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Failed ulnar nerve surgery due to persistent unrecognized snapping triceps from cubitus varus due to a distal humeral malunion in an adult: illustrative case

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BACKGROUND Snapping triceps is a dynamic condition in which a portion of the medial head of the triceps dislocates over the medial epicondyle during flexion or extension. Pushed by the triceps, the ulnar nerve typically also dislocates over the medial epicondyle, causing neuropathy. Posttraumatic cubitus varus deformities resulting from pediatric supracondylar fractures have been associated with snapping triceps. This is the first case of snapping triceps associated with cubitus varus due to distal humeral malunion, which occurred in an adult.

OBSERVATIONS A 23-year-old man sustained a left distal humeral fracture from arm wrestling, which was treated nonoperatively, healing in a varus malunion. Within several months, he developed ulnar neuropathy and snapping at the medial elbow, which was diagnosed as a dislocating ulnar nerve and was treated with ulnar nerve transposition. He presented 8 years later with continued ulnar neuritis symptoms and snapping and was found to have snapping medial triceps. He chose nonoperative treatment.

LESSONS Snapping triceps, presenting as snapping at the elbow with ulnar nerve symptoms, can be incorrectly diagnosed as isolated ulnar nerve dislocation. Unrecognized snapping triceps leads to persistent symptoms after ulnar nerve transposition. The patient in this case demonstrated that an altered triceps line of pull can cause snapping triceps regardless of how the cubitus varus originated.

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KEYWORDS snapping triceps; ulnar neuritis; distal humeral fracture; posttraumatic; cubitus varus

Snapping triceps is a dynamic condition in which the triceps dislocates over the medial epicondyle during flexion or extension, is characterized by a snapping sensation experienced by the patient, and can typically be appreciated by an experienced examiner.[1–3] The triceps most commonly dislocates medially but can occur laterally on rare occasions.[4–6] In triceps displacement during range of motion, the ulnar nerve also frequently dislocates, being pushed by the medial head of the triceps over the medial epicondyle. The dislocation of the ulnar nerve can result in friction neuritis, or the action and relationship of the triceps on the nerve can result in compression and neuropathy. The association of ulnar nerve symptoms, particularly in the presence of a snapping structure, may lead to the diagnosis of ulnar neuritis secondary to ulnar nerve dislocation; the snapping triceps (a second snap) may not be identified or treated, leading to persistent symptoms after surgery, including pain, snapping, and even ulnar nerve symptoms.[7]

Snapping of the medial triceps has been identified in three groups of individuals, including those with 1) anatomical variations in the triceps (musculotendinous variations), 2) hypertrophied triceps (such as weightlifters), and 3) a cubitus varus deformity from either a congenital or posttraumatic condition.[1,4,5,8,9] In cubitus varus, the line of pull of the triceps is displaced medially, which can have a further medial effect on the ulnar nerve, resulting in dislocation and neuropathy.[1,5,10] The triceps angle (T angle) is defined as the angle between the bony alignment of the proximal ulna and the triceps line of pull.[5] The most commonly described example of snapping triceps and cubitus varus in the literature is due to a pediatric supracondylar fracture that healed in varus malunion and years or decades later presents in adulthood or adolescence with the characteristic symptoms of ulnar neuropathy and snapping triceps.[4,6,8,11–18] In this report, we present the first case of a posttraumatic snapping triceps associated with cubitus varus and ulnar neuropathy due to a distal humeral malunion that occurred in an adult.

Illustrative Case

A 32-year-old right-handed man was seen virtually for left-sided ulnar neuritis symptoms and medial elbow snapping. At age 23 years, he had sustained a left distal humeral fracture while arm wrestling. This was treated nonoperatively and healed in a varus malunion.

ABBREVIATIONS MRI = magnetic resonance imaging; US = ultrasound.
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Within several months of the fracture, he noted ulnar nerve symptoms with tingling in the little and ring fingers. He was found to have a dislocating ulnar nerve and underwent a submuscular ulnar nerve transposition 1 year later by another surgeon. Following the surgery, the ulnar nerve paresthesias improved initially, but he was aware of persistent (painless) snapping over the medial epicondyle. He resumed weight training again. In the year or 2 prior to presentation, he had increasing medial elbow pain, painful snapping of the medial triceps during resisted elbow extension, and worsening ulnar two-digit paresthesias. His elbow issues were interfering with his quality of life and his ability to do weight training and rock climbing.

He had been evaluated by multiple physicians at other institutions, but no definitive diagnosis was offered. Neurological examination was normal, including electromyography. Elbow radiographs showed a distal humeral malunion with 12° of varus (Fig. 1). Magnetic resonance imaging (MRI), performed with the elbow in extension, showed T2 hyperintensity and mild enlargement of the ulnar nerve in its transposed position. Ultrasound (US) revealed the medial displacement of the triceps over the medial epicondyle in elbow flexion.

On physical examination, he appeared fit but was not an overly muscular individual. He had approximately 15° of cubitus varus. He had full active and passive elbow flexion and extension. The medial triceps visibly dislocated (snapped) over the medial epicondyle, reproducing the pain. He had pain and snapping while doing a push-up test. There was no muscle atrophy.

Despite the limitations of a virtual examination, the senior author diagnosed him as having snapping medial triceps and ulnar neuritis due to cubitus varus from a distal humeral malunion. He discussed treatment options including nonoperative measures and the avoidance of provocative activities (including weight training), surgical treatment of the triceps alone (either excision or rerouting of the snapping component of the triceps) with neurolysis of the ulnar nerve, and humeral osteotomy with or without surgical treatment of the triceps and ulnar nerve. The primary symptoms would most likely be effectively dealt with by addressing the snapping of the medial triceps; the persistent ulnar nerve symptoms were believed to be due to the irritation of the transposed ulnar nerve by the anterior displacement of the triceps. Although the osteotomy would improve the patient's cosmetic concerns, it presented additional operative risks related to the osteotomy and internal fixation, such as nerve injury or nonunion. Ultimately, the patient opted for nonoperative treatment.

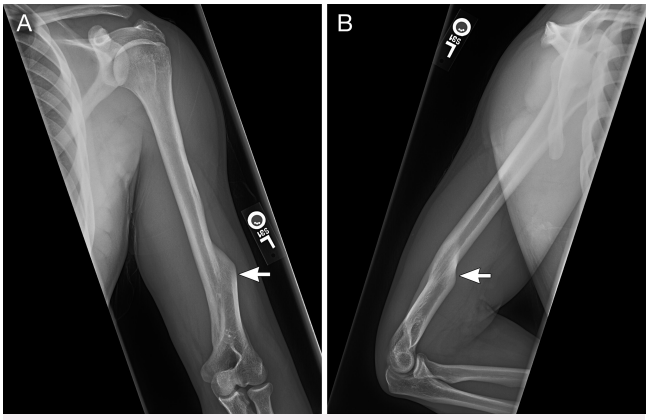

FIG. 1. Anteroposterior (**A**) and lateral (**B**) radiographs demonstrate the malunion of the distal humerus (*arrows*).

Informed Consent

The necessary informed consent was obtained in this study.

Discussion

Observations

The patient's ulnar neuropathy was originally thought to be due to a dislocating ulnar nerve, not a dislocating nerve and triceps, and thus was treated with an ulnar nerve transposition. Presumably, he had 2 snaps originally, and the snapping of the medial triceps was not recognized or treated and persisted. While we acknowledge that this patient could have had a predisposition to developing this condition from hypertrophy (a well-established cause of triceps in and of itself), we believe that temporally the new bony malalignment from the humeral malunion caused the snapping triceps: the posttraumatic cubitus varus deformity altered the triceps line of pull.[1,8,9] It is also possible that the fracture and subsequent cubitus varus deformity served as the precipitating factor on top of an underlying hypertrophic predisposition.

