Snapping Triceps Syndrome

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Snapping triceps syndrome is a rarely diagnosed condition that can present with symptoms of ulnar neuritis or as an isolated problem itself. First described in 1970, this syndrome is minimally present in the literature with a few mechanistic studies, anatomical studies, radiological reports, and occasional case reports or series. In this article, we briefly review the literature, discuss potential causes and typical presentations of snapping triceps syndrome, and describe our operative technique. We also provide a representative case with intraoperative videos that illustrate the pathology and surgical treatment. *(J Hand Surg Am. 2018;43(1):90.e1-e5.*

Key words Cubital tunnel, cubitus varus, operative technique, snapping triceps syndrome, ulnar neuritis.

Online Exclusive

Snapping triceps syndrome is a rarely diagnosed syndrome; it can include symptoms related to irritation or subluxation of the ulnar nerve at the cubital tunnel or inflammation and pain from a dislocating triceps segment. Snapping triceps syndrome was first described in 1970 by Rolfsen,[1] in a case of a 21-year-old man who presented with ulnar neuritis, subluxation of the ulnar nerve at the cubital tunnel, and a snapping sensation. An anterior ulnar nerve transposition improved his neuritis, but the snapping remained requiring a return to the operating room and resection of an abnormal medial triceps band.

Dislocation of the triceps over the lateral epicondyle has also been described[2]; however, the relative prevalence in literature case studies strongly favors dislocation over the medial epicondyle.[1–9] This syndrome is seen more often in men, laborers, athletes, and those with varus/valgus deformity at the elbow.

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Received for publication March 3, 2017; accepted in revised form October 14, 2017.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/18/4301-0024$36.00/0
https://doi.org/10.1016/j.jhsa.2017.10.014

Snapping triceps syndrome may present unilaterally, bilaterally, or even asymptomatically, with concurrent ulnar neuropathy and/or subluxation.[6] Numerous studies have looked at mechanisms behind snapping triceps. Anatomical variations—such as a prominent medial head of the triceps,[10] variant slips of the triceps muscle,[11] hypoplasia of the medial epicondyle, hypertrophy of the distal triceps muscle,[6] and cubitus varus from displaced supracondylar humerus fractures[3]—have been described as etiologies.

Treatments described in the literature vary, but excision of the medial head of the triceps, transposition of the triceps, and distal humeral osteotomy are most consistently described. Aside from several series published by Spinner and Goldner et al,[4,5] the literature consists of case reports, which implies that the incidence is low or uncommonly recognized. Our experience has identified 3 patients in a 1-year period alone. We suggest that snapping triceps syndrome is more common than currently recognized, and it may be a treatable cause of persistent, symptomatic ulnar neuropathy.

MECHANISM

Whereas no single definitive mechanism has been identified for snapping triceps syndrome, the predisposition to snapping triceps syndrome is thought to be related to the interplay of location, axis, and pull

of the distal medial triceps tendon as well as humeral bony anatomy (varus deformity, medial epicondylar prominence, ulnar groove depth). Spinner et al[6] introduced the T (triceps) angle as a calculation of the triceps line of pull (analogous to the Q angle of the quadriceps). This angle summarizes the individual contributions of each head of the triceps as well as the carrying angle of the elbow. Alterations in the T angle can lead to displacement of the force vector and medial dislocation.

Differential activation of the triceps heads has also been considered as a potential cause of the snapping. Boon et al[12] performed an electrodiagnostic study examining variable triceps segment activation in symptomatic patients and controls. No difference was found in triceps segment activation time or percentage of full strength between the groups. Their data did show an increased frequency of maximal contraction and speed of activation in the medial head of the triceps (relative to other heads) in both patient groups. This finding introduces the possibility that the higher incidence of snapping triceps syndrome in weight lifters and athletes could be partially attributed to muscle dynamics and hypertrophy.

In a study of cadavers with normal anatomy, deep elbow flexion caused the medial triceps tendon to anteromedially displace the ulnar nerve by an average of 7.3 mm.[13] This relationship may explain why ulnar nerve subluxation tends to accompany medial triceps dislocation.

PRESENTATION

Patients may initially present with a variety of complaints. A common presentation includes cubital tunnel syndrome, with or without subluxation, and may include prominent medial elbow snapping. Snapping triceps is commonly described as a first snapping or popping (ulnar nerve subluxation), followed quickly by a second snap (medial triceps). Spinner and Goldner[7] reported that the ulnar nerve typically subluxates around 70° to 90° of passive elbow flexion, with the medial triceps dislocating at 115°.

