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Reconstruction of a chronic, isolated, myotendinous rupture of the short-head component of the distal biceps tendon

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A 2015 study estimated a national incidence of distal biceps tendon rupture at 2.55 per 100,000 patient-years, an increase from the previously reported incidence of 1.2 ruptures per 100,000 patient-years in 2002.[9,17] Distal myotendinous ruptures are much rarer. Schamblin and Safran[19] have reported the largest case series to date of distal biceps myotendinous injuries, with only 6 patients. López-Zabala and Fernández-Valencia[12] reported 2 more cases. These series described patients with complete distal biceps musculotendinous rupture. In these cases, the injuries were acute and were successfully managed nonoperatively. We present the case of a patient with a chronic, isolated, myotendinous rupture of the short-head component of the distal biceps tendon who continued to have symptoms 2 years after his injury and was successfully managed with surgical treatment.

Case report

An active 40-year-old, right-hand-dominant male competitive softball player presented >2 years after sustaining an injury to his left elbow. He was playing softball when he went to field a ball with an extended elbow. He experienced a sudden popping sensation associated with pain at the anterior elbow. Shortly thereafter, bruising developed, and he noted a deformity of his biceps muscle. He saw his primary care provider, and no further treatment was recommended. Since that time, he continued to have limitations with elbow flexion because of arm pain. He reported painful cramping in the biceps and had difficulty in lifting his 2-year-old child. He reported that the arm felt "useless" and that there had been no improvement over time, despite resting, physical therapy, and nonsteroidal anti-inflammatory medications. His Disabilities of the Arm, Shoulder, and Hand score was 11, and his Mayo Elbow Performance Score was 85.

On evaluation of the left elbow, his distal biceps tendon was palpable, and he had a normal hook test result. He had full active elbow range of motion but notable deformity of the medial aspect of his biceps muscle bellies when engaged in active flexion (Fig. 1). He had 5/5 strength in elbow flexion, although he complained of pain and had decreased endurance compared with the contralateral side. He did not have pain or weakness with resisted supination. There were no areas of tenderness to palpation.

At this point, a chronic, partial distal biceps tendon tear involving only the short-head contribution was suspected. Subsequent magnetic resonance imaging revealed the true diagnosis: isolated rupture of the short-head biceps at its distal myotendinous junction (Fig. 2). Having failed to respond to nonoperative treatment, he was offered surgical reconstruction. Informed consent was obtained.

Surgical details

Surgery was performed under general anesthesia. An anteromedial approach to the arm was used. The short head

The patient described herein has provided permission to discuss his case and is fully aware of the intent to publish.

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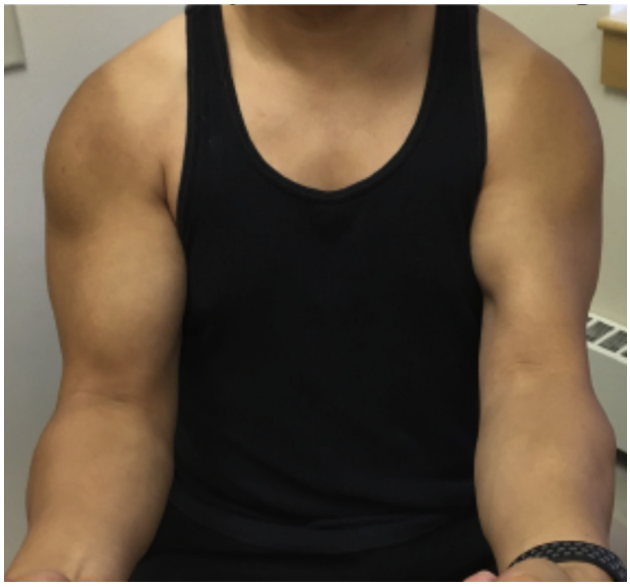

Figure 1 Deformity noted at the short head of the biceps with elbow flexion.

