Surgical Treatment of Cubital Tunnel in Pediatric Athletes

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Abstract

Keywords

- cubital tunnel syndrome
- electrodiagnostic finding
- Michigan Hand Questionnaire
- pediatric athletes

Background Cubital tunnel syndrome is the second most common upper extremity peripheral nerve entrapment syndrome. In particular, cubital tunnel has been documented occasionally in young, throwing athletes.

Materials and Methods Billing databases were searched for patients undergoing surgical decompression of the ulnar nerve at the elbow, who were age 18 or younger at the time of surgery. Charts were reviewed and patients were included if they had an isolated mononeuropathy consistent with cubital tunnel syndrome and were symptomatic. Data on age of onset, duration of symptoms, Dellon classification, nerve subluxation, provocative testing results, nerve conductions, and exacerbating activities were abstracted. Patients were contacted for a postsurgical follow-up questionnaire.

Results Seven patients were identified. The average age was 16, and duration of symptoms was 7 months. All seven patients had normal electrodiagnostic studies and had failed a course of conservative treatment. All were satisfied with surgery and felt improvement. One stopped playing their sport, and three had mild symptoms with varied activities.

Conclusion Although uncommon, pediatric cubital tunnel syndrome does occur. Surgical release improves symptoms and return to activities. Nevertheless, some degree of symptoms often persists. Electrodiagnostic studies may be negative in many patients with an otherwise consistent history and examination.

Level of Evidence This is a level IV therapeutic study.

Introduction

After carpal tunnel syndrome, cubital tunnel syndrome is the most common upper extremity peripheral nerve entrapment syndrome.¹ Although less common to present in the pediatric population, cubital tunnel syndrome is occasionally seen among the pediatric cohort. In particular, cubital tunnel syndrome has been previously documented in young, little-league male baseball pitchers.^{2,3}

Godshall and Hansen first reported ulnar neuropathy in two 14-year-old little league pitchers.⁴ Aoki et al provided further insight on six cases of cubital tunnel syndrome in adolescent baseball players, showcasing efficacy of anterior

subcutaneous transposition of the ulnar nerve for the condition.⁵ In 2012, Stutz et al reported their findings in 35 pediatric patients, treating 39 extremities for cubital tunnel syndrome between 2000 and 2009. Within the 39 extremities treated, patients who were associated with nine of the extremities reported participation in throwing sports.⁶ However, Stutz et al did not provide commentary on the ability to return to play.

Given these limited previous descriptions of pediatric cubital tunnel in athletes, the purpose of this study was to describe the presenting symptoms, electrodiagnostic findings, and surgical outcomes of pediatric athlete patients who were diagnosed with cubital tunnel syndrome.

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Materials and Methods

After achieving institutional review board approval, the authors identified patients by sorting through billing databases for those who were age 18 or younger at the time of surgery and have a CPT code of 64718 (ulnar nerve release at the elbow). Patients were excluded due to a traumatic etiology or previous surgery. They then excluded patients who were not athletes or who did not have an exacerbation of their symptoms with their sport. Each patient was clinically diagnosed with cubital tunnel syndrome by a hand fellowship-trained surgeon and elected to undergo surgical treatment following unsuccessful nonsurgical management. To meet criteria for diagnosis, patients had at a minimum a history of numbness and tingling in an ulnar nerve distribution with medial elbow discomfort and ulnar axis pain proximal to Guyon's canal. Electrical studies were conducted to assess conduction of the ulnar nerve and rule out other potential sources of neuropathy.

The patient demographic data collected included age, sex, sport, duration of symptoms, and affected extremity (►Table 1). Symptomatology included complaints of pain and/or numbness and tingling when performing their sport. Physical examination assessments included ulnar nerve subluxation,⁷ a Tinel's sign over the ulnar nerve at the elbow,⁸ the elbow flexion compression test,⁹ and two-point discrimination. Patients were also assessed for other sources of medial elbow pain, including medial collateral ligament injury, snapping triceps, medial epicondylitis, and congenital abnormalities of the joint.

The authors classified patients during pretreatment based on Dellon classification.¹⁰ Patient-rated outcomes were assessed postoperatively with the Michigan Hand Questionnaire (MHQ), a standardized instrument that has shown to have strong construct validity and good responsiveness in adult patients with cubital tunnel.¹¹ Patients were also asked specific questions regarding residual symptoms with sporting activities. These questions included presence of residual symptoms, if patients returned to sport, patient's comfort with returning to sport, and any modifications required of patients to continue playing their sport.