Examination at the medial elbow should be performed with passive and active full range of motion. Tension can be placed on the triceps to help accentuate any snapping. This can be done with full shoulder extension with the humerus vertically straight (increasing tendon stretch). Provider-resisted active range of motion or a push-up can further stress this mechanism.[7]

DIAGNOSIS

Static computed tomography scans and magnetic resonance imaging scans before and after dislocation can be used to assess the anatomy. However, ultrasound is regarded as the imaging modality of choice. Ultrasound imaging is readily available, inexpensive, and most importantly, dynamic.[14] Suspected ulnar neuropathy can be confirmed with nerve conduction studies.

TREATMENT

Initially, nonoperative measures are typically employed. These include avoidance of exacerbating factors (eg, weight lifting, swimming). Some practitioners also recommend avoiding sustained or repetitive elbow flexion, a course of anti-inflammatories, and orthosis fabrication of the elbow at 70° of flexion.[7]

SURGICAL ANATOMY

Surgical treatment of snapping triceps begins with decompression of the ulnar nerve. The ulnar nerve lies in the posterior compartment of the distal arm, along the posterior border of the medial intermuscular septum, medial to the triceps. The proximal portion of the cubital tunnel is defined by the Osborne ligament (Fig. 1).

The triceps muscle is composed of 3 distinct heads: lateral, long, and medial. The lateral head originates from 3 sites on the humerus. The long head originates from the infraglenoid tuberosity of the scapula. The medial head originates from the posterior humerus, distal to the spiral groove. Distally, these 3 heads coalesce and insert as both tendon and muscle. The tendinous portion inserts onto the olecranon and an expansion inserts into the posterior crest of the ulna medially, the fascia of the extensor carpi ulnaris origin laterally, the antebrachial fascia distally, and the anconeus.

Cubitus varus

Cubitus varus deformity has been described to alter the musculoskeletal planes and can contribute to snapping triceps syndrome.[3,8] A mathematical, sawbone, and cadaveric study found that a 30° varus deformity (or osteotomy) can medialize the vector of the triceps pull by 1.5 to 2 cm. In 5 of 6 cadaveric limbs, this was enough to produce a snapping triceps.[6]

Further, medial olecranon elongation can occur from chronic overpull of the medial triceps during skeletal growth in patients with cubitus varus (early

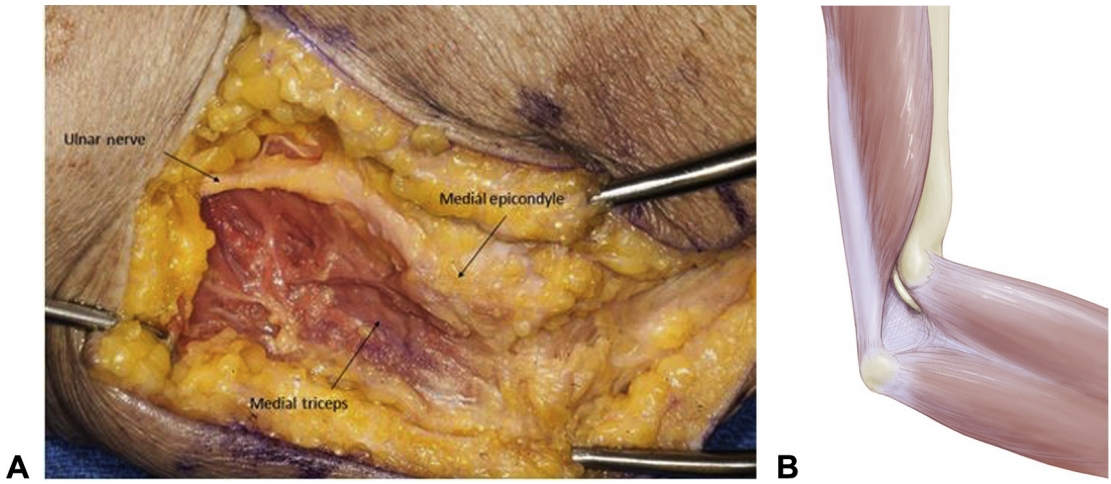

FIGURE 1: Cadaveric **A** photograph and **B** illustration of anatomy of the cubital tunnel and surrounding structures.

supracondylar fractures). This medial olecranon elongation further medializes the triceps tendon distally, decreasing the distance to tendon dislocation.[5]

Anomalous triceps muscle

Rare, but reported, instances exist of a fourth slip of the triceps brachii muscle passing medially around the muscle belly of the long head of the triceps and giving rise to a muscle belly (8 cm in length), at the distal third of the humerus.[4,11] A variant fourth head of the triceps brachii is found throughout the literature[15] and has been described in case reports of snapping triceps syndrome.[9]

In a large case series, Spinner and Goldner[5] examined 17 patients (22 limbs) with snapping triceps. All of the patients who required operative treatment (6 patients, 7 limbs) were found to have a combination of anatomical variations during surgery. These anomalies included thickening of the fascial edge of the medial triceps, an accessory triceps tendon, prominence of the medial head of the triceps, supernumerary medial bands, and posttraumatic cubitus varus deformity.

