Surgical Repair and Fasciotomy for an Intrasubstance Biceps Rupture Following Direct Blunt Constriction

Wayne W. Chan¹*, Stacey Gallacher², Corinne Sommi³, Theodore A. Blaine¹, and Karen M. Sutton¹

¹Department of Orthopaedics & Rehabilitation, Yale University School of Medicine, USA
²St. Luke’s Orthopedic Care, St. Luke’s University Health Network, USA
³Tulane University School of Medicine, USA

Abstract

Intrasubstance ruptures of the biceps brachii are a rare but debilitating injury to the upper extremity. Previous case reports focus predominantly on paratroopers sustaining a blunt constriction injury against a static line or water sport participants sustaining a traction injury following a forced extension of a flexed elbow. We describe a water skier sustaining an intra substance biceps rupture following a presumed blunt constriction mechanism. Initial imaging was suspicious for injury to the short head of the biceps at the myotendinous junction; however there was no clear evidence of intrasubstance disruption. The patient clinically worsened, with increasing concern for compartment syndrome, so he was subsequently taken to the operating for an exploration, fasciotomy, neurolysis of the musculocutaneous nerve, and primary repair of the intrasubstance biceps rupture. At latest follow up, the patient had returned to competitive weight lifting and bodybuilding, and was noted to have a normal contour of his biceps

INTRODUCTION

Traumatic injuries to the biceps brachii often involve either the long head tendon origin or the biceps insertion onto the radius. Distal biceps tendon injuries occur predominantly in males age 40-60, and are characterized by eccentric contraction with the elbow in a flexed and supinated position [1]. The failure point is commonly localized to the tendinous portion or myotendinous junction [2]. In contrast, intrasubstance ruptures of the biceps brachii typically involve younger patients and are associated with a higher energy mechanism. Case reports of this rare injury predominantly center on paratroopers, who are injured exiting the aircraft when the static line becomes entrapped in the axilla, causing blunt constriction, forced abduction, and external rotation of the affected arm [3,4]. Mizuno et al. [5] attribute a full belly rupture to a high intensity extending force against an eccentrically contracting muscle. Other mechanisms for intrasubstance biceps tears involves sports such as water skiing and wakeboarding, with case reports speculating on a forced extension injury with the elbow held in flexion while holding the towrope [6-8].

INTRODUCTION

In previously described case reports involving water skiing, the biceps tendon was injured at the tendinous portion. It has been suggested that this injury may be explained by pre-existing pathologic changes of the patient’s tendon that would lead to decreased tensile strength [6]. Our case report involves a 21 year-old patient who sustained a complete midsubstance biceps rupture while water skiing and subsequently underwent open surgical repair. The patient provided written informed consent for print and electronic publication of this case report.

CASE REPORT

We retrospectively reviewed the records of a 21 year-old right hand dominant male who sustained a traumatic injury to his left upper extremity while wakeboarding. The towrope slipped to the level of his upper arm, he lost control, and then crashed. The patient presented with pain, and on exam, there was marked swelling and diffuse ecchymosis of the left arm (Figure 1). Radiographs, a Computed Tomography (CT) angiogram and a Magnetic Resonance Imaging (MRI) were obtained in the emergency department. The MRI was significant for edema in the short head of the biceps muscle and coracobrachialis...
at the level of the myotendinous junction, however there was no clear midsubstance disruption of the biceps. The patient was admitted for observation and monitoring for potential compartment syndrome. Due to persistent pain, increasing swelling and concern for compartment syndrome, he was subsequently taken to the operating room.

Following induction of general anesthesia, the patient was placed in the beach chair position with the entire left arm prepped and draped and positioned in a Spider arm positioner (Smith and Nephew, Andover, MA). A standard deltopectoral approach was used for exploration, which revealed a small rupture of the upper border of the pectoralis major tendon. Further exploration distally revealed extensive disruption of the fascia over the biceps muscle, a large hematoma, and complete disruption of the biceps muscle belly (Figure 2A). The initial imaging did not show the extent of the injury of the biceps muscle belly and therefore the extent of the injury and addressing swelling. The hematoma and muscle belly were debrided, the fasciotomy was extended, and a neurolysis of the musculocutaneous nerve was performed. The attenuated upper border of the pectoralis major tendon was primarily repaired with #2 Orthocord (DePuySynthes, West Chester, PA). The epimysium of the disrupted muscle fibers of the biceps was repaired using a running locking suture with #2 Orthocord (Figure 2B), while the overlying fascia was left open. The wound was copiously irrigated and closed primarily over a drain. The swelling markedly decreased after surgical intervention.

Postoperatively, the shoulder and elbow were immobilized in a sling for two weeks to protect the repairs. A complete neurovascular examination was repeated and continued to show intact radial and ulnar pulses and intact sensory and/or motor function of the axillary, musculocutaneous, median, radial and ulnar nerves. At two weeks, gentle range of motion of the shoulder and elbow was initiated. Lifting and strengthening were restricted for eight weeks postoperatively, followed by gradual progression thereafter. At his most recent visit, seven months removed from surgery, he had minimal pain in the left upper extremity, full range of motion, and was performing biceps curls with a 10-pound weight without pain. He continues to progress with his gym-related activities. He describes being extremely satisfied with his surgery and his subjective shoulder value is 95%. He has returned to competitive weight lifting and bodybuilding, and has regained the normal contour of his biceps.

**DISCUSSION**

Eccentric failure is a common and well-understood mechanism for injury to the biceps brachii [2]. Isolated injuries to the short head of the biceps are far less common, and can be due eccentric failure [6] or blunt constriction [5]. We have presented a case report of the latter, during which a young water skier sustained an injury similar to a well-described series of midsubstance biceps brachii ruptures in military paratroopers. During static line parachute jumps, intrasubstance biceps tears can occur when the static line passes medial to the jumper’s arm and forcefully tightens against the arm during descent [4].

In our case study, the mechanism of injury was consistent with the blunt trauma observed in paratrooper injuries [4]. The ends of the muscle at the site of tear were cleanly transected perpendicular to the longitudinal axis of the muscle. In contrast to the water-skiing incident injury [6], which required a primary repair, our patient also underwent a complete fasciotomy of the arm with decompression and neurolysis of the musculocutaneous nerve due to extreme swelling and concern for compartment syndrome. Given the low incidence of this injury, no standardized treatment framework exists for midsubstance biceps ruptures. Yet, most studies demonstrate improved outcomes with surgical repair compared to nonoperative treatment. Heckman reported significant continued weakness in a review of military paratroopers after nonoperative treatment of this injury [3]. Similarly, Kragh et al., reported a comparison of nonoperative...
versus operative treatment using either locking sutures or modified Mason-Allen sutures with improved outcomes in the group treated surgically [9]. Wilson and collaborators also support early surgical repair for the best functional and cosmetic results and suggest that surgical repair can lead to a higher return in supination strength compared to conservative treatment [4]. Surgical intervention should be considered urgently as to prevent a persistent muscular defect that has been noted in cases of late repair [4,10].

This case describes a complex intrasubstance biceps injury with a combined injury mechanism of abduction and blunt trauma of a contracted bicep against a rigid object. Aggressive surgical treatment was taken to avoid degeneration of the biceps, avoid complications from possible compartment syndrome and to maintain strength, function and contours of the biceps muscle. The patient is on schedule to return to his normal activities after the appropriate rehabilitation period.

REFERENCES


