

# Rupture of the distal biceps tendon. Why is the incidence rate increasing? When should it be repaired?

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## Summary

**Introduction and objectives:** The breaking of the distal biceps tendon is rare and represents only 3% of all breakings of this tendon. However, for the last decade this percentage has increased up to 10%. They are characteristic of middle-aged men with a predominance of the dominant arm. Local risk factor (high functional demand) and systemic ones (smoking, dyslipidemia, steroids, analogies, obesity) are associated with this pathology. Our goal is to analyze the risk factors which are associated with this condition and evaluate the results after surgical repair of the tendon.

**Materials and methods:** Retrospective study of 13 patients diagnosed with distal biceps tendon breaking in our hospital from May 2012 to January 2014. All patients were treated surgically with anatomic reattachment single trak (69,23 % with Endobutton's technique and 30,77 % remembering using harpoons). There have been assessed factors such as potential risk factors, joint mobility, early and late complications and the patient's degree of satisfaction (scale Karunakar). Their clinical follow-up was carried out for at least 6 months after the surgery.

**Result:** All patients were male, with an average age of 42,69 years, the 92,3 % were in the dominant arm, 76,92 % of the patients usually exercised the biceps while training and 53,84 % were taking medication for dyslipidemia. The results obtained after the treatment were excellent, showing that all patients were satisfied with it.

**Conclusion:** The risk factors that are known so far such as smoking, dyslipidemia, steroids, anabolics and obesity do not justify the increase in the current incidence rate. Regular exercise involving the biceps brachial muscle in patients with risk factors increases the probability of breaking the distal biceps tendon and anatomic reattachment anterior approach is a correct treatment option.

## Key words:

Break. Biceps. Factors.

## Rotura distal del tendón de la porción larga del bíceps braquial. ¿Por qué está aumentando su incidencia? ¿Cuándo se debe reparar?

### Resumen

**Introducción y objetivos:** La rotura del tendón distal del bíceps braquial es poco frecuente y representa sólo el 3% de todas las roturas de este tendón, aunque en la última década ha aumentado hasta un 10%. Son características en varones de edad media con predominio del brazo dominante. Se asocian factores de riesgo locales (alta demanda funcional) y sistémicos (tabaco, dislipemia, corticoides, anabolizantes, obesidad). Nuestro objetivo es analizar los factores de riesgos asociados a esta patología y evaluar los resultados tras la reparación quirúrgica de dicho tendón.

**Material y métodos:** Estudio retrospectivo de 13 pacientes diagnosticados de rotura de bíceps distal en nuestro servicio desde mayo de 2012 hasta enero de 2014. Todos fueron tratados quirúrgicamente con reinserción anatómica con vía única (69,23% con técnica Endobutton y 30,77% con reanclaje mediante arpones. Se ha valorado los posibles factores de riesgo, movilidad articular, complicaciones precoces y tardías y satisfacción del paciente (escala de Karunakar). Su seguimiento clínico ha sido de al menos 6 meses.

**Resultados:** Todos fueron varones con edad media de 42,69 años en brazo dominante en el 92,3%. El 76,92% realizaban deportes para ejercitar el bíceps y el 53,84% tomaba medicación por dislipemia. El resultado obtenido tras el tratamiento fue excelente estando satisfechos la totalidad de los pacientes

**Conclusiones y discusión:** Los factores de riesgo conocidos hasta la fecha son el tabaco, dislipemia, corticoides, anabolizantes y obesidad que no justifican el aumento de la incidencia actual. La práctica deportiva habitual que implique tonificar y muscular el músculo braquial en pacientes con factores de riesgo aumenta la probabilidad de rotura del tendón distal de bíceps y su reinserción anatómica por vía anterior es una correcta opción terapéutica.

## Palabras clave:

Rotura. Bíceps. Factores.

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## Introduction

Rupture of the distal biceps tendon is a rare injury that comprises around 3% of the pathologies of this tendon<sup>1</sup>. It appears in middle-aged males (40-50 years) with pre-dominance in the right arm. The rupture is located in the musculo-tendinous junction, which is the weakest area of the muscle-tendon-bone complex and specifically the insertion of the tendon in the radial tuberosity. The aetiology of the rupture of this long-head tendon tends to be traumatic. It occurs upon performing an unexpected extension load applied with the elbow in flexed position<sup>2</sup> but it can also occur as a result of mechanical over-exertion or as the final phase of a degenerative process<sup>3</sup>. In this case, before the distal biceps rupture the patient, presented clinical tendinitis (painless) and in the histopathological study a pathological alteration can be observed of the tissue prior to the rupture, with degenerative and atrophic changes to the tendon, with disorganised collagen fibres, a reduction in the number of fibroblasts, areas of necrosis and calcification, which could have been caused by a failure within the normal repair mechanism of the tendon due to an anomalous regulation of the metalloproteinases of the extracellular matrix.

