Anconeus Epitrochlearis Muscle Associated With Cubital Tunnel Syndrome: A Case Series

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Abstract

Background: Cubital tunnel syndrome is a common compressive neuropathy of the upper extremity. The anconeus epitrochlearis muscle is an unusual but occasional contributor. We review our experience with this anomalous muscle in elbows with cubital tunnel syndrome. **Methods:** We retrospectively reviewed charts of 13 patients noted to have an anconeus epitrochlearis muscle associated with cubital tunnel syndrome. **Results:** Ten patients had unilateral ulnar neuropathy supported by nerve conduction studies. Three had bilateral cubital tunnel syndrome symptoms with 1 of those having normal nerve conduction studies for both elbows. Eight elbows were treated with myotomy of the anconeus epitrochlearis muscle and submuscular transposition of the ulnar nerve. The other 8 elbows were treated with myotomy of the anconeus epitrochlearis muscle and in situ decompression of the ulnar nerve only. All but 1 patient had either clinical resolution or improvement of symptoms at follow-up ranging from 2 weeks to 1 year after surgery. The 1 patient who had persistent symptoms had received myotomy and in situ decompression of the ulnar nerve only. **Conclusions:** An anomalous anconeus epitrochlearis occasionally results in compression of the ulnar nerve but is usually an incidental finding. Its contribution to compression neuropathy can be tested intraoperatively by passively ranging the elbow while observing the change in vector and tension of its muscle fibers over the ulnar nerve. Regardless of findings, we recommend myotomy of the muscle and in situ decompression of the ulnar nerve. Submuscular transposition of the ulnar nerve may be necessary if there is subluxation.

Keywords: anomalous muscle, compression syndrome, myotomy, ulnar nerve transposition, ulnar neuropathy, anatomy of upper extremity

Introduction

Described in 1867 by Austrian anatomist Gruber, the anconeus epitrochlearis muscle is a common anomalous muscle that originates from the medial epicondyle of the humerus, arches over the ulnar nerve, and inserts onto the medial olecranon.^{12,18} Although presumed to be an atavistic structure in humans, it is frequently present in amphibians, reptiles, and most mammals.⁹ Receiving its innervation via the ulnar nerve, the anconeus epitrochlearis muscle is thought to function as an elbow adductor, elbow extensor, and forearm supinator; it may also possibly offer some protection to the ulnar nerve.^{9,18}

The anconeus epitrochlearis muscle draws our surgical attention due to its implication as an unusual cause of cubital tunnel syndrome. The English-language literature includes reports of several cases. We report our experience with 16 elbows in 13 patients, in whom an anconeus epitrochlearis muscle was associated with cubital tunnel syndrome.

Methods

After institutional review board approval (PRO00017066), we identified 19 consecutive patients treated by our senior authors for cubital tunnel syndrome with the mention of an anconeus epitrochlearis in their operative report between 1999 and 2016. In our retrospective review of these charts, we collected the following variables: date of operation, age at time of operation, gender, operative side, preoperative symptoms, nerve conduction study and imaging results, treatment, follow-up interval, and outcome.

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Table 1. Summary of Cases.

Age	Gender	Side	Symptoms	Exam and tests	Treatment	Outcome	Follow-up
43	M	R	Paresthesias in ulnar nerve distribution and a soft mass over elbow	Abnormal NCS and mass on MRI	Removal of lipoma, myotomy and transposition	Relief from symptoms	1 y
27	M	L	Bilateral paresthesias and cramping in ulnar nerve distribution	Normal NCS	Myotomy and transposition	Relief from symptoms	6 wk
27	M	R	Bilateral paresthesias and cramping in ulnar nerve distribution	Normal NCS	Myotomy and transposition	Relief from symptoms	1 y
55	M	L	Numbness and weakness in ulnar nerve distribution	Abnormal NCS	Myotomy and transposition	Improved symptoms	1 y
46	F	L	Bilateral paresthesias in ulnar nerve distribution	Abnormal NCS	Myotomy and transposition	Relief from symptoms	6 mo
47	F	R	Bilateral paresthesias in ulnar nerve distribution	Abnormal NCS	Myotomy and transposition	Relief from symptoms	6 mo
58	M	L	Paresthesias in ulnar nerve distribution	Abnormal NCS	Myotomy and transposition	Improved symptoms	1 y
59	M	R	Numbness in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Improved symptoms	6 mo
61	M	L	Burning pain in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Improved symptoms	2 wk
40	M	L	Burning pain and weakness in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Improved strength	4 wk
59	M	L	Numbness and weakness in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Improved symptoms	4 wk
64	M	L	Paresthesias in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Relief from symptoms	3 wk
63	M	L	Paresthesias and weakness in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Improved symptoms	7 wk
67	M	L	Pain and paresthesias in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Persistent symptoms	6 mo
62	M	L	Numbness in ulnar nerve distribution and pain at elbow	Abnormal NCS	Myotomy and in situ release only	Relief from symptoms	2 wk
56	M	R	Numbness in ulnar nerve distribution	Abnormal NCS	Myotomy and in situ release only	Relief from symptoms	3 wk

Note. MRI = magnetic resonance imaging; NCS = nerve conduction study.

Results

Of the 19 charts reviewed, we excluded 6 for incomplete follow-up data. As a result, between years 1999 and 2016, we identified 16 elbows in 13 patients with an anconeus epitrochlearis muscle associated with cubital tunnel syndrome (Table 1). Review of intraoperative photos and operative notes demonstrated significant variation in the size of the muscle. Some were large and fleshy, while others mostly fascial bands. Only 1 patient (8%) was female, though she has bilateral elbows included in this study. Five of 16 elbows (31%) were on the right. Eight elbows were treated with myotomy of the anconeus epitrochlearis muscle and submuscular transposition of the ulnar nerve prior to year 2010. One of these elbows also had a lipoma associated at the surgical site, which was removed at the time of surgery. The following 8 elbows had myotomy of the anomalous muscle and in situ decompression of the ulnar nerve only without transposition. All but 1 patient in the myotomy and in situ decompression only group had either clinical resolution or improvement of their symptoms at follow-up ranging from 2 weeks to 1 year following surgery. Median follow-up was 6 months.

Discussion

Cadaver studies report the incidence of the anconeus epitrochlearis muscle to be anywhere from 4% to 34% (Table 2). Gruber found the muscle in 34 of 100 (34%) cadavers,¹² LeDouble in 32 of 102 (32%) cadavers,¹⁸ Bando in 45 of 157 (29%) cadavers,² Von Clemens in 4 of 100 (4%) elbows,²⁴ Mumenthaler in 10 of 56 (18%) cadavers,²⁰ Dahnert and Wood in 9 of 212 (4%) cadavers,⁷ Dellon in 7 of 64 (11%) cadavers,⁸ O'Driscoll et al in 3 of 27 (11%) elbows,²¹ and Campbell et al in 14 of 130 (11%) cadaver elbows.⁵ Of note, Campbell et al also found a dense fibrotendinous band, which the authors called an epitrochleoanconeus ligament, in 6 of 130 (5%) cadaver elbows.⁵

More recently, physicians have used modern imaging modalities to evaluate the elbow for an anconeus epitrochlearis muscle. Between 1993 and 1998, Okamoto et al used ultrasound for preoperative evaluation of 32 consecutive elbows diagnosed with cubital tunnel syndrome. They found evidence of an anconeus epitrochlearis muscle in 2 of the 32 (6%) patients, though when directly visualized intraoperatively, only 1 was actually found to have the

Table 2. Summary of Incidence of Anconeus Epitrochlearis.

Author	Reference	Year	n (%)	Method
Gruber	12	1867	34/100 (34%)	Cadaveric
LeDouble	18	1897	32/102 (32%)	Cadaveric
Bando	2	1956	45/157 (29%)	Cadaveric
Von Clemens	24	1957	4/100 (4%)	Cadaveric
Mumenthaler	20	1958	10/56 (18%)	Cadaveric
Dahners & Wood	7	1973	9/212 (4%)	Cadaveric
Dellon	8	1986	7/64 (11%)	Cadaveric
O'Driscoll et al	21	1991	3/27 (11%)	Cadaveric
Campbell et al	5	1991	14/130 (11%)	Cadaveric
Okamoto et al	23	2000	2/32 (6%)	Ultrasound
Husarik et al	15	2009	14/60 (23%)	Magnetic resonance imaging

anomalous muscle.²³ The other patient was reported to have symptoms from a band and not the anconeus epitrochlearis muscle itself. From our observations, there seems to be significant variation in the size of the muscle, ranging from large and fleshy muscle to almost a fascial band in some instances.

In 2009, Husarik et al evaluated 60 asymptomatic patients with magnetic resonance imaging (MRI) of their dominant elbows and found an anconeus epitrochlearis muscle in 14 (23%) of the 60 patients, concluding that an anconeus epitrochlearis muscle is a common MRI finding in asymptomatic elbows.¹⁵

There are largely anecdotal reports of cubital tunnel syndrome associated with an anconeus epitrochlearis muscle in the English literature (Table 3). Wachsmuth and Wilhelm reported on 16 cases with satisfactory relief of symptoms after myotomy and anterior transposition of the ulnar nerve.²⁵ Other authors since then have also reported good results with myotomy and anterior transposition.^{6,17} Hirasawa et al reported a case of bilateral anconeus epitrochlearis muscle hypertrophy in an individual with a history of intense weight lifting and shot-putting.¹³ At surgery, both elbows underwent myotomy of the anomalous muscle. Anterior transposition of the ulnar nerve was performed only on the right elbow. Despite the contrasting treatment for each elbow, at 6-month follow-up all symptoms were relieved and the patient had improved grip strength bilaterally.

Gessini et al reported on 1 case with delayed motor and sensory nerve conduction velocities at the elbow.¹¹ The anconeus epitrochlearis muscle was surgically detached from the olecranon without transposition of the ulnar nerve. At 1-month follow-up, motor symptoms had improved, but without improvement in sensory symptoms. Dahners and Wood reported on 1 case treated with resection of a small portion of the muscle origin only.⁷ The patient had symptom relief and no recurrence at 3-month follow-up. Masear et al reported on 5 elbows with an anconeus epitrochlearis in a series of 42 surgical explorations to treat cubital tunnel syn-

drome.¹⁹ They described the epitrochleoanconeus ligament as a band form of the anconeus epitrochlearis muscle.

O'Hara and Stone reported on 1 case treated with myotomy alone and without nerve transposition.²² Prompt resolution of symptoms was noted in the immediate postoperative period. Hsu et al reported on 1 case with concomitant compression by a $2 \times 1 \times 1$ cm ganglion cyst.¹⁴ They decompressed the ulnar nerve by muscle resection and ganglion cyst excision without transposition of the nerve. No symptom recurrence was noted at 2-year follow-up postoperatively.

Jeon et al reported on 2 cases of medial elbow pain in which MRI evaluation demonstrated an anconeus epitrochlearis muscle with edema-like signal changes on each elbow.¹⁶ One patient underwent surgery, during which the anconeus epitrochlearis was divided.

Gervasio and Zacccone reported presence of an anconeus epitrochlearis muscle with a prominent medial head of triceps in 5 out of 156 (3.2%) patients who underwent surgery for cubital tunnel syndrome.¹⁰ Treatment consisted of simple nerve decompression with resection of the anconeus epitrochlearis muscle and partial resection of the triceps muscle. All patients obtained complete recovery.

Boero et al reported on 1 pediatric case.³ Prior to surgery, the anconeus epitrochlearis muscle compressing the ulnar nerve was visualized on ultrasound. There was no subluxation of the ulnar nerve following excision of the muscle, and the patient improved.

In our series, half of the cases were treated with submuscular transposition of the ulnar nerve in addition to myotomy of the anconeus epitrochlearis muscle, as this was the senior authors' preferred technique for cubital tunnel syndrome prior to year 2010. The other 8 elbows were treated with myotomy of the anconeus epitrochlearis and in situ decompression of the ulnar nerve for a distance of 8 cm proximal and distal to the medial epicondyle. The surgeons observed elbow flexion and extension intraoperatively to check for ulnar nerve subluxation. Since none of the 8 elbows demonstrated ulnar nerve subluxation following

Table 3. Summary of Previously Reported Cases.

