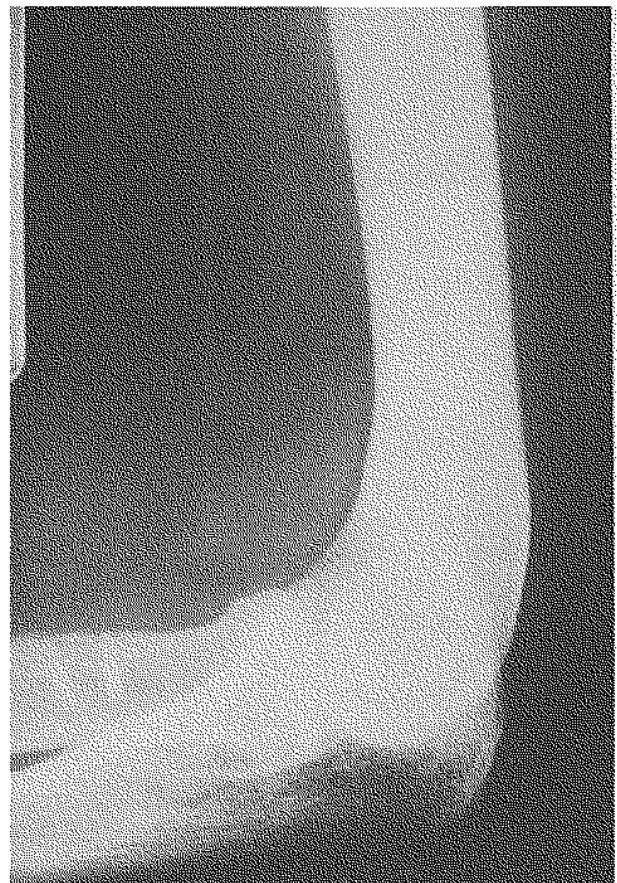


Fig. 3.

The Mitek anchor seems to be sufficiently strong to maintain the repair throughout the healing and rehabilitation processes (15).

Because of the risk of radial nerve injury, some surgeons suggested attaching the tendon of the biceps brachii to the brachialis muscle (7, 16). Although this technique simplifies the operation and avoids radial nerve injuries, it ignores the fact that the biceps is the most powerful supinator in the forearm. One should keep in mind that the supination strength and endurance is not restored with this operation, and that this results in a very severe functional handicap to the active laborer. If the biceps tendon is too short, it might be better to perform a Z-shaped tendoplasty, than to imbed the biceps into the brachialis muscle, in order to avoid loss of extension.

In order to allow reattachment with less difficulty and with less risk of damage to the radial nerve, the two-incision technique was developed by Boyd and Anderson (5). The dorsal incision compensated for the limited anterior exposure. When using the two-incision technique, the anterior curvilinear incision stops a few centimeters distal to the joint line. The bicipital tunnel is located between the pronator teres and the flexor mass, and with a blunt instrument the opening of the canal is located between radius and ulna. The forearm is flexed and a second incision is made over the posterolateral aspect of the elbow. The muscles attached to the lateral surface of the olecranon are detached by subperiosteal dissection and retracted laterally. By fully pronating the forearm, the radial tuberosity is identified, and after that a unicortical window is made in the tuberosity with a small osteotome. Two drill holes are placed next to the window, and sutures are brought through the drill holed and secured with the arm in 90° flexion and full pronation (5). Unfortunately, this technique has been associated with reports of motion-limiting soft tissue ossifications and proximal radioulnar synostosis (8). The cause for the synostosis is the subperiosteal release of the anconeus muscle from the lateral aspect of the olecranon and proximal ulna, which may cause damage to the proximal portion of the interosseous membrane, a hematoma between radius and ulna, and stimulation of the ulnar

periosteum. A modification of the Boyd-Anderson approach has been successfully used by some authors (8, 17). After the placement of the blunt instrument into the canal of the biceps tendon, the area for the posterior incision can be located. By performing a limited muscle-splitting approach through the extensor muscle mass, a subperiosteal dissection of the ulna is avoided, the radial tuberosity is clearly visualized and the likelihood of synostosis is decreased. In the current series no radio ulnar synostosis was seen in the two-incision technique. There was only one ossification at the insertion of the biceps tendon and one radial nerve neurapraxia. Even with this approach the wound should always be drained to decrease the possibility of hematoma formation. Despite all these precautions, Leighton *et al.* (14) had one patient who developed a synostosis that required resection.

In conclusion, although distal biceps tendon ruptures are very rare, one has to be aware of this pathology, because the best functional results are obtained after an early reconstruction. Currently the repair with Mitek anchors is a very simple and reliable technique that can be performed through a limited anterior exposure, minimizing radial nerve injuries. If the two-incision technique is used, the ulna should not be exposed to avoid a radioulnar synostosis, and the wound should always be drained to decrease the likelihood of hematoma formation.

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SAMENVATTING

C. MARTENS. Heelkundige behandeling van distale bicepspees rupturen.

Distale bicepspees rupturen komen zelden voor. Deze multicentrische studie, uitgevoerd in samenwerking met de BOTA (Belgische Orthopedie en Trauma Associatie), geeft de complicaties en de resultaten weer na een heelkundige behandeling van 18 distale bicepspees rupturen. In deze reeks wordt aangetoond dat het gebruik van Mitek ankertjes een éénvoudige en solide fixatie met zich meebrengt die kan uitgevoerd worden via een enkelvoudige anterieure toegang met minimale risico's voor de radiale zenuw.

Wanneer een dubbele incisie techniek volgens Boyd en Anderson toegepast wordt, mag de ulna niet gedeperioosteerd worden. De beste toegang via dorsaal naar het tuberositas radii is dan via het klieven van de extensorspiermassa om een radio-ulnaire synostose te vermijden. De wonde dient ook altijd gedraineerd te worden om hematoomvorming tegen te gaan.

RÉSUMÉ

C. MARTENS. Traitement chirurgical des ruptures du tendon distal du biceps. Résultat d'une étude multicentrique du BOTA et revue de la littérature.

Les ruptures du tendon distal du biceps sont relativement rares. L'auteur présente une étude multicentrique réalisée sous l'égide du BOTA (Belgian Orthopedic Trauma Association), étude portant sur les résultats et les complications du traitement chirurgical de 18 cas de rupture du tendon distal du biceps. Cette étude a montré qu'une réparation par des ancrs Mitek pouvait assurer une fixation simple et fiable, au prix d'un simple abord antérieur comportant peu de risques de lésion du nerf radial. Si l'on utilise une technique par deux incisions selon Boyd et Anderson, il faut éviter d'aborder le cubitus pour éviter une synostose radio-cubitale ; il est préférable de fendre la masse commune des extenseurs plutôt que de réaliser une dissection sous-périostée du cubitus, et l'incision doit toujours être drainée pour réduire le risque d'hématome.