

Closed proximal muscle rupture of the biceps brachii in wakeboarders

Cecilia Pascual-Garrido · Britta L. Swanson · Stephen M. Bannar

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Abstract Closed proximal muscle rupture of the biceps brachii is a rare injury. In this report, two cases of closed proximal muscle rupture of the biceps brachii after wakeboard traumas are described. Both patients presented with a swollen arm, weakness during flexion, and a mass in the affected forearm. Magnetic resonance imaging showed displacement of the biceps brachii into the forearm. The rupture was successfully treated with muscle removal in one case and muscle repair in the other. In patients with a wakeboard trauma and similar presentations, closed proximal muscle rupture of the biceps brachii should be suspected.

Keywords Wakeboard · Trauma · Biceps brachii

Introduction

Closed proximal muscle rupture of the biceps brachii is a rare occurrence [7]. The largest series of closed biceps muscle tears was described in paratroopers [5] where misrouting of the static line around the arm during jumping produced a direct blunt force on the biceps muscle belly, squeezing it in two against the humerus.

Wakeboarding is a sport similar to water skiing except that the boarder rides on a single board and is pulled by a rope attached to a wide handle. The handle is often held in the crook of the elbow while performing tricks such as flips and jumps. While executing a trick, the handle can slip up the arm while the boarder is in the air and then slide down the arm as the boarder lands on the water at high speeds. This may result in a closed rupture of the biceps brachii as exemplified in the following two cases.

Case reports

Two patients were surgically treated at our clinic because of a traumatic closed proximal muscle rupture of the biceps brachii secondary to a wakeboard injury. Patient A was a 28-year-old right-hand dominant male. Patient B was a 44-year-old right-hand dominant male. Each patient was evaluated independently and on separate occasions. However, their presentations were very similar and are described together.

The patient attempted a wakeboarding maneuver and failed. His stance was with the left foot forward, and the handle was held in his right arm. During the trick, the handle caught around his upper arm while the boat was pulling at high speed. Radiograph of his arm showed no major abnormalities, and the patient was treated with a sling, ice, and pain medication. Approximately 2 weeks later, the patient was seen at our clinic for consultation. He presented with right upper extremity pain and weakness in his right arm. Physical examination revealed intact skin over the upper arm, but there was a palpable gap in the anterior soft tissue overlying his right humerus. There was also a large amount of ecchymosis, extensive forearm swelling, and a hematoma in the upper arm. The patient

C. Pascual-Garrido (✉) · S. M. Bannar
Department of Orthopedic Surgery, Tahoe Orthopedics and Sports Medicine, PO Box 11889, Zephyr Cove, NV 89448, USA
e-mail: cecilia.pascualgarrido@gmail.com

S. M. Bannar
e-mail: sbannar@bartonhealth.org

B. L. Swanson
Barton Lake Tahoe Sports Medicine Fellowship,
So. Lake Tahoe, CA, USA
e-mail: swansobr@gmail.com

had 20 degrees loss of active and passive terminal extension of the elbow. Diminished motor strength with flexion of the elbow and supination of the forearm was evident compared with the muscle strength of the contralateral limb. The right upper extremity was neurovascularly intact. On the suspicion of biceps muscle injury, a magnetic resonance imaging (MRI) scan of his right upper extremity was obtained that demonstrated a complete tear of both heads of the biceps brachii muscle through the mid-portion of the muscle belly (Fig. 1).

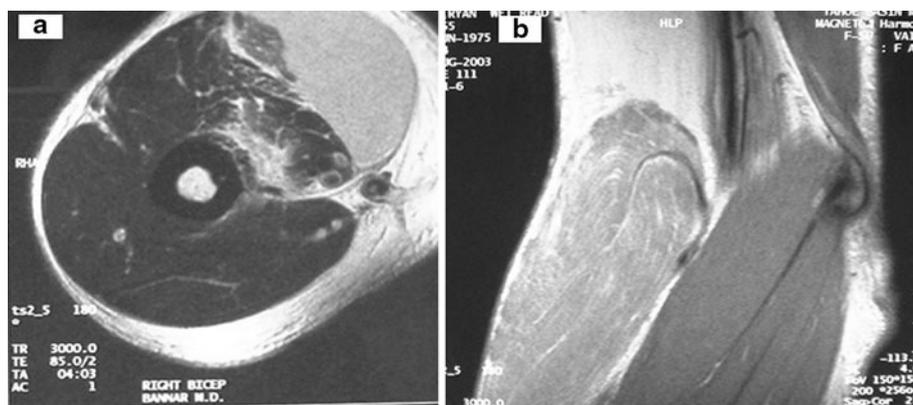
Operative technique

A different operative technique was performed for each patient.

