

# Triceps tears in athletes: different injury patterns and surgical treatment

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## Abstract

**Introduction** Triceps muscle tears requiring surgical treatment are uncommon injuries.

**Method** We present 10 cases, all of them were athletes. All these patients were treated surgically between 1993 and 2009. Three operations were performed in the acute phase and the rest seven cases an average of 6 months (range 3–12 months) after the primary injury. The mean follow-up period after surgery was 6 years (range 2–9 years).

**Results** The result was evaluated to be excellent in five cases, good in four, and fair in one patient. All except one patient were able to resume full training.

**Conclusion** Our results show that surgical treatment seems to be beneficial in severe triceps tears even after failed conservative treatment.

**Keywords** Triceps · Tear · Muscle · Tendon · Surgical treatment

## Introduction

Triceps brachii muscle–tendon complex tears are fairly uncommon injuries. Anzel et al. [1] reviewed 1,014 tendon ruptures in 781 patients and found only 8 triceps ruptures (0.8%) in the series. They are usually related to accidents or sudden unexpected acute loading of the arm during sports [2–6]. Case reports and small series of patients with triceps tears have been reported as both sports injuries and as work-related injuries [2–5, 7, 8]. In athletes triceps tears have been described mainly in power events but also, e.g. among football players and the use of anabolic steroids has been associated with some of these injuries [3, 4, 6, 8, 9]. Also local steroid injections and olecranon bursitis are well known risk factors for triceps tears [4–6, 8]. The aim of this study was to provide more information about surgical treatment in athletes with a triceps tear. We also wanted to describe different injury patterns by presenting schematic drawings.

## Patients and methods

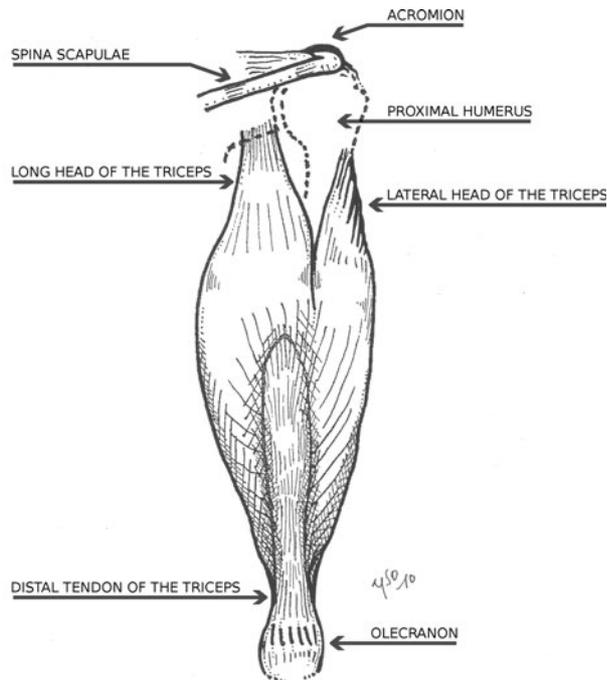
In total, 12 athletes with a triceps muscle–tendon tear were surgically treated at Mehiläinen Hospital and Sports Clinic, in Turku, Finland during 1993–2009. Two athletes were excluded from this study because of the short follow-up period (<6 months). The patients were all males, participating in power sports with heavy weight training. The tear occurred after falling on the outstretched arm in only one patient, in all the other patients the onset of the symptoms were related to vigorous weight training. The mean age of the patients was 35 years (range 25–49 years). The right arm was affected in six patients and the left arm in four. Four patients had been previously treated for chronic but