SURGICAL MANAGEMENT

After a failed trial of nonoperative management, surgical intervention becomes the treatment of choice. Treatment of any cause of an altered T angle should be considered. Numerous surgical options to address the snapping triceps have been described. They include centralization or excision of the snapping slip or, if indicated, corrective osteotomy with or without bone grafting to address humeral malalignment. A centralization procedure is typically chosen in cases in which the snapping triceps segment is a significant bulk of the medial head. Excision has been chosen in select cases with small dislocating segments.

SURGICAL TECHNIQUE

Patients with snapping triceps syndrome often have concurrent cubital tunnel syndrome with subluxation on examination. Therefore, when surgery is chosen, we perform a standard cubital tunnel release with subfascial transposition (our preferred technique). A tourniquet is used for visualization. A 10-cm incision is designed over the intermuscular septum proximally, through the cubital tunnel, and between the 2 heads of the flexor carpi ulnaris distally. Care is taken to protect the medial antebrachial cutaneous nerve, and a complete release of the ulnar nerve is performed while protecting the epineurium, vascularity, and muscular branches. S-Shaped fascial step-lengthening flaps are raised from the flexor pronator fascia, with the proximal flap based laterally. The flexor pronator mass is then debulked as needed to prevent nerve kinking. The ulnar nerve is transposed anteriorly and the fascial flaps secured with a 3-0 Ethibond suture.

Next, attention is turned to the medial triceps tendon. The posterior skin flap over the medial elbow is raised for visualization. Next, passive range of motion is used to assess the triceps stability. Any subluxation is noted and marked. Electric stimulation is performed if no dislocation is observed with passive motion.

In our experience, usually around 20% of the medial triceps tendon is involved. The dislocating segment is released off of the main tendon sharply, while protecting the integrity of the remaining tendon. A running locking Bunnel or Krackow stitch is placed into the released tendon using #2 Fiberwire.

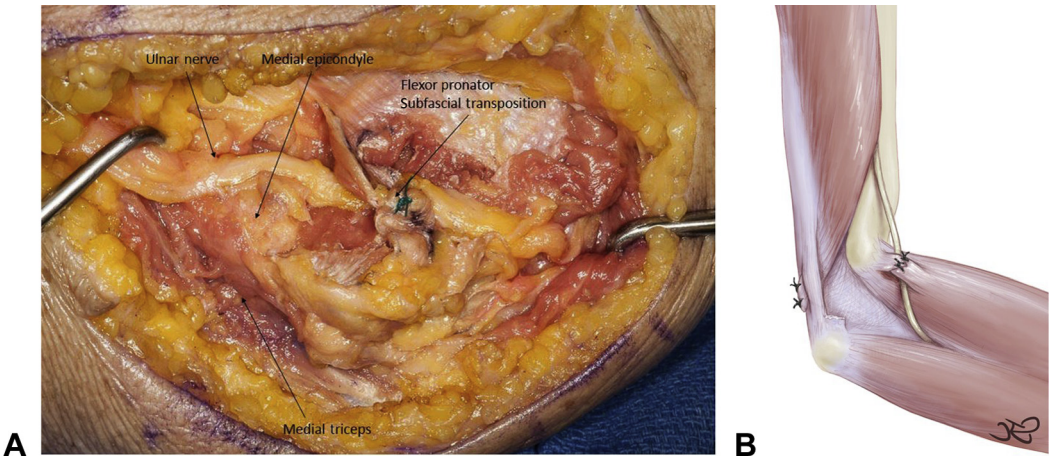

FIGURE 2: Cadaveric **A** photograph and **B** illustration of the technique of triceps centralization with subfascial anterior transposition of the ulnar nerve.

A longitudinal split is made in the muscle just proximal to the main tendon body. The released tendon is woven through this split and into the main tendon and secured with the Fiberwire suture and additional horizontal mattress sutures (Fig. 2). Dislocation is again assessed and additional release or rerouting is performed as needed.

POSTOPERATIVE MANAGEMENT

No standardization of postoperative management is found in the literature. The most thorough description of a postoperative regimen comes from Spinner and Goldner.[7] They used a long-arm orthosis for 3 to 5 days, followed by a bulky dressing and a sling for 7 to 10 days with gentle elbow range of motion and ulnar nerve-gliding exercises. They then graduated their patients to full passive extension and 110° of active flexion for 21 days. Five weeks after surgery, full active flexion and extension were started.

Our preferred protocol is to use an orthosis to place the elbow in 90° of flexion for 2 weeks. The orthosis and sutures are then removed, and the patient is allowed full active and passive range of motion, but cautioned against forceful passive flexion or exercises requiring contraction of the triceps until 3 months. Physical therapy is initiated for throwing athletes at 2 weeks after surgery, focusing first on range of motion, then gradually increasing activities to allow full return to play by 3 months.

