JSES Open Access 3 (2019) 361–364

Contents lists available at ScienceDirect

JSES Open Access

journal homepage: www.elsevier.com/locate/jses

Complete transections of the coracobrachialis and short head of biceps brachii after skurfing injury: a case report and brief review of the literature

Samantha H. Epstein, BS [a,*], A. Ross Sussmann, MD [b], Brian M. Katt, MD [c], Robert E. Epstein, MD [b], Joseph A. Abboud, MD [d]

[a] University of Virginia School of Medicine, Charlottesville, VA, USA
[b] University Radiology, Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, USA
[c] Rothman Orthopaedic Institute, Philadelphia, PA, USA
[d] Rothman Orthopaedic Institute, The Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

ARTICLE INFO

Keywords:
Coracobrachialis
biceps brachii
rupture
skurfing
water sports
rope injury

The vast majority of biceps injuries involve the long head of the biceps tendon. Less frequently, and typically in younger patients, the injury can occur through the muscle belly. Scattered case reports describe patients with a short head injury of the biceps alone.[2] Concomitant ruptures of both the short head of the biceps and coracobrachialis muscles are even rarer, as, to our knowledge, this has only been mentioned once in the literature.[11] In our case report, such an injury is presented, having occurred after a "skurfing" accident. Water skurfing is a recently popularized sport that is a form of water skiing. The participant rides a version of a surfboard, rather than skis, while being towed behind a motorboat.[9,12] This sport is similar to wakeboarding; however, in water skurfing, the participant's feet are not attached to the wakeboard, and the participant does not necessarily hold the rope at all times. Common wakeboarding injuries include head injuries, lacerations, anterior cruciate ligament tears, shoulder dislocations, fractures, and ankle sprains.[1,5] However, there are very limited reports detailing upper extremity injuries resulting from water skurfing.[7] There may be potential for more severe injuries, as there is a greater risk of falls because the participant's feet are not fixed to the board. Furthermore, tricks are performed while obtaining slack in the rope, increasing the chance of entrapping an extremity and leading to injury through rope traction and compression. This mechanism of rope traction and compression itself is well described, especially in parachute jumpers and wake boarders; however, resultant ruptures of both the short head of the biceps and coracobrachialis muscles is rarely seen. Therefore, this case report aims to familiarize the reader with both this uncommon injury pattern and a successful treatment approach.

Case report

A 15-year-old right-hand-dominant boy presented to the hospital with right arm pain and swelling hours after a traumatic fall while water skurfing. When he fell from the wakeboard, the rope wrapped around his right upper arm, resulting in a violent traction-type injury from the pull of the motorboat. He was an experienced skurfer without any prior injuries to his arm. Right elbow radiographs showed soft tissue swelling at the distal arm, but no fracture or dislocation, and the patient was discharged home. Because of continued swelling and pain, he returned to the hospital 2 days after the injury. Physical examination revealed swelling and ecchymosis of the anterior and medial surfaces of the arm. The extremity was neurovascularly intact. There were rope skin burns at the upper arm overlying a site of relative muscle mass defect. Distal to this region, just above the elbow, there was abnormal muscle contour (Fig. 1). Because of a concern for deep soft tissue injury, magnetic resonance imaging (MRI) of the right arm and elbow was performed. This demonstrated complete ruptures of the coracobrachialis and biceps short head muscle bellies at the level of the middle third of the arm, with distal retraction of both muscle

* Corresponding author: Samantha H. Epstein, BS, University of Virginia School of Medicine, 65 Updikes Mill Rd, Belle Mead, NJ 08502.
E-mail address: she7cz@virginia.edu (S.H. Epstein).

https://doi.org/10.1016/j.jses.2019.08.001

bellies (Fig. 2). The imaging also showed that the biceps short head muscle belly had partially folded over itself and bulged into the medial aspect of the distal one-third of the arm. The exact locations at which the ruptures occurred were demonstrated to be within or near the muscle bellies themselves, because the tendon origins of both muscles were completely spared. Imaging also demonstrated severe tearing of the brachioradialis and extensor carpi radialis longus muscle bellies at the level of the elbow, including a 4.8×3.6×1.7-cm hematoma within this muscle (Fig. 2). The patient had no other associated injuries.