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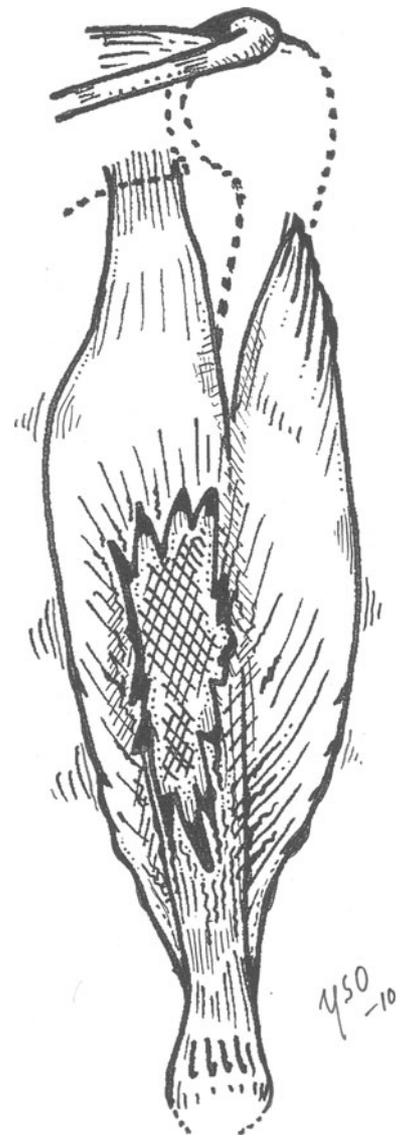
**Fig. 1** Anatomy of the normal triceps brachii muscle (*right side, posterior view*)

tolerable posterior elbow and upper arm pain in the affected arm. Two patients had had corticosteroid injections. All patients were treated surgically, but only three within 2 weeks of the injury. In the other patients the delay from the beginning of symptoms to surgery averaged 6 months (range 3–12 months). Radiographs were negative in eight patients, whereas in two patients triceps calcifications distally near the olecranon were seen. Ultrasound performed acutely revealed a tear of the triceps in all cases. MRI was also done in three cases to evaluate more precisely the extent of the injury. The normal anatomy of the triceps muscle is depicted in Fig. 1.

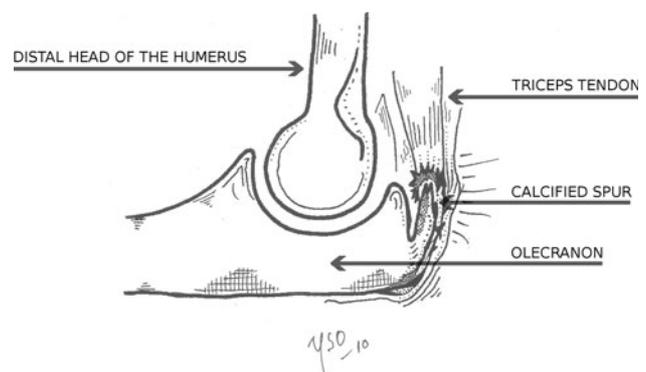
In six patients the tear was located in the musculotendinous area (Fig. 2). In these cases the injuries were initially diagnosed as partial tears and were first treated with rest and then with rehabilitation. They later suffered from new injuries, or the lesion prevented their weight training, leading to muscle weakness and wasting which developed over time. In three patients there was a distal avulsion of the triceps tendon from the olecranon (Figs. 3, 4) and one patient was diagnosed with a proximal (long head of the triceps) avulsion from the scapula (Fig. 5).

Three patients with complete distal avulsion reported pain and inability to fully extend the affected elbow. Localized swelling and hematoma were common findings in the early phase. Patients with partial injuries also reported of pain, discomfort and stiffness of the affected elbow.

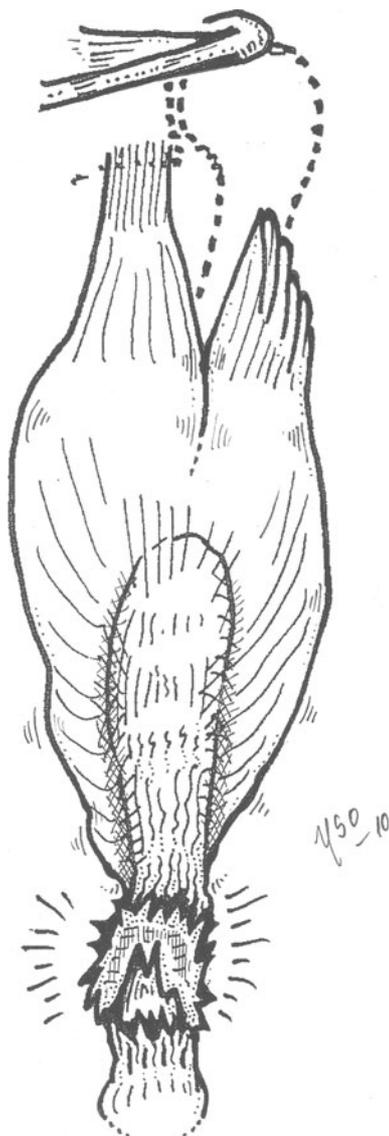
In surgery the musculotendinous tear was repaired with sutures after excision of scar tissue, adhesions and possible