Table 1 displays the most frequent causes of tendinitis of the distal biceps tendon<sup>4</sup>.

The consumption of steroids, nicotine<sup>4</sup> and statins<sup>5</sup>, hyperparathyroidism, chronic acidosis<sup>6</sup>, and some systems diseases (systemic lupus erythematosus)<sup>7</sup> have been described as risk factors in the rupture of the distal biceps tendon but these do not justify the increase in the incidence rate of this pathology in the past decade.

The biceps are attributed as the male muscle by excellence, which marks the difference between the female and male aesthetic. Over recent years, men's interest in displaying large and well-defined biceps has increased and they achieve this by training with repetitive flex-extension movements, with or without load. Despite its rarity, athletes that perform strength training and practise contact sports may present problems related to this pathology<sup>8</sup>.

Good results have been published with conservative and surgical treatment, but recently-published bio-mechanical studies comment that if the distal biceps tendon is not reinserted anatomically, the flex strength is reduced by 30% and the supinator strength by 40%<sup>9</sup>. The majority of the studies recommend operation of acute ruptures of the distal brachial biceps tendon in young patients, with high functional demand, of an active working or sporting age, with whom it is impossible to bring the

distal biceps stump of the bicipital tuberosity closer with the elbow at a 70°10 flex. Sutural anchors allow for less dissection and minimises the risk of radial paralysis by a single anterior channel.

Over the last two years, the cases of distal biceps rupture have increased in our clinic. Our aim is to identify the possible risk factors and causes of this increase, and to assess the results following its surgical repair.

## Material and methods

A retrospective study has been carried out on thirteen patients, diagnosed and operated with acute rupture of the distal long head of the biceps between November 2012 and June 2014. To demonstrate the influence of risk factors, the following data was collected: age, sex, affected side, profession, antecedents of previous tendinitis pathology (pain in the insertion of the distal biceps and/or muscle belly of the biceps), risk factors, sporting habits and result of the functional test.

The risk factors were taken into account: Smoker or ex-smoker (number of cigarettes smoked a day and years smoking), corticosteroid use (reason for prescription, doses and duration), treatment for dyslipemia (generic name, doses and treatment duration), consumption of anabolic agents (daily doses and consumption time). And pre-disposing factors: profession (in which repetitive flex-extension movements of the elbow are carried out, with or without lifting loads) and sporting habits (strength training and contact sports).

The diagnosis was performed, assessing the pain, swelling, deficit in flex and supination, the presence of a visibly sunken area and the Hook test.

All the patients were given an informed consent form and the advantages and disadvantages of surgical intervention were explained to them. The minimum follow-up after treatment was six months.

The variables were statistically analysed with the SPSS programme (15.0; SPSS Inc, Chicago, Ill).

## Surgical technique

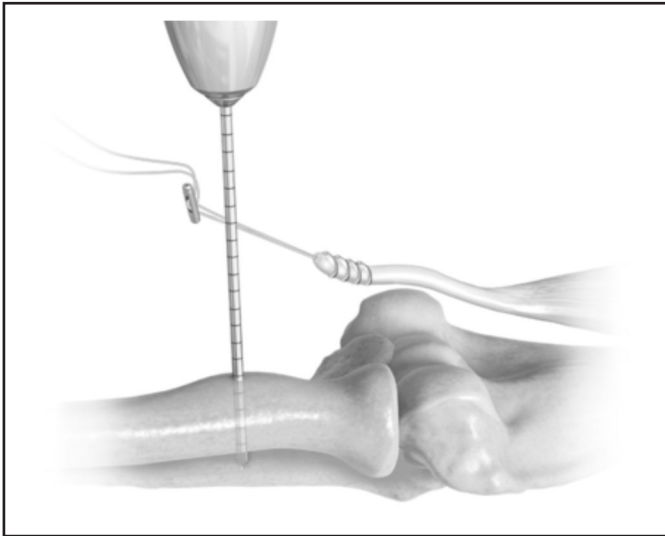
By means of an anterior single-incision Henry-type channel, the distal biceps tendon was located and repaired anatomically.

In nine patients (69.23%) the tendon was reinserted using the BicepsButton® technique (Arthrex, Naples, FL), and in four (30.77%) with sutural anchors (Figures 1 and 2).