While some may say that the nature of virtual visits proved to be a limitation of this study, we would argue that snapping triceps has classic characteristics governed by consistent biomechanical pathology that allow the condition to be recognized in a patient with a novel fracture over a virtual visit. Through observation of the medial epicondyle during the range of motion, combined with a review of imaging studies confirming the ulnar nerve in its anterior position, it was undeniable to the senior author and the patient that the snapping was the medial head of the triceps. Additionally, the senior author sought the second opinion of another expert at his institution, who agreed that the diagnosis was certain, even with the limitations of a virtual examination.

Our review of the literature revealed 30 patients (25 men, 5 women) in 11 publications on posttraumatic cubitus varus with the subsequent development of snapping triceps syndrome.[4,6,8,11–18] Twenty-eight were supracondylar fractures, 1 was a lateral condylar fracture,

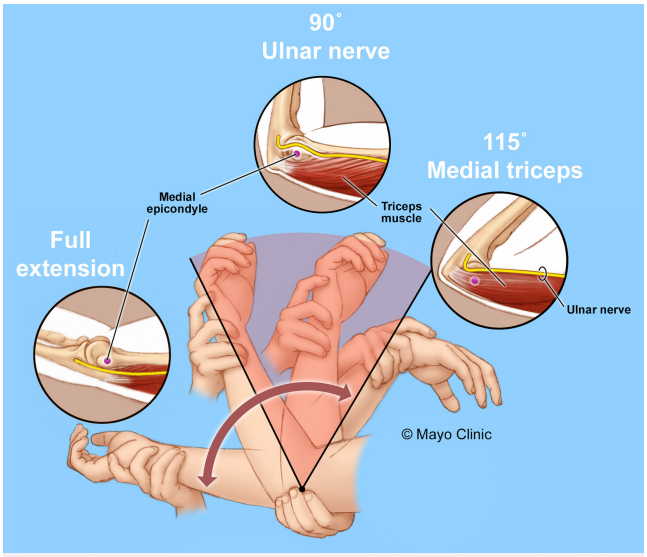

FIG. 2. Snapping of the ulnar nerve and medial head of the triceps can be assessed by testing the position of these structures with passive and active elbow flexion and extension. The snap angles are highlighted in the *shaded area*: the ulnar nerve tends to dislocate over the medial epicondyle at about 90° and the medial triceps at about 115° (with permission, Mayo Foundation, 2024).

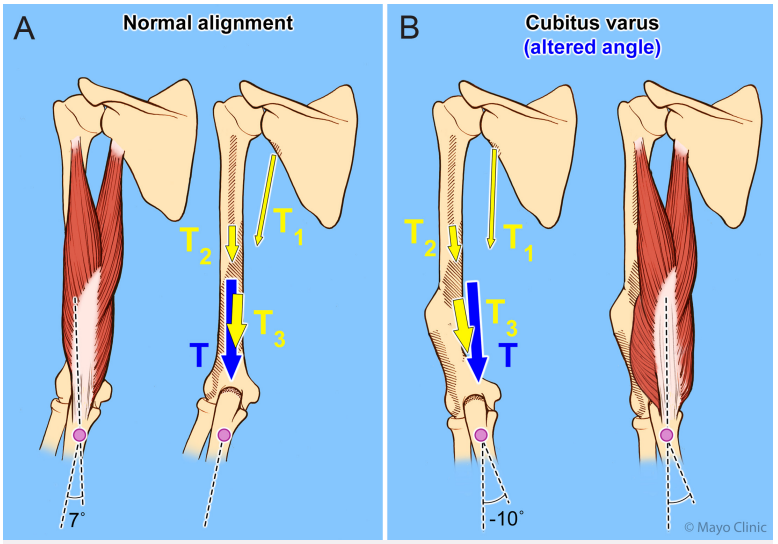

FIG. 3. The T angle is the angle between the triceps line of pull (summated force of the triceps from the individual triceps' three heads (T_1, T_2, T_3) and the bony alignment of the proximal ulna. A normal carrying angle is about +7° in a man and 10° in a woman (**A**). In normal individuals, with elbow flexion, the triceps and ulnar nerve are displaced medially but not over the medial epicondyle. In contrast, this patient had a cubitus varus deformity with −12° (**B**). The resultant altered line of pull is displaced medially. Thus, in a cubitus varus deformity, the medial displacement of the triceps (and ulnar nerve) is more marked and, in some patients, can lead to dislocation over the medial epicondyle with elbow flexion (with permission, Mayo Foundation, 2024).