**Fig. 2** A schematic drawing of partial tear of the triceps muscle (*right side*). The tear is located at the musculotendinous area



**Fig. 3** A schematic drawing of avulsion of the distal triceps tendon from the olecranon with calcification spur (*lateral view*)

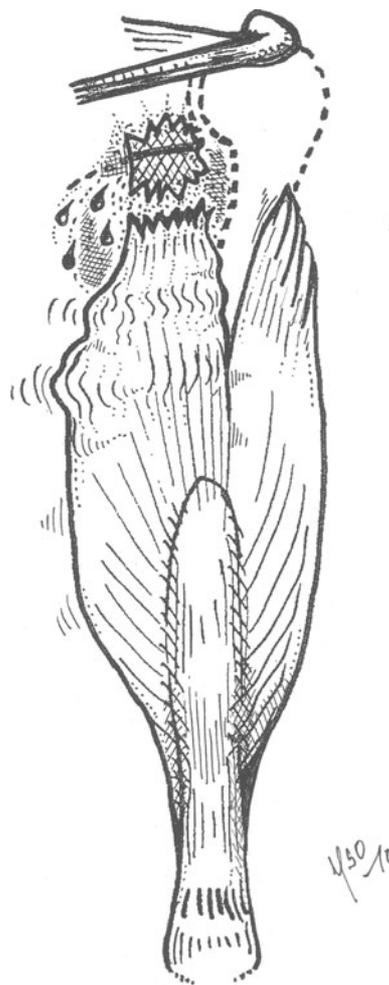


**Fig. 4** A schematic drawing of avulsion of the distal triceps tendon from the olecranon (*right side, posterior view*)

calcifications. In the distal and proximal avulsion injuries suture anchors (DePuy Mitek, Raynham, MA, USA) were used. No auto- or allograft was required in any operations [10].

Postoperatively the arm was bandaged and kept without a plaster cast to avoid stretching the triceps for 3 weeks. Mobilization and physiotherapy were started after 3 weeks. It took an average of 8 weeks (range 4–12 weeks) to obtain normal flexion of the elbow. Light strength training was permitted 2–3 months after surgery.

The patients were followed-up at the Mehiläinen Hospital and Sports Clinic in Turku, Finland. Follow-ups were routinely arranged with monthly visits up to 3–4 months and then at 6 and 12 months postoperatively. Additional



**Fig. 5** A schematic drawing of avulsion the long head of the proximal triceps tendon from the scapula (*right side, posterior view*)

follow-ups were scheduled as necessary, as well as for study purposes.

A four-category (excellent, good, fair, poor) rating system was used to evaluate the overall result according to the following criteria. The result was graded as excellent if the patient was asymptomatic and able to return to the preinjury level of sporting activity. If there were occasionally minor symptoms in the affected upper extremity during sport but the patient was able to return to the preinjury level of sport, the result was classified as good. The result was fair if the patient was still limited by pain, had not achieved preinjury activity level, showed moderate or severe restriction in the range of motion of the involved elbow, but noticed some improvement in symptoms after surgery and had no more symptoms related to daily activities. Finally, the result was classified as poor when the patient had no improvement at all and had disturbing symptoms even in activities of daily living.