Given this constellation of injuries and the patient's continued pain, surgical reconstruction was contemplated and ultimately elected. Eight days after the injury, the patient was brought to the operating room. An anterolateral approach to the humerus was used. The radial nerve was lateral to the field and not visualized, and the brachial artery, median nerve, and ulnar nerve were medial and not identified. No muscle splitting was necessary. Surgical exploration confirmed that the biceps short head and coracobrachialis were torn across their muscle bellies, and that the distal stumps of both muscles were flipped distally (Fig. 3). The proximal stumps of the muscles were mobilized, reapproximated to the distal stumps, and secured with No. 2 FiberWire (Arthrex Inc, Naples, FL, USA) sutures. This was chosen to allow for continued strength while healing and to eliminate any worry about suture breakdown in the setting of delayed healing. A Krackow locking suture was used both proximally and distally. The forearm muscle injuries were left to heal conservatively. Postoperatively, the patient was splinted for comfort. The splint was removed on postoperative day 5, and at follow-up several days after surgery, the incision was healing appropriately (Fig. 4). At 3 weeks postoperation, the sling was used for comfort rather than full-time. At this time, a physical therapy protocol was started as well. The patient began with range of motion exercises, followed by lifting up to 2 lb as tolerated. This was increased to 5 lb at 6 weeks. By 10 weeks postoperation, he was limiting upper body conditioning to mild pain, and by 14 weeks, was able to return to full activities. At this point, he had excellent strength, full elbow range of motion, and a normal contour of the upper extremity. He was cleared to resume upper extremity conditioning and wrestling at that time.

Figure 1 Photograph of right upper extremity, 2 days after traumatic skurfing injury. Skin burns from rope traction were present on the upper arm, overlying a defect in the underlying muscle. Distal to this region, just above the elbow, an abnormal bulge of the muscle mass was present.

Discussion

In this case report, a traumatic injury from skurfing, a newly popular water sport, resulted in complete tears of the coracobrachialis and the short head of the biceps muscle in a 15-year-old boy. Specifically, his injury occurred when the rope was held in his armpit while he attempted a trick. When he fell, the rope wrapped around his arm, resulting in a forced traction injury. Although rope traction injuries have been described to cause biceps brachii tears, we were able to find only 1 report of both a complete coracobrachialis and short head of biceps brachii muscle rupture. This injury is mentioned in a 1941 article by Tobin et al,[11] in which a parachute jumper's arm and axilla were entangled in the static line that is connected to the plane for the automatic opening of the parachute, causing direct trauma. The article does not mention whether the patient was treated surgically to confirm the muscle tears, and no follow-up was reported. More recently, Heckman et al[4] described a series of closed transections of the biceps brachii in military parachutists. More than 50 patients were encountered in a center performing in excess of 100,000 jumps per year. The injury occurred when the static line was medial to the arm as the paratrooper prepared to jump. The line created a localized force on the midportion of the arm. Acute injuries were treated with either surgical repair or immediate hematoma decompression and casting in full flexion for 6 weeks. Results showed similar healing in both groups and 77% of elbow flexion strength after correction for dominance. This report also included 6 patients treated at an average of 19 months after injury; in the surgically treated subset of these 6 patients, the muscle defect could not be corrected fully and only small improvements in strength were noted. This report suggests that early recognition and treatment of biceps brachii muscle ruptures leads to better functional outcomes. Similarly, a review article by Wilson et al[13] found that early surgical intervention with primary repair has been more successful than late reconstruction.

Spiegl et al[10] published the only other report of a rupture of the coracobrachialis muscle from indirect, nonpenetrating trauma. The patient was lifting a heavy piece of equipment with his arm flexed at the elbow and shoulder when the machine jerked. He subsequently experienced diminished sensation over the lateral forearm and paresthesias when the elbow and shoulder were in flexion. MRI of the shoulder and elbow both failed to cover the area of injury, as the muscle defect was in the midportion of the arm. An upper extremity MRI scan diagnosed a distal rupture of the coracobrachialis at the musculotendinous junction. At the time of surgery 11 weeks after the injury, a neurolysis of the musculocutaneous and lateral antebrachial cutaneous nerves was performed. The muscle could not be anatomically repaired. To avoid compressing the surrounding neurovascular structures, the muscle was sewn to the adjacent biceps muscle.

A similar injury report, by Moorman et al,[7] involved a 15-year-old waterskiing on a boogie-board. This case involved a significant