Nonsurgical treatments consisted of nighttime splinting, activity modification, and/or usage of anti-inflammatory medication. The decision for surgical intervention was at the

discretion of the treating physician and consent of patient, following the ineffectiveness of previously applied nonsurgical management. Surgical management consisted of anterior subcutaneous transposition, anterior intramuscular transposition, or in situ decompression. The operating surgeon and patients, based on etiology, symptomatology, and presence or absence of the subluxating ulnar nerve, selected the surgical procedure.

Results

The authors identified a potential sample of 15 patients (►Fig. 1). Of the 15 pediatric athletes, 7 could be contacted postoperatively, at an average of 33 months. Patients ranged in age from 13 to 18 years (mean, 16 years). Subjective complaints at the time of consultation included three extremities exhibiting pain, numbness, and constant tingling, but worse with athletic activities. Two extremities exhibited numbness and tingling only when performing an athletic motion and two exhibited numbness and tingling as well as pain only when performing an athletic motion. Of the seven patients, 6 had a positive Tinel's sign over the ulnar nerve at the elbow. Six exhibited positive results for an elbow flexion compression test and four exhibited a positive ulnar nerve compression test. Five of the patients exhibited weakness when performing a grip test. The two-point discrimination was normal in all patients except for one (7 mm) and was not recorded in another.

Preoperative, the Dellon classification showed four patients as mild, two as moderate, and one as severe. Four of the patients received a magnetic resonance imaging (MRI). Of those four, all patients had a normal MRI. All patients demonstrated normal findings on electromyogram/nerve conduction study (EMG/NCS). All patients underwent initial nonoperative conservative treatment as described previously; however, the treatment was not effective in any patients. Patients' average time of symptoms prior to surgery was 7 months.

Patients' average age at the time of surgical intervention was 16 years. Four of the patients were treated with anterior subcutaneous ulnar nerve transposition; three of the four of these had nerve subluxation. Two patients were treated with

Table 1 Patient demographic data

Case	Age (y)	Sex	Duration of symptoms (mo)	Sport
1	16	M	8	Pitching (baseball)
2	15	F	10	Basketball
3	16	F	7	Tennis
4	18	M	2	Pitching (baseball)
5	16	F	–	Basketball
6	17	M	5	Pitching (baseball)
7	17	F	7	Cheerleading

Fig. 1 Flowchart of patient exclusion. The flowchart shows how patients were selected and excluded from this study based on selected criteria. *CPT code of 64718 is indicative of required ulnar nerve release at the elbow.

in situ decompression, with one patient receiving excision of a hypertrophic medial slip of the triceps and one patient with excision of an anconeus. One patient was treated with anterior intramuscular ulnar nerve transposition, which included excision of an anconeus. Of the seven patients, one required revision surgery. That patient received an initial anterior intramuscular ulnar nerve transposition for Dellon severe classification of ulnar neuropathy prior to the first surgery. Given persistent symptoms including numbness and tingling in the affected extremity as well as pain when performing certain activities, the patient was later treated with neurolysis. During revision surgery, a thick band of a retained ligament of Struthers was revealed.

Five of the seven patients recorded 100% satisfaction on the MHQ, with two noting complete resolution, one with occasional numbness and tingling when playing tennis and the last switching positions from pitcher to second base. Two patients recorded 83% and 75% satisfaction scores on the MHQ, with the first exhibiting cold sensitivity and the second receiving revision surgery. Overall MHQ satisfaction among the seven pediatric athlete patients was 94%. Among patients, five were able to return to their sport at the same level. One patient was unable to continue playing while another was able to continue playing their sport but was forced to switch positions, from pitcher to second baseman.

Discussion

Felice and Jones reported on 21 cases of pediatric ulnar neuropathy. Of the two pediatric patients who were diagnosed with cubital tunnel syndrome, both exhibited normal EMG.¹² Among the seven patients reported in this study, all pediatric athlete patients exhibited normal EMG preoperatively. During preoperative assessment, patients exhibited positive signs for cubital tunnel syndrome on provocative tests.

In 2005, Aoki et al reported the impact and stress that is placed upon the ulnar nerve at the elbow during a throwing motion that is commonly seen in athletics.⁵ In particular, the throwing motion is indicative of the motion exhibited by an athlete playing baseball.⁶ Cubital tunnel syndrome has been well documented in overhead athletes.^{2-5,13} In this study, five of the seven patients participated in overhead sports, specifically baseball or softball. However, nonoverhead athletes also exhibited symptoms. Therefore, although the authors may see a greater number of overhead athletes with ulnar nerve problems at the elbow, