Triceps tendon rupture: repair and rehabilitation

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Abstract

Triceps tendon ruptures are rare injuries and are frequently missed on initial presentation to the emergency department. In cases of complete rupture, surgical repair is recommended but no guidelines exist on the optimum reconstructive technique or rehabilitation. We present a surgical technique and rehabilitation programme for the management of these injuries. A midline posterior incision is performed, the ruptured triceps tendon is identified and mobilized, and the tendon footprint is prepared. The tendon is then repaired using bone suture anchors, with a parachute technique, and held in 40° of flexion. The rehabilitation programme is divided into five phases, over a period of 12 weeks. Range of movement is gradually increased in a brace for the first 6 weeks. Rehabilitation is gradually increase in intensity, progressing from isometric extension exercises to weight-resisted exercises, and finally plyometrics and throwing exercises. Our surgical technique provides a solid tendon repair without the need for further metalwork removal. The graduated rehabilitation programme also helps to protect the integrity of the repair at the same time as enabling patients to gradually increase the strength of the triceps tendon and ultimately return to sport activities.

Keywords

triceps tendon rupture, tendon repair, triceps rehabilitation

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Introduction

Triceps tendon rupture is a rare injury, estimated to account for less than 1% of all upper limb tendon injuries.^{1,2} These injuries can be difficult to diagnose and are frequently missed in the emergency department (ED), potentially resulting in considerable loss of function.^{1,3} In cases of complete rupture of the triceps tendon, surgical repair is usually recommended; however, no clear guidelines exist for the treatment of these injuries or the postoperative rehabilitation.^{4,5} Delayed repair is technically demanding and results are inferior to acute repair; therefore, prompt recognition and repair leads to superior outcomes. We report our technique for surgical repair, as well as a regime for post-operative rehabilitation of these injuries.

Surgical technique

The patient is placed in a lateral decubitus position with pelvic supports placed over the anterosuperior iliac spine and sacrum. A right-angle padded bar is used to

support the arm and a high arm tourniquet is applied. Exposed pressure areas are padded and the contralateral arm is supported in a gutter to allow for anaesthesia access. The arm is circumferentially prepared with 2% chlorhexidine gluconate and exclusion drapes are applied.

A midline posterior approach is used with a skin incision curved over the ulnar aspect of the olecranon. Two fasciocutaneous flaps are raised either side and ulnar nerve is identified with blunt dissection and protected throughout the procedure.

Soft tissue dissection is continued until the ruptured triceps tendon is adequately exposed. If the tendon end

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Figure 1. Mobilization of the ruptured triceps tendon is essential especially in this missed acute rupture.

is degenerative in appearance, then this is sharply excised to healthy tissue, aiming to optimize tendon healing. The musculotendinous junction of the triceps is then mobilized by blunt dissection, taking care to protect the ulnar and radial nerves (Figure 1). With adequate mobilization of the triceps, even ruptures that are detected several weeks after injury can be successfully repaired.

The avulsed tendon footprint is prepared by debriding any remaining soft tissue and superficially decorticating the olecranon using a rotating burr. The tendon repair is performed using bone anchors. Two or three double loaded 5-mm Twin Fix bone suture anchors (Smith and Nephew Ltd, Watford, UK) are inserted into the olecranon using a hammer until a secure hold is achieved (Figure 2). The number of bone anchors used is dependent on the extent of the tendon rupture and the quality of the soft tissues.

The suture ends of the bone anchors, consist of a strong non-absorbable polyethylene suture Ultrabraid (Smith and Nephew Ltd) are used to perform a locking Krackow suture in a retrograde fashion proximally up the tendon approximately 5 cm and then back down again until the suture exits the tendon. The same process is repeated on the other side of the tendon using the other bone anchor (Figure 3).

Figure 2. Bone suture anchor insertion into olecranon.

Figure 3. Locking Krackow suture of distal tendon stump.

The exiting suture ends are then tied to the free suture end of the bone anchor using a parachute technique to dock the tendon firmly against the prepared bony surface. The tendons are repaired with good apposition in 40° of flexion to avoid excess tension on the repair (Figure 4).

Figure 4. Triceps tendon repair.

Postoperative rehabilitation

We have devised a postoperative rehabilitation programme for patients undergoing triceps tendon repair. This comprises five different phases of rehabilitation exercises, over the course of 12 weeks, designed to gradually increase strength and range of movement, whilst protecting the integrity of the repair. At all times, patients are advised to perform the specified exercises as pain allows and to stop if the pain increases.

Phase 1 (0–2 weeks)

The patient is placed postoperatively in a plaster slab, at 45° of flexion. Patients are advised not to use the arm for any weight bearing activities (e.g. pushing open a door or pushing up from a chair).

Patients are advised wrist extension and flexion exercises using a light dumbbell and shoulder pendulum and isometric range of movement exercises. The aim of this phase is to establish a pain free range of movement and minimize the effects of immobilization.

Phase 2 (2–4 weeks)

Patients are converted into a range of movement brace, locked at 0° to 90°, which prevents early hyperflexion to protect the tendon repair. Patients are advised to avoid passive flexion beyond 90° when out of the brace and to avoid resisted elbow extension.

Exercises in the brace include active supination and pronation and active elbow flexion, as well as light isometric elbow flexion. Anconeus strengthening exercises are commenced, as well as theraband shoulder rotation

exercises. Full active elbow extension is allowed, as well as active assisted elbow extension with the shoulders at 90° of abduction. This is then progressed to active elbow extension with the shoulders at 90° of abduction.

Phase 3 (4–6 weeks)

The range of movement of the elbow brace is increased to 0° to 120°. Patients are advised to avoid resisted elbow extension and not to passively flex beyond 120° out of the brace.

Exercises are performed as per phase 2 and progressed to include open chain shoulder exercises (flexion and abduction) and loaded supination and pronation exercises.

Phase 4 (6–12 weeks)

The elbow brace is removed and patients are allowed a full range of movement. They are advised to avoid heavy lifting and any activities that cause them pain. The aim of this phase is to commence strengthening and kinetic chain exercises, at the same time as being aware of reduced vascularity of the tendon repair at week 6.

Exercises include isometric elbow extension in varying angles (30°, 60°, 90° and 120°) in both open and closed chain. Supine resisted elbow flexion and extension is performed with the shoulder at 90° with a 0.5-kg weight. This is progressed to wall press ups and proprioceptive exercises using a gym ball against a wall. Gentle overhead throwing is performed, as well as bouncing a ball on the floor. Finally sport specific kinetic exercises are introduced.

Phase 5 (12 weeks)

The aim of this phase is to gradually return the patient to sporting activity. Supine elbow exercises are performed with increasing loads (Figure 5), progressing to plyometrics and throwing exercises in different positions (Figure 6). Floor press ups are then introduced, as well as bench presses and shoulder presses. Finally, tricep dips, crawling on hands and feet and sports specific exercises are performed.

Discussion

No clear treatment guidelines have been established for triceps tendon ruptures, largely as a result of the rarity of the condition. Complete ruptures should be repaired surgically by reattaching the avulsed tendon to the olecranon, to prevent late disability and to maximize functional outcome. Surgical repair of the triceps tendon is generally associated with little morbidity, although strength may not return to that of the uninjured side.⁶

Figure 5. Supine elbow extension exercises with weights.

Figure 6. Throwing exercises with gym ball.

Different surgical repair techniques have been described, including the use of transosseous sutures through horizontal bone tunnels in the olecranon, which can be combined with tension band wiring, to protect the repair. Kirschner wires reinforced with circlage wire can also be used if a significant olecranon fragment is present.^{2,4-7} Tendon repairs can also be augmented, using artificial ligament or tendon graft, if the quality of the tissue is poor as a result of systemic disease, or in the case of chronic rupture.^{3,8} We prefer to use suture bone anchors because we consider that this provides a solid repair and does not require further surgery for removal of metalwork, which can be the case if Kirschner wires are used.

Rehabilitation after surgery is also controversial. Early range of movement is recommended by most individuals aiming to prevent postoperative stiffness, although a degree of protection is required to prevent failure of the repair.⁹ We immobilize patients in a plaster slab for the initial 2 weeks to allow wound healing, followed by a gradual increase in range of movement using a functional brace, limiting flexion and a graduated rehabilitation programme.

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Ethical review and patient consent

Written consent was obtained from patients to obtain intraoperative images.

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