Author	Year	Patients	Symptoms	Special	Treatment	Outcome	Follow- up
Boero et al	2008	1 elbow 1 patient	Elbow pain and paresthesia in ulnar distribution	Motor and sensory latency on EMG & NCV US visualized an anconeus epitrochlearis muscle compressing the ulnar nerve	Myotomy	Resolution of symptoms	3 mo
Gervasio	2008	5 elbows 5 patients					
Jeon et al	2005	2 elbows 2 patients		MRI			
Hsu	2004	1 elbow 1 patient	Ulnar distribution numbness and tingling	Concomitant ganglion cyst	Myotomy and excision of ganglion cyst	No recurrence of symptoms	2 yr
O'Hara and Stone	1996	1 elbow 1 patient	Ulnar distribution numbness and tingling	Tinel sign over cubital tunnel Ulnar nerve compression by prominent medial head of triceps and anconeus epitrochlearis	Myotomy	Resolution of symptoms	Early postoperative period
Masear et al	1988	5 elbows 4 patients		NCV measurements	Myotomy	Markedly improved	19.5 mo (16-29 mo)
Dahners and Wood	1984	1 elbow 1 patient	Ulnar distribution numbness and cramping	Symptoms exacerbated by playing the clarinet Tinel sign at cubital tunnel NCV sensory delay at elbow	Myotomy	Relief of symptoms and able to play the clarinet without cramping	3 mo
Gessini et al	1981	1 elbow 1 patient	Pain in elbow and forearm, paresthesia in ulnar distribution, and difficulty in fine movement	Motor and sensory NCV at elbow 16 m/sec	Myotomy	Persistent sensory deficit in ulnar distribution, persistent atrophy of hypothenar eminence and interossei muscles, and improvement of fine finger movements Motor NCV 25 m/sec and sensory NCV 16 m/sec	1 mo
Hirasawa et al	1979	2 elbows 1 patient	Bilateral numbness and weakness	Intense weight lifting and shot-putting	Myotomy and transposition on R, myotomy only on L	Relief of symptoms and improvement in grip strength bilaterally	6 mo
Chalmers	1978						
Kurihara	1977				Myotomy and transposition		
Vander-pool et al	1968						
Wachsmuth and Wilhelm	1968	16			Myotomy and transposition		

Note. EMG = electromyography; NCV = nerve conduction velocity; US = ultrasound; MRI = magnetic resonance imaging.

myotomy and in situ decompression, submuscular transposition was deemed unnecessary.

No significant difference was noted in terms of clinical improvement between elbows treated with myotomy and transposition versus elbows that received myotomy and in situ decompression only. All but 1 patient in the myotomy and in situ decompression only group had either complete relief from symptoms or improvement of symptoms.

The role of ulnar nerve transposition in the treatment of cubital tunnel syndrome has often been debated. A recent Cochrane Review meta-analysis of 3 randomized controlled

trials suggests no statistically significant difference in postoperative outcome in the treatment of ulnar neuropathy between in situ decompression of the nerve only and decompression with transposition, regardless of the finding of an anconeus epitrochlearis muscle.⁴ The analysis did find, however, that the rate of deep and superficial surgical site infections is higher when decompression with transposition is performed.

When observed intraoperatively, the anconeus epitrochlearis muscle changes its vector as the elbow is ranged from extension to flexion as well as during forearm pronation and

Figure 1. (a) With elbow extension, the anconeus epitrochlearis is relaxed. (b) At 45° of flexion, the vector of the muscle become oblique with increased tension of the muscle fibers. (c) With the elbow flexed, the vector of the muscle fibers becomes even more oblique resulting in compression of the ulnar nerve. (d) There is persistent indentation of the ulnar nerve (arrow) following myotomy of the anconeus epitrochlearis.

Figure 2. (a) With elbow in extension, there is no tension on the hemostat within the cubital tunnel. (b) With elbow flexion, the vector of the muscle changes, but there is no tension on the hemostat or underlying nerve. Compression was present from Osborne's ligament, and the anconeus epitrochlearis was an incidental finding.

supination. This change in vector may convert a relaxed anconeus epitrochlearis to become taut over the ulnar nerve (Figure 1). With severe compression, indentation of the ulnar nerve can occur at the site of the anconeus epitrochlearis. This supports the concept that the dynamic anatomy of the elbow may be contributing to the compression of the

ulnar nerve, as described by Apfelberg and Larson.¹ More commonly, however, we have noticed the muscle is relaxed throughout the full range of the elbow and is likely only an incidental finding (Figure 2). This can be tested by placing a hemostat deep to the muscle and over the nerve to gauge the severity of compression. Regardless of findings, we rec-

commend myotomy of the anomalous muscle along with in situ decompression of the ulnar nerve as this alone should achieve relief.

Following myotomy and in situ decompression, the surgeon should observe the ulnar nerve as the elbow is brought into flexion and extension. The released ulnar nerve now may have a tendency to sublux and become vulnerable to recurrence of neuropathy. When presented with findings of subluxation, we perform submuscular transposition of the ulnar nerve.

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Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

This study was a retrospective chart review carried out with the approval of our institutional review board.

Statement of Informed Consent

All patients whose charts were reviewed for this study signed the standard informed consent forms prior to their surgical procedures, allowing data to be used for educational purposes. No recognizable images are included in the figures.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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