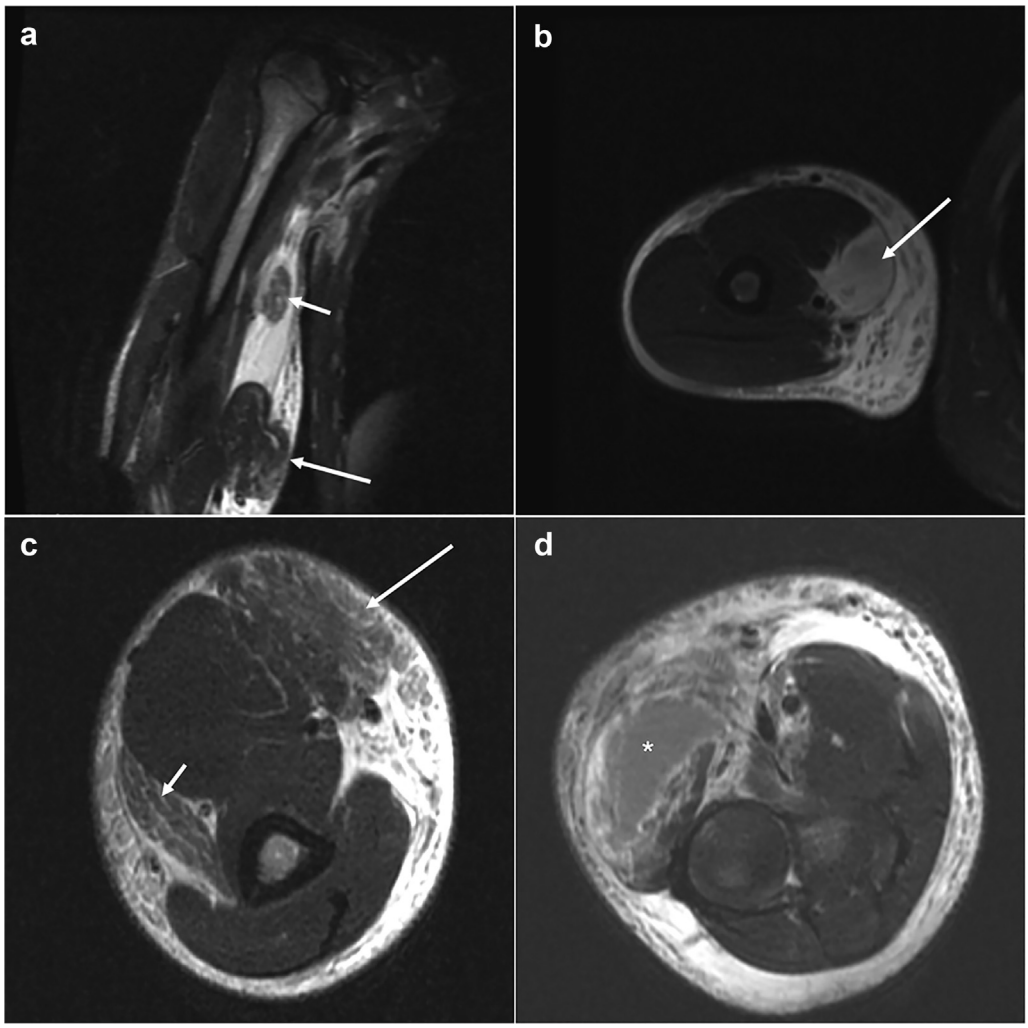

Figure 2 **(a)** MRI coronal image demonstrating transections of the short head biceps (*long arrow*) and coracobrachialis (*short arrow*) muscle bellies with proximal defect and distal retraction and folding over of the biceps; Cor FSEIR TR 4000/TE 36. **(b)** MRI axial image demonstrating defect (*arrow*) due to retraction of the short head biceps muscle belly; AX FSE T2FS TR 3000/TE 58. **(c)** MRI axial image demonstrating retracted biceps short head muscle bulging medially (*long arrow*) and partial tearing of brachioradialis muscle (*short arrow*); AX FSE T2FS TR 3000/TE 68. **(d)** MRI axial image demonstrating extensor carpi radialis longus muscle belly hematoma (*); AX FSE T2FS TR 3000/TE 68. *MRI*, magnetic resonance imaging; *Cor*, coronal; *FSEIR*, fast spin echo inversion recovery; *TR*, time to repetition; *TE*, time to echo; *AX*, axial; *FSE*, fast spin echo; *T2FS*, T2-weighted fat-saturated.

force translated to the arm resulting in a complete rupture of the biceps brachii with “slingshot displacement” of the muscle belly into the forearm. The force was so severe as to enable subcutaneous dissection to the muscle's resting place distally. At the time of surgery, the muscle was not viable and was excised, leaving the patient with approximately 30% loss of elbow flexion strength. This case offers another example of the high tensile loads that are an inherent hazard of waterskiing and related sports like skurfing.

Figure 3 Surgical finding of torn and distally retracted short head of the biceps and coracobrachialis.

Pascual-Garrido et al[8] detail 2 cases with a similar mechanism of injury from wakeboarding. Each patient had the rope handle caught around the arm as the boat was pulling at high speed. MRI in each case demonstrated complete tears of both heads of the biceps brachii muscle through the midportion of the muscle belly. In the first of these cases, the muscle was displaced into the forearm and was able to be repaired to the proximal myotendinous junction, eventually restoring full range of motion. In the second case, the biceps was necrotic and excised. In these cases, the mechanism was likely due to the boarder holding the rope handle in the crook of the elbow, from which it slid up to the shoulder then stripped the muscle from bone owing to the distal force on the rope from the boat.

