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Ultrasonic Percutaneous Tenotomy for the Treatment of Recalcitrant Triceps Tendinopathy

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Abstract

Distal triceps injuries are uncommon, and are often managed non-operatively. Ultrasonic percutaneous tenotomy is a recently developed technique using a specialized device designed to microresect and debride tendinopathic tissue. The device is directed into the pathology tissue using ultrasound guidance. We describe the surgical technique for and present a series of patients with refractory partial triceps tendon tears treated with ultrasonic percutaneous tenontomy.

Keywords: Triceps Tendinopathy; Triceps tear; Needle tenotomy; Tenex

Introduction

Distal triceps tendon injuries are uncommon, and often the result of an isolated traumatic event [1]. Injuries can occur from athletic injury, weight-training, local corticosteroid injections, anabolic steroids, and complications of septic olecranon bursitis [1,2]. For complete distal triceps tendon tears, management is almost uniformly surgical [3]. In the majority of cases, the tear is partial and managed non-operatively [1]. When nonoperative management is unsuccessful, interventions can be limited. Local corticosteroid injections are associated with triceps tendon rupture, and surgery is associated with a prolonged recovery [4,5]. Regenerative procedures have become more common in the last decade to augment the natural healing process in recalcitrant tendinopathy. The literature on regenerative procedures for refractory triceps tendon pathology is limited, and to the authors' knowledge, only 2 case reports have described regenerative procedures for recalcitrant triceps tendon pathology [6,7]. Cheatham described the successful treatment of distal triceps tendinopathy with platelet rich plasma, and Hall and Woodroffe presented a case of recalcitrant calcific triceps tendinopathy with ultrasonic percutaneous tenotomy [6]. In Hall and Woodroffe's case, there was a small intra-substance partial thickness tear associated with the calcific tendinopathy [7]. In this case, it is not clear if the improvement was due to treatment of the calcification, tendon tear or both [7]. Here we present four patients who underwent ultrasonic percutaneous tenotomy for the treatment of refractory partial interstitial tear of the triceps tendon.

Material and Methods

Description of the procedure

The procedure was completed in an ambulatory surgical center under sterile conditions. The patients were positioned supine, and the interstitial tear localized with ultrasound. A solution of lidocaine 1% without epinephrine (2 ml) and ropivicaine 0.5% (2 ml) was injected around the triceps tendon sheath and into the interstitial tear using a 25 gague 1.5" needle for anesthesia (Figure 1). A stab incision was made with an 11-blade scalpel through the skin wheal. The cutting power and irrigation/aspiration setting of the hand-piece is set using the main console (Figure 2). The tip of the Tenex hand-piece (Tenex Health, Lake Forest, California) was then introduced through the incision and guided to the pathologic tissue using ultrasound guidance (Figure 3). The tip of the hand-piece was activated by intermittently depressing the foot pedal. When the probe was activated the needle would move at an ultrasonic frequency, and both irrigate and aspirate the diseased tendon. The tip of the hand-piece was redirected and the probe activated fragmenting and removing pathologic tissue (Figure 4). Multiple passes were made through the hypoechoic tendon to completely resection of diseased tendon.

Postoperative care

The stab incision is closed with a steri-strip (3M, St. Paul, Minnesota) and covered with

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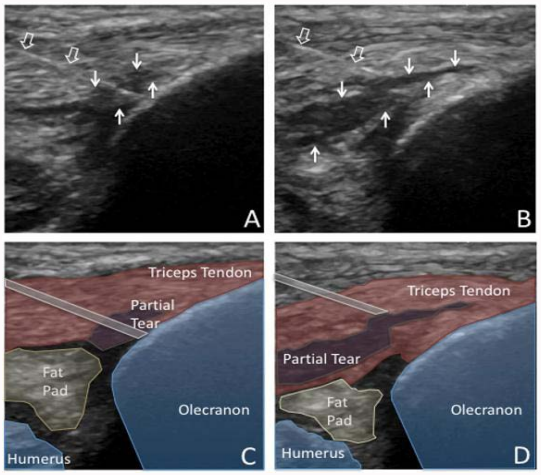

Figure 1: Sonographic images from (A and C) a 26 year old female and (B and C) 38 years old male long axis to the triceps showing 25 gauge needle (open arrow) with the distal tip in the partial tear (arrows) anesthetizing the tear. Representative sonographic images obtained using GE Logiq E, 12L-RS Linear Array Transducer, 5 to 13 MHZ.

Figure 2: Tenex console with touch screen controlling the oscillation, or "cutting power," and aspiration of the hand piece. Cutting and aspiration settings include high, medium and low settings.

Tegaderm (3M, St. Paul, Minnesota). The dressing is removed 5 to 7 days after the procedure. One patient was placed in an elbow T-Scope brace locked at 0 to 60º for 2 weeks and progressed to 0 to 90º for weeks 3 to 4 after the procedure. Three patients were allowed to return to normal activity without restrictions, and started a home strengthening program at 2 weeks. All subjects had a progressive rehabilitation program. No formal physical therapy was prescribed. Patients were instructed to discontinue NSAIDs 1 week prior and 6 weeks post-procedure, and post-procedure pain was managed with cryotherapy, acetaminophen and tramadol.