and 1 was a lateral epicondylar fracture (which initially healed in cubitus valgus nonunion and then was overcorrected to varus through a supracondylar varus osteotomy 6 years prior to presentation for snapping triceps).[4,6] Some cases also had posterolateral rotatory instability (due to ligamentous injury). The average age at presentation was 25.4 years (range 7–70 years), average age at initial fracture was 11.1 years (range 1–37 years), average age at snapping onset was 22.9 years (range 4–68 years), and average alignment was a 21° varus (range 5°–45°).

In contrast, our patient, a 32-year-old man, had a distal humeral fracture at age 23 years, snapping onset began around age 25 years, and alignment was a 12° varus. Furthermore, our report is only the second publication with posttraumatic snapping triceps after a fracture sustained as an adult (of interest, the only other report, by Shimizu et al.,[18] indicated that the average age at fracture in their series of 8 patients was 22 years, with the oldest being 37 years, each of whom sustained a supraconylar fracture).

Lessons

Not every case of snapping at the medial epicondyle during elbow flexion or extension is from the ulnar nerve. The medial triceps can snap/dislocate as well and cause the symptoms expected of ulnar nerve dislocation. This diagnosis requires a high level of suspicion and, if missed in patients with ulnar neuritis or neuropathy, can result in unnecessary and unhelpful surgeries like ulnar nerve transposition, which do not address the underlying cause of the irritation.[3,19,20] Our patient was one of these missed patients. Techniques for diagnosis and treatment have been described elsewhere in the literature.[2,21] The snaps of the ulnar nerve dislocating and the medial triceps dislocating should be able to be differentiated based on the flexion angle at which they occur, i.e., the "snap angle."[2] Starting in full extension and passively flexing, the ulnar nerve typically snaps first at approximately 90° flexion, and then the medial triceps snaps at approximately 115° (Fig. 2).[2] Preoperative imaging includes dynamic US or MRI done with the elbow in extension and flexion.[18,21–24] Intraoperative testing should include flexing and extending the elbow (especially after an ulnar nerve transposition to ensure that no other snapping structure is seen and that the ulnar nerve is stable in its anterior position without compression).[6,25]

Snapping triceps should be suspected in patients with cubitus varus who have ulnar symptoms. While cubitus varus most commonly arises from childhood supracondylar fractures that heal in varus malunion, this report demonstrates that other humeral fractures can result in the same altered line of pull and subsequent triceps snapping syndrome (Fig. 3).[5] This patient's symptoms suggest that the principles governing snapping triceps and the triceps line of pull (T angle) in cubitus varus apply regardless of how the cubitus varus occurred, even though this condition has not been reported in a distal humeral fracture.[5]

Whereas cubitus valgus deformity (typically also from malunion from supracondylar fracture) has been well known to be associated with so-called tardy ulnar neuropathy, cubitus varus has also been associated with ulnar neuropathy.[26–29] We believe that the combination of cubitus varus and snapping triceps and ulnar neuropathy is underrecognized.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: both authors. Acquisition of data: both authors. Analysis and interpretation of data: both authors. Drafting the article: both authors. Critically revising the article: both authors. Reviewed submitted version of manuscript: both authors. Approved the final version of the manuscript on behalf of both authors: Spinner. Statistical analysis: O'Driscoll. Administrative/technical/material support: both authors. Study supervision: both authors. Conducted literature review: O'Driscoll.

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