Patient A

Under general anesthesia, the patient was placed in supine position with his right arm on an arm board. A direct anterior approach was made along his mid-humerus. As soon as the subcutaneous fascia was opened, a large hematoma of approximately 400 cc of dark blood was evacuated. The incision was then carried proximally and distally along the course of the humeral shaft and down to the level of the elbow crease. The entire anterior humerus was devoid of any biceps and the dissection was carried proximally to assess the proximal avulsion site. The entire biceps muscle had been displaced subcutaneously into the forearm. The musculature was brought out through the incision. There was noted to be no gross necrosis of the muscle but proximally it did not contract with electrocautery. A running locking stitch was placed through the muscle end and was repaired to the proximal myotendinous junction. The muscle belly was repaired securely, allowing early motion of the elbow with full flexion and approximately 40 degrees short of extension.

Fig. 1 Patient A: MRI Axial T2 centered at the distal arm shows high signal and discontinuity of muscle fibers in both heads of the biceps brachii muscle. There is extensive edema in the surrounding soft tissues (a). Sagittal MR centered at the distal arm revealed the displacement of the biceps brachii in the forearm (b)



Patient B

The approach was similar to that of Patient A. After dissecting the subcutaneous tissue, a large hematoma of approximately 800 cc of clotted blood was removed. The entire biceps muscle with both heads was absent from the anterior aspect of the arm and was stripped down to the forearm. The biceps was carefully dissected and found to be completely necrotic. It was brown, with no contractility and no blood flow. The decision was made to remove the biceps as there would be no chance of it healing.

Four years post-operatively, both patients referred that they did not have any limitations with the affected arm and were able to perform all activities as before the trauma. On physical examination, both patients showed no difference in function compared with the contralateral uninjured side, with normal range of motion of the shoulder, elbow, and wrist. Both patients had marked hypotrophy of the operated arm and continued to have diminished strength of elbow flexion.

Discussion

Closed rupture of the biceps brachii muscle does not occur often [1, 4, 7]. Early reports of this type of injury came from military parachutists [5, 6, 8]. It is believed that misrouting of the static line underneath the arm during a jump resulted in a blunt trauma to the biceps muscle belly, dissecting it into two segments.

Recent reports of closed rupture of the biceps brachii are from water sport injuries, specifically those that utilized a tow-line to pull the athlete at high speeds [2, 3, 9]. The mechanism of injury is similar in all cases. In wakeboarding, the boarder holds the handle in the crook of their elbow. During a trick or flip, the handle can slide proximally toward the shoulder when the line has slack. As the boarder lands on the water and the high-speed boat takes up

the slack, the handle slides down the length of the arm until it is grasped by the hands or in the crook of the elbow. This dissects and strips the biceps into the forearm. However, intraoperative findings are different.

The injuries in parachuters were reported to be a complete transection of the muscle belly, perpendicular to its longitudinal axis, into two segments that retracted proximally and distally. In contrast, the proximal heads of the wakeboarders' biceps were severed, and both long and short heads were stripped down to the forearm by the handle. The mechanism of injury in water skiers was similar to what we described for the wakeboarders. These authors found intraoperatively that the entire biceps was stripped down to the forearm and none attempted to repair the biceps. The authors concluded that surgical intervention with biceps removal should be attempted in these cases [2, 3, 9]. In our cases, repairing the biceps or removing it completely had similar functional results.

Conclusion

Closed proximal muscle rupture of the biceps brachii should be suspected in patients with a tow-line trauma that presents with pain, a mass in the forearm and limitations in flexing the elbow. Early diagnosis is critical if reattachment of the muscle is to be considered. Resection versus reattachment of the muscle depends on the length of time since the trauma, the presence or absence of neurovascular

injuries, the overall condition of the muscle, and the age and activity of the individual prior to the injury [6, 10].

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