Results

Five patients diagnosed with partial interstitial tear of the distal triceps tendon were treated with an ultrasonic percutaneous needle tenotomy. All patients were diagnosed clinically, and with a diagnostic ultrasound. Two patients (3 elbows) had concordant ultrasound and MRI findings. In 3 of the patients (4 elbows), the source of pain was confirmed with an ultrasound-guided diagnostic anesthetic injection (lidocaine 1%, 1.5 ml). The average age of the patients was 44.6 years (range, 26 to 61 years), and included 3 male and 2 females (Table 1). Average follow-up was 64.2 weeks (range 24 to 112 weeks). One patient (subject #3 in Table 1), elected to repeat the procedure at

Figure 3: The patient is positioned supine (A) with the shoulder abducted to 90º and the elbow flexed over the table at 90º.

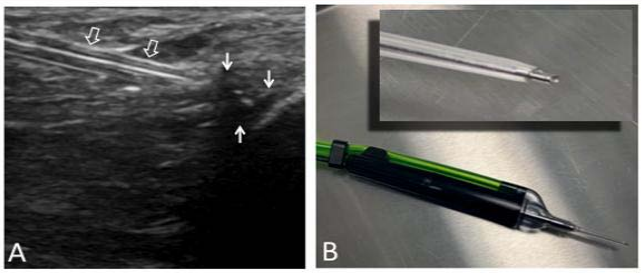

Figure 4: (A) The tip of the Tenex hand-piece (open arrows) directed into hypoechoic tear (arrows). The redundant appearance of the needle from the double lumen. (B) Close up of the Tenex hand-piece showing the double lumen design. The inner most steel cannula oscillates when activated debriding the targeted tissue and aspirating fluid and pathologic tissue. The outer most cannula allows outflow of normal saline irrigating the pathologic tissue.

72-weeks. The patient was pain free with daily activity, but reported residual pain when doing push-ups. After the repeat procedure he was able to return to push-ups and lifting pain free.

Discussion

Ultrasonic percutaneous needle tenotomy is not a novel technique. Case series have demonstrated improved pain and function with ultrasonic percutaneous tenotomy for the treatment of chronic lateral epicondylitis patella tendinopathy, and plantar fasciitis [8-13]. This case series demonstrates that ultrasonic percutaneous tenotomy could be an effective treatment for a chronic partial triceps tendon tears. Traditionally, percutaneous needle tenotomy procedures involve repeatedly fenestrating the affected tendon. The procedure disrupts the degenerative tissue and encourages bleeding, which stimulates a healing response. One limitation of a traditional percutaneous needle tenotomy is that after fenestrating and disrupting the affected tendon the body must then remove the diseased tendinopathic tissue. Ultrasonic percutaneous tenotomy is a different technology. In addition to disrupting the affected tendon, the Tenex TX1 probe has the ability to debride and remove pathologic tissue. The probe oscillates at a high frequency emulsifying the pathologic tissue, and continuously irrigates and aspirates the fluid and debris through the hollow 18-gauge needle. Removing the pathologic tendon was previously only attainable by performing an open or arthroscopic surgery. In an animal model, after removing the pathologic tissue with ultrasonic percutaneous tenotomy the evacuated space was repopulated with mature and immature fibroblasts and the collagen fibers demonstrated a more normal alignment and ratio of type

Table 1: Clinical presentations, outcomes and follow-up.

S. No	Age/sex	Duration symptoms	Mechanism of injury	Pain scores (vas 0-10) 0, 2, 6, 12, 24, 52, 104 wks	Complications	Follow-up (wks)
1	61 F	6 mo	None	4, 0, 0, 0, 1, 0	None	52
2	26 F	4 Yr	MVA	LT 8, 4, 0, 0, 0, 0	None	68
		4 Yr	MVA	RT 8, 0, 0, 0, 0, 0	None	57
3	38 M	1 Yr	None	4, 4, 2, 1, 1, 1	Olecranon bursitis	72
4	52 M	4 mo	Lifting weights	6, 2, 1, 1, 0, 0, 0	None	112
5	46 M	2 Yr	Lifting weights	7, 3, 4, n/a, n/a	None	12

F: Female; M: Male; mo: Month; wks: Weeks; yr: Year; MVA: Motor Vehicle Accident; n/a: Not Available
*Last documented follow-up after the procedure

I and III collagen [14]. In this series, the ultrasonic percutaneous tenotomy was performed with sonographic guidance, targeting only the abnormal appearing tissue and avoiding normal tendon. Patients were allowed to return to normal activity as tolerated, and the arm was not immobilized after the procedure in the majority of the patients. In contrast, open procedures usually require immobilization for 6 weeks and return to previous activity no earlier than 3 to 6 months. In addition to a prolonged recovery, potential surgical complications include flexion contracture, olecranon bursitis and infection [3]. In our series, one case was complicated by an olecranon bursitis, but the swelling resolved spontaneously within one week (subject #3 in Table 1). The authors suspect that the fluid used to irrigate the pathologic tissue distending the bursal space. No other complications were observed.

Limitations

There are limitations to this report, including the limitations inherent in a case study. The cases presented were performed at 2 separate institutions, and there may be slight variations to the procedure post-procedure protocol with each contributing physician. In addition, outcomes were dependent on patient self reported pain scores and functional outcomes were not performed.

Conclusion

Partial triceps tendon tears are uncommon, and when nonoperative management is unsuccessful, there is no consensus to guide management. In recalcitrant cases, ultrasonic percutaneous tenotomy may be an effective treatment to relieve pain.

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