Finally, DiChristina and Lustig[2] reported a case in which a patient sustained an isolated short head of biceps rupture. This also occurred via a tow line as the patient fell while waterskiing. The fall

Figure 4 At postoperative follow-up several days after surgery, the incision appeared to be healing well and the normal contour of upper arm musculature was restored.

occurred during a maneuver in which the patient had the tow line wrapped around his left arm to the level of the midforearm. The tendon was surgically repaired and the patient was placed in a shoulder immobilizer with elbow flexion greater than 90°, leading ultimately to an excellent result.

Concurrent biceps short head and coracobrachialis injuries are so rare that there is no consensus on optimal management, although excellent results with early muscle repair have been reported.[5,6] Although our patient's skurfing injury itself is noteworthy, it is also important to note the utility of MRI in the diagnosis of these tears, because radiography is naturally limited in its ability to depict muscle pathology. Although clinical suspicion and physical examination have primary place in diagnosing severe traction injuries, the full extent of an injury may not be appreciated without advanced imaging. This is particularly relevant in a case such as ours, in which the combination of biceps short head and coracobrachialis tearing is so rare that many clinicians may suspect only the one injury and not the other if relying entirely on physical examination and history. Furthermore, complications such as hematoma and neurovascular compression can often be detected preemptively through MRI, as in our case, where there was a sizeable hematoma in the extensor carpi radialis longus muscle belly. MRI enables visualization of soft tissues with high resolution and excellent contrast, making it ideal for evaluating the severity of muscle injuries and identifying any associated injuries. This may assist both surgical planning and establishment of a postoperative recovery regimen.[3] In our patient, correct diagnosis through imaging allowed for appropriate and timely surgical planning after an informed discussion regarding operative and nonoperative options. Prompt surgical reconstruction ultimately enabled the patient to have a successful outcome with no residual functional deficit.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Carson WG Jr. Wakeboarding injuries. Am J Sports Med 2004;32:164–73. https://doi.org/10.1177/0363546503258910.
2. DiChristina DG, Lustig KA. Rupture through the short head of the biceps muscle belly. A case report. Clin Orthop Relat Res 1992:139–41.
3. Guermazi A, Roemer FW, Robinson P, Tol JL, Regatte RR, Crema MD. Imaging of muscle injuries in sports medicine: sports imaging series. Radiology 2017;281:646–64. https://doi.org/10.1148/radiol.2017160267.
4. Heckman JD, Levine MI. Traumatic closed transection of the biceps brachii in the military parachutist. J Bone Joint Surg Am 1978;60:369–72.
5. Hostetler SG, Hostetler TL, Smith GA, Xiang H. Characteristics of water skiing-related and wakeboarding-related injuries treated in emergency departments in the United States, 2001-2003. Am J Sports Med 2005;33:1065–70. https://doi.org/10.1177/0363546504271748.
6. Kragh JF, Basamania CJ. Surgical repair of acute traumatic closed transection of the biceps brachii. J Bone Joint Surg Am 2002;84:992–8.
7. Moorman CT, Silver SG, Potter HG, Warren RF. Proximal rupture of the biceps brachii with slingshot displacement into the forearm. A case report. J Bone Joint Surg Am 1996;78:1749–52.
8. Pascual-Garrido C, Swanson BL, Bannar SM. Closed proximal muscle rupture of the biceps brachii in wakeboarders. Knee Surg Sports Traumatol Arthrosc 2012;20:1019–21. https://doi.org/10.1007/s00167-011-1654-2.
9. Skurfing (sport) [Internet], Wikipedia. Available at: https://en.wikipedia.org/w/index.php?title=Skurfing_(sport)&oldid=864127361; 2018. Accessed February 1, 2019.
10. Spiegl UJ, Faucett SC, Millett PJ. Traumatic rupture of the coracobrachialis muscle: a case report. JBJS Case Connect 2014;4:e544. https://doi.org/10.2106/JBJS.CC.M.00294.
11. Tobin WJ, Cohen LJ, Vandover JT. Parachute injuries. J Am Med Assoc 1941;117:1318–21.
12. Wakesurfing [Internet], Wikipedia. Available at: https://en.wikipedia.org/w/index.php?title=Wakesurfing&oldid=877228588; 2019. Accessed February 1, 2019.
13. Wilson DJ, Parada SA, Slevin JM, Arrington ED. Intrasubstance ruptures of the biceps brachii: diagnosis and management. Orthopedics 2011;34:890–6. https://doi.org/10.3928/01477477-20110922-25.