**Table 1. Causes of tendinitis.**

Extrinsic factors	Intrinsic factors
<ul style="list-style-type: none"> <li>– Mechanical overloading.</li> <li>– Increased intensity of the strain.</li> <li>– Increase in the frequency of the strain.</li> <li>– Increase in the duration of the strain.</li> <li>– Technical training errors.</li> <li>– Postural errors.</li> <li>– Working position (ergonomics).</li> </ul>	<ul style="list-style-type: none"> <li>– Anatomical factors.</li> <li>– Malalignment, angular or torsional deformities.</li> <li>– Muscle weakness or agonist-antagonist imbalance.</li> <li>– Vascular insufficiency.</li> <li>– Age-related alterations. Degenerative process of the tendon reduction in intrinsic repair capacity, increase in stiffness, ischemia.</li> <li>– Systemic diseases.</li> <li>– Enthesis associated with spondylo-arthropathies. Others: tendinopathies associated with quinolones.</li> </ul>

**Figure 1. BicepsButton® Technique: Preparation for tendon insertion.**



**Figure 2. BicepsButton® Technique: Re-insertion of the distal head of the biceps.**



Tendon samples from two patients were sent to the Pathology Anatomy Service, whose reports revealed degenerated tendon.

The average waiting time from diagnosis of the rupture to surgical intervention was 6 days (1-11).

An antebrachial splint immobilised the area for 3 weeks and immediately after its removal rehabilitation treatment commenced with passive and active elbow flex-extension. The patients were assessed upon the first, third and sixth month, and a year after the surgery. We assessed the following parameters: mobility, strength, pain and personal satisfaction. Mobility was assessed by comparing it to the contralateral arm and measuring the arch of movement manually with a goniometer. The degree of satisfaction was assessed according to the Karunakar *et al*<sup>11</sup> scale.

## Results

All were males with an average age of 42.69 years (30-65 years) and twelve (92.3%) ruptures were located in the dominant arm. Eleven ruptures (84.6%) affected the right arm and two (15.4%) the left arm. One patient had an antecedent of contralateral rupture (left side). In our study, the rupture was generated in eight cases (61.53%) whilst under strain (six lifting a weight at work or in the gym, another taking a ski-lift button, and the other climbing), in four cases (30.8%) following a trauma to the elbow and in one case (7.67%) following a fall. The patient with bilateral rupture suffered the first following a blow to the non-dominant elbow whilst boxing and the second whilst climbing.

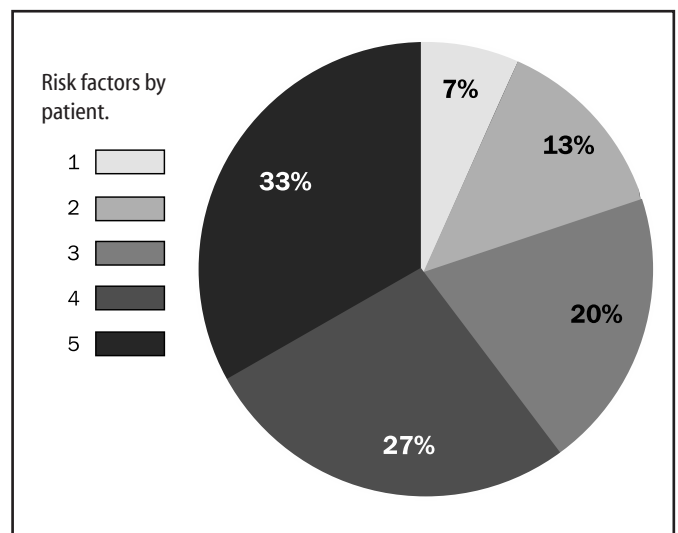
With regards to the different aetiologic factors that appear in the bibliography<sup>6</sup>, two patients (15.38%) had been smokers for over 7 years and a further two (15.38%) had stopped smoking 2 years ago. Two (15.4%) took corticosteroids on demand due to respiratory pathologies, seven (53.84%) took anti-dyslipemia agents on a daily basis, and two (15.4%) had been taking anabolic agents daily to improve their sporting performance for over 3 months. Three (23.1%) reported an antecedent of tendinopathy (tendinitis) in the years leading up to the rupture and one (7.7%) had a contralateral rupture. Six (46.15%) patients carried out repetitive movements with a load on a daily basis at work, and ten (76.92%) persistently carried out sporting activities in which the brachial biceps muscle worked actively (weights at the gym, climbing and boxing) (Table 2 and Figure 3).

All the patients had at least one risk factor. All, except one, carried out daily repetitive flex-extension movements with a load.