CASE EXAMPLE

A 16-year-old right-handed female softball pitcher presented to our clinic with a several-year history of right-sided medial elbow pain. She had a remote history of radial head subluxation as a child. She reported right elbow pain and ulnar neuritis as long as she could remember, with exacerbation over the prior 6 months. Her symptoms were exacerbated by weight lifting and throwing. A recent magnetic resonance imaging scan showed chronic annular ligament tearing; otherwise no significant abnormalities. On examination, she had palpable ulnar nerve subluxation at 90° and medial triceps dislocation at 100° (palpable and visible) (Video 1; available on the *Journal*'s Web site at www.jhandsurg.org). She had mild irritation of the ulnar nerve at the cubital tunnel on examination, but no distal findings.

Given the patient's recalcitrant symptoms, surgery was recommended. An ulnar nerve transposition was performed and the previously appreciated snapping was attributed to a hypertrophic medial triceps muscle (Video 2; available on the *Journal*'s Web site at www.jhandsurg.org). The triceps was then centralized using the previously discussed technique (Video 3; available on the *Journal*'s Web site at www.jhandsurg.org) with intraoperative resolution of the medial triceps dislocation (Video 4; available on the *Journal*'s Web site at www.jhandsurg.org).

Physical therapy was initiated at 2 weeks, including a modified return to throwing protocol. She progressed well after surgery with resolution of her snapping and return to full, pain-free activity at 3 months after surgery.

ACKNOWLEDGMENTS

The authors wish to thank Stacy Cheavens, MS, CMI (illustrations), Steve Friedman, BA (editing), and Mark Kinnaman, BFA (photography of cadaver dissections).

REFERENCES

1. Rolfsen L. Snapping triceps tendon with ulnar neuritis: report on a case. *Acta Orthop Scand*. 1970;41(1):74–76.
2. Spinner RJ, Goldner RD, Fada RA, Sotereanos DG. Snapping of the triceps tendon over the lateral epicondyle. *J Hand Surg Am*. 1999;24(2):381–385.
3. Kontogeorgakos VA, Mavrogenis AF, Panagopoulos GN, Lagaras A, Koutalos A, Malizos KN. Cubitus varus complicated by snapping medial triceps and posterolateral rotatory instability. *J Shoulder Elbow Surg*. 2016;25(7):e208–e212.
4. Spinner RJ, O'Driscoll SW, Jupiter JB, Goldner RD. Unrecognized dislocation of the medial portion of the triceps: another cause of failed ulnar nerve transposition. *J Neurosurg*. 2000;92(1):52–57.
5. Spinner RJ, Goldner RD. Snapping of the medial head of the triceps and recurrent dislocation of the ulnar nerve. Anatomical and dynamic factors. *J Bone Joint Surg Am*. 1998;80(2):239–247.
6. Spinner RJ, An KN, Kim KJ, Goldner RD, O'Driscoll SW. Medial or lateral dislocation (snapping) of a portion of the distal triceps: a biomechanical, anatomic explanation. *J Shoulder Elbow Surg*. 2001;10(6):561–567.
7. Spinner RJ, Goldner RD. Snapping of the medial head of the triceps: diagnosis and treatment. *Tech Hand Up Extrem Surg*. 2002;6(2):91–97.
8. Spinner RJ, O'Driscoll SW, Davids JR, Goldner RD. Cubitus varus associated with dislocation of both the medial portion of the triceps and the ulnar nerve. *J Hand Surg Am*. 1999;24(4):718–726.
9. Reis ND. Anomalous triceps tendon as a cause for snapping elbow and ulnar neuritis: a case report. *J Hand Surg Am*. 1980;5(4):361–362.
10. Dellon AL. Musculotendinous variations about the medial humeral epicondyle. *J Hand Surg Br*. 1986;11(2):175–181.
11. Fabrizio PA, Clemente FR. Variation in the triceps brachii muscle: a fourth muscular head. *Clin Anat*. 1997;10(4):259–263.
12. Boon AJ, Spinner RJ, Bernhardt KA, Ross SR, Kaufman KR. Muscle activation patterns in snapping triceps syndrome. *Arch Phys Med Rehabil*. 2007;88(2):239–242.
13. Apfelberg DB, Larson SJ. Dynamic anatomy of the ulnar nerve at the elbow. *Plast Reconstr Surg*. 1973;51(1):76–81.
14. Zbojniewicz AM. US for diagnosis of musculoskeletal conditions in the young athlete: emphasis on dynamic assessment. *Radiographics*. 2014;34(5):1145–1162.
15. Nayak SR, Krishnamurthy A, Kumar M, Prabhu LV, Saralaya V, Thomas MM. Four-headed biceps and triceps brachii muscles, with neurovascular variation. *Anat Sci Int*. 2008;83(2):107–111.