of the biceps was noted to be retracted and scarred. The fascia and scar tissue encasing the retracted muscle were left intact; no distinct tendon was identified at this level. The long head was noted to be intact with a normal distal tendon and myotendinous junction. A separate transverse incision was made in the antecubital fossa. The proximal aspect of the distal biceps tendon was bifurcated. The lacertus fibrosus was noted to be intact, originating from the short-head component of the distal biceps tendon, and separate from the long-head component of the tendon. There was scar tissue and tenoma between the lacertus and the retracted short-head muscle belly; this was dissected free of the long head. The lacertus fibrosus was released distally such that traction on the lacertus resulted in movement of the short head but not of the long head. The gracilis tendon was then harvested from the ipsilateral thigh. A double-loaded suture anchor (2.9-mm Osteoraptor; Smith & Nephew, Andover, MA, USA) was placed in the bicipital tuberosity, adjacent to the short-head footprint. The gracilis tendon graft was then secured to the bicipital tuberosity with one suture from the anchor according to a modified version of the technique described by Drosdowech et al.[6] The lacertus was then tubularized and the gracilis graft passed through the tubularized lacertus in a Pulvertaft weave. The remaining suture from the anchor was then placed in the tubularized lacertus according to the same technique to augment the distal reconstruction and to supplement the distal tension applied to the retracted short-head muscle belly.[2] The proximal aspect of the tendon graft was then woven through the scarred muscle belly and remaining tenoma in a figure-of-8 fashion. The remaining sheath was then tubularized around the tendon graft (Fig. 3). The elbow was placed at 50° of flexion as the tension on the short-head musculotendinous unit was set. The incisions were closed in layers, and a long arm splint was applied with the elbow in 90° of flexion.

Postoperative course

The patient was given indomethacin (25 mg orally 3 times/d) for 3 weeks postoperatively for heterotopic ossification prophylaxis. He remained in a posterior splint for 4 weeks. At 4 weeks postoperatively, he commenced gentle passive range of motion; and at 8 weeks postoperatively, he commenced active range of motion. Strengthening commenced at 12 weeks postoperatively, followed by a return-to-play program at 4 months postoperatively.

Outcome

The patient's incisions healed uneventfully. The contour of his biceps was improved, and he had full range of motion (Fig. 4). He had no numbness in the medial or lateral antebrachial cutaneous nerve distributions. The cramping pain for which he sought surgery was eliminated. He returned to competitive softball at 6 months postoperatively. At 1-year follow-up, his Disabilities of the Arm, Shoulder, and Hand score was the minimum (0) and his Mayo Elbow Performance Score was the maximum (100). When asked if he would have the procedure again, he replied, "unequivocally yes."

Discussion

There are numerous points worthy of discussion in this case. It is a unique situation that did well with surgical treatment.

Distal biceps injuries are rare but well appreciated and increasingly studied. The anatomy of the distal biceps has been well described. Simplistically, the short and long heads of the biceps brachii coalesce distally to form a single tendon that inserts onto the bicipital tuberosity. In reality, the presence of a bifurcated tendon, in which the short- and long-head components are distinguishable, is fairly common. In a cadaveric study, Athwal et al[1] found that the short- and long-head components coalesced to some degree but could still be easily separated and traced to their respective insertion sites in 53% of specimens. Cho et al[3] similarly found that the distal biceps tendon had 2 easily separated parts in 48% of the specimens they dissected, and Dirim et al[5] found that the common distal biceps tendon had 2 macroscopically identifiable components (ie, short- and long-head contributions) that could be easily separated in 41% of their specimens. In our patient, there were separate tendinous contributions from both the short and long heads that coalesced distally into a single tendon.