**Table 1** Patient's age, sports activity, delay from injury to surgery, location of tear, the result of treatment and follow-up time in 10 patients with a triceps tear

Age (years)	Sport	Delay from injury to surgery (months)	Location of tear	Result	Follow-up (years)
39	Gym training	3	Myotendinous tear	Good	3
37	Power lifting	4	Myotendinous tear with large seroma cavity	Fair	3
34	Power lifting	5	Myotendinous tear	Good	6
28	Power lifting	7	Myotendinous tear	Excellent	8
30	Body building	10	Myotendinous tear with large seroma cavity	Good	5
29	Power lifting	12	Myotendinous tear with degenerative tendon changes	Good	7
49	Power lifting	1 week	Avulsion from olecranon	Excellent	1
48	Power lifting	2 weeks	Avulsion from olecranon	Excellent	2
35	Power lifting	3	Avulsion from olecranon	Excellent	7
25	Power lifting	2 weeks	Avulsion from scapula	Excellent	9

## Results

The mean follow-up time after surgery was 5 years (range 2–9 years). The results were excellent in five patients and good in four. These patients were able to resume full training 4–6 months after surgery. However, in three patients some triceps muscle atrophy persisted. In one patient the triceps muscle remained remarkably thin and weak, and the result was rated to be fair. No ADL-related symptoms were reported. There were no operative complications in the series. The details of the patients are given in Table 1.

## Discussion

Triceps tears have been reported to occur accidentally with forceful trauma mechanisms or as sports injuries [3–6, 8]. The typical injury mechanism is a rapid eccentric load against a contracting triceps while extending elbow [4, 6]. According to Sierra et al. [8] direct trauma to the flexed elbow followed by forced elbow extension is the other typical injury mechanism. The diagnosis of an acute triceps tear can be difficult and can easily be missed [6, 11]. In sudden total or subtotal tears the loss of function and strength is remarkable and massive swelling and hematoma may develop [6, 8]. A palpable gap is a common finding at the injury site after swelling has subsided [8]. With partial tears the clinical findings are less obvious and the tear may be surprisingly painless [12, 13].

The diagnosis of a triceps tendon rupture is clinical and should be suspected based on the history and clinical findings. The diagnosis and location of the tear can be confirmed with either ultrasound or MRI. According to location, triceps ruptures can be categorized into distal, central and

proximal ones [8]. The tear can be an avulsion from the olecranon with or without a small flake of bone [4–6, 8]. A rupture in the musculotendinous area tends to extend more to the medial part of the muscle but it can be in the belly of the triceps muscle also [2, 14, 15]. Avulsion of the long head of the triceps from the scapula is a very rare injury. To our knowledge no previous reports of surgically treated proximal triceps avulsion has been previously published. Bilateral distal triceps tendon ruptures have also been reported [8, 12].

In complete triceps tendon ruptures/avulsions early surgical treatment is usually recommended and good results have been reported [4–6, 8]. If the tear is more proximally at the musculotendinous region or over the muscle belly and if it is partial conservative treatment is usually chosen [6, 8, 12, 15]. Partial triceps muscle tears seem to have a good healing tendency if reinjuries can be avoided [8].

After injury the affected area of skeletal muscle undergoes remodelling, with resultant scar formation [16]. However, like in other muscle injuries also in partial triceps tears the risk of recurrence is obvious. The main reason for recurrence is too early and enthusiastic mobilization of the affected muscle after injury [17]. In power athletes light weight training can be possible very soon after a partial triceps tear, which may induce a re-rupture at the site of the primary lesion. Recurrent injuries may lead to excessive scarring, formation of adhesions, impaired regeneration of the injured muscle and reduced biomechanical properties. In our series the surgically treated musculotendinous injuries were all partial tears with a quite long delay from the onset of symptoms to surgery. The inability to reach preinjury level of training due to continuing symptoms were the reasons for the operation. Also recurrences were commonly reported by these athletes before surgery. It seems that

rehabilitation after partial triceps tear is a real challenge among power lifters. Return to sports should proceed gradually so that the risk of recurrence could be minimized.

## Conclusion

Complete distal triceps avulsion is a rare but serious injury that leads to significant disability. The awareness of this particular type of injury combined with early, accurate imaging to confirm the diagnosis is required. We recommend early surgical treatment in case of complete distal avulsions. If partial triceps tear is diagnosed and symptoms are prolonged despite of conservative treatment the option for surgical repair should still be kept in mind. According to our results good or even excellent outcomes may be expected after surgical treatment in most cases of chronic partial musculotendinous triceps tears. Considering partial tears further studies are needed to evaluate at which point surgery should be considered if symptoms are prolonged and to clarify if there is a subgroup of patients who should be operated already at early phase.

**Conflict of interest** The authors declare that they have no conflict of interest.

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