The patients that had carried out mechanical over-exertion (occupational or sporting), suffered more ruptures of the distal tendon (0.05) than those that had not.

Neither taking corticosteroids, anabolic or dyslipemia agents, nor being a smoker were risk factors in the rupture of this tendon ( $p < 0.5$ ).

**Figure 3. Risk factors by patient.**



**Table 2. Patient risk factors.**

Case	Smoker	Corticosteroid	Dyslipemia	Anabolic agent	Tendinopathy	Risky occupation	Hobby
1	No	No	No	No	Yes	Yes	Yes
2	No	No	Yes	No	No	Yes	No
3	No	No	Yes	No	No	Yes	No
4	Ex-smoker	Yes	No	No	No	Yes	Yes
5	No	No	No	Yes	No	Yes	Yes
6	No	No	No	No	No	No	Yes
7	No	No	No	No	No	No	Yes
8	No	No	Yes	No	Yes	No	Yes
9	No	Yes	No	No	Contralateral	No	Yes
10	No	No	Yes	No	No	No	No
11	Yes	No	Yes	No	No	No	Yes
12	Ex-smoker	No	Yes	No	No	Yes	Yes
13	Yes	No	Yes	Yes	Yes	No	Yes

After 6 months, all the patients were able to perform a complete flex, eleven (92.3%) a complete extension and three (23.1%) had a minor limitation in supination. Eleven patients (84.6%) recovered the same strength as the contralateral arm. No patient registered pain. No differences were found ( $p > 0.05$ ) between the two surgical anchoring techniques used.

The degree of personal satisfaction was assessed according to the Karunakar *et al.*<sup>7</sup> scale. Nine patients (69.2%) expressed an excellent degree of satisfaction, and four patients (30.8%) good. No cases of re-rupture were registered. All the patients returned to their work and sporting activities 6 and a half months after surgery<sup>2-8</sup>.

## Discussion

All our patients were males, they were aged over 30 years and they carried out some kind of sporting activity various times a week, in which the biceps muscle had an actively participative role. The incidence rate of this pathology in women has not varied, despite the increase in sporting activities, because they do not wish to increase the muscular volume of this muscle<sup>6,12</sup>. Karunakar *et al.*<sup>11</sup> in their study, mentioned that the rupture of this tendon usually occurs in men between 40 and 50 years of age, and they also related age and sinew rupture with the decline of the connective tissue's resistance to tension with the ageing process, though they do not statistically prove this. In our study, just as in that of Karunakar *et al.*<sup>11</sup> there is also a histological study that reveals the degenerative and atrophic changes of the tendon, despite this being a slightly younger sample group. To provide statistical evidence, we should have designed a case study (patient with rupture), a control study (patient without rupture), and compared the pathological study of the long-head distal biceps tendon of patients of the same age.

Over the last decade, distal biceps rupture has constituted 10% of the pathology for this muscle, i.e. the incidence rate has increased by

approximately 7%.<sup>1</sup> However, the risk factors described to date have not varied<sup>7</sup>. In our study, the patients that took anti-dyslipemia agents and/or regularly exercised the brachial biceps, presented this rupture. Authors such as Rantanen and Orava<sup>13</sup> have affirmed that athletes were at the greatest risk of suffering from this injury, and in the study conducted by Pullatt *et al.*<sup>5</sup> half the patients had dyslipemia that was treated pharmacologically.

We do not agree with the results from the study by Safran *et al.*<sup>4</sup> in which they conclude that the consumption of corticosteroids and anabolic agents are predisposing factors to the rupture of this injury. We do recognise that 62% of the patients had more than two risk factors, i.e. that as risk factors increase, so does the possibility of acquiring this rupture.

The difficult of this study is obtaining a suitable sample size due to the low incidence rate of this injury. This is only possible if the study duration is extended.

We only proposed surgical intervention to young patients with functional demands, both occupational and sporting, and we ensured that they would follow post-operational recommendations. We preferred to use the anterior and single channel, reinserting the tendon anatomically because according to publications to date, that is the most effective method.

Overall the surgical results were positive; only 23.33% (3/13) displayed limitations in the pronosupination position and 7.69% (1/13) in extended position. In our case we did not have to perform any further interventions and complications were minimal.

In the study performed by Guerra-Vélez *et al.*<sup>14</sup> the best functional results were also obtained in patients in whom the tendon was reinserted anatomically through a single channel.

Despite this being a short series, we conclude that in regular sporting practice, which involves toning and building the brachial muscle, patients with risk factors face a higher possibility of rupturing the distal biceps tendon, and that the anatomical reinsertion by anterior channel is a good therapeutic option.

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