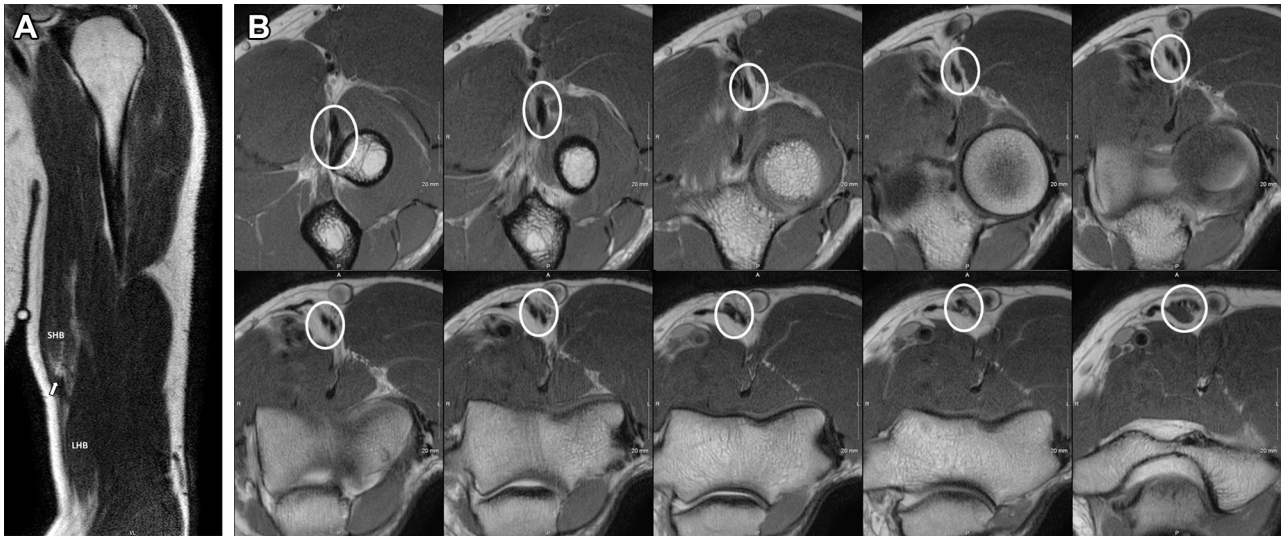

Figure 2 Magnetic resonance imaging. (**A**) T1 coronal magnetic resonance image of the arm demonstrating retracted short head of the biceps with respect to the long head. In addition, there is some fatty replacement (*arrow*) along the short-head distal myotendinous junction, consistent with chronic injury. *SHB*, short head of biceps; *LHB*, long head of biceps. (**B**) T1 axial magnetic resonance images of the distal arm, from distal (*upper left*) to proximal (*lower right*). The contiguous images demonstrate a normal, intact distal biceps tendon insertion/footprint (*images left to right, 1-5, top row, 6-10, bottom row*). More proximally, the tendon is noted to be bifurcated (*images 5-8*). More proximally, the lacertus is seen originating at the short-head component of the distal biceps tendon.

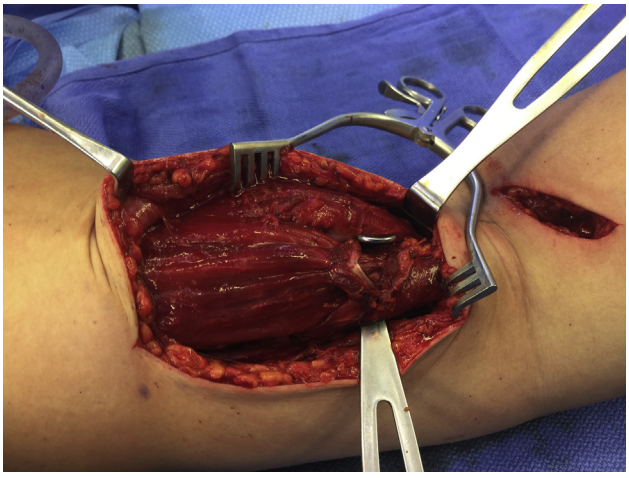

Figure 3 Intraoperative photograph demonstrating reconstruction of the distal myotendinous junction of the short head. The gracilis tendon had been woven through the scarred and fibrotic distal portion of the short-head muscle belly. The remaining sheath was then tubularized around the tendon graft (*left*, proximal; *right*, distal).

Most distal biceps injuries are tendinous, although isolated ruptures of a component of a bifurcated distal biceps tendon are rare. In a retrospective magnetic resonance imagingstudy of injured distal biceps tendons, Dirim et al[5] noted that the tendon appeared bifurcated in only 12% of cases. Of those cases, the short-head component was completely ruptured in 75%, whereas the long-head component was ruptured in only 12.5% (and it was ruptured only with a complete rupture of the short-head component as well). The distal biceps tendon rotates externally as it approaches the bicipital tuberosity; the long head inserts posterosuperiorly (proximally), and the short head inserts anteroinferiorly (distally).[1,3,8] As the short head inserts more distally, it has a larger lever arm for flexion than the long head. A biomechanical study in 2012 found that the short head contributed 15% more than the long head to a biceps flexion load at 90° of flexion.[8] As injuries tend to occur as an eccentric load on a flexed elbow, it is logical that the short head is thus more susceptible to injury in this position. It is not clear whether a bifurcated tendon changes the propensity for injury, however.

Our patient represents an even rarer injury: an isolated myotendinous rupture of the short-head component of the distal biceps. Only 8 cases have been reported to date of distal biceps myotendinous injuries, and each of these cases involved both the short- and long-head components to the distal biceps tendon.[12,19] It is unclear whether bifurcated distal biceps tendons were present in these cases. Our case is unique in that only the short head had a myotendinous rupture; the long head was intact. Whereas most distal biceps tendon injuries occur from an eccentric load on a flexed elbow, these cases highlight a different mechanism for myotendinous ruptures, one that is shared by our patient: active glenohumeral flexion with the elbow extended or semiextended.[12,19] Whereas each previously described patient was successfully treated nonoperatively, our patient was still symptomatic 2 years after injury despite appropriate nonoperative treatment.

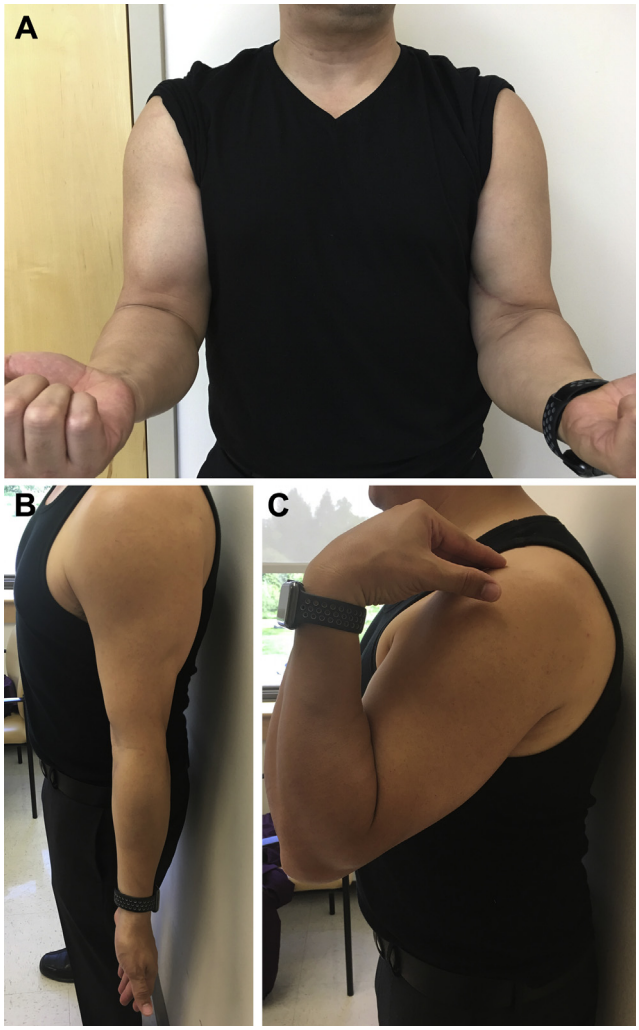

Figure 4 Postoperative outcome. (**A**) Improved biceps contour. (**B**) Full extension. (**C**) Full flexion.

Much has been written about distal biceps tendon tears and their treatment; very little has been written about the treatment of distal myotendinous injuries. Sassmannshausen et al[18] argued that the medial portion of the distal biceps tendon (ie, short-head component) contributes ~50% of biceps function, and therefore surgical repair of an isolated short-head rupture should be considered to improve the patient's function. To date, there are reports of only 6 cases of isolated short-head tendon ruptures that were managed surgically, all with acute repair.[4,10,18,21] The treatment of chronic, retracted distal biceps tendon tears after failed nonoperative management is a challenge, and many surgical techniques exist. Morrey et al[15] demonstrated that excellent results can be obtained after primary reattachment of the retracted tendon even if up to 90° of elbow flexion is required to bring the tendon down to bone. Certainly, a strong and intact musculotendinous junction is needed to support this degree of stretch. If the retracted tendon cannot reach the bicipital tuberosity, tendon reconstruction is favored. For tendon reconstruction, both autograft and allograft tendon options exist. Previously described autografts for distal biceps tendon reconstruction include local lacertus fibrosus, semitendinosus, flexor carpi radialis, palmaris longus, and fascia lata.[7,11,14,16,22] Tendon allografts, including Achilles, hamstring, and tibialis anterior, have also been described.[13,20] The specific technique and tissue used depend on the surgeon's preference.

There have not been any reports before ours of the surgical management of chronic cases of isolated short-head distal biceps myotendinous ruptures. There is mention of an isolated short-head distal biceps tendon rupture being successfully managed nonoperatively,[10] and there are reports of complete distal myotendinous rupture being successfully managed without surgery.[12,19] Nonoperative treatment is not always successful, however. Whereas acute repair of myotendinous injuries may not always be feasible, our case illustrates that chronic reconstruction may result in good symptomatic improvement and improved functional outcomes. The fibrosis that resulted from the chronicity of the injury allowed stronger tissue in which to secure the graft, making reconstruction more technically feasible. Our case suggests that these injuries can in fact be successfully managed surgically.

Conclusion

Distal biceps myotendinous injuries are exceedingly rare and, unlike distal biceps tendon injuries, are caused by active glenohumeral flexion with the elbow extended or semiextended. When both the short- and long-head components are involved, these patients have been successfully managed nonoperatively.[12,19] Isolated short-head myotendinous ruptures may also occur, as presented in our case. Although these injuries are susceptible to the same challenges in terms of acute surgical management, surgical reconstruction was successful in our patient in a chronic setting after failed nonoperative treatment.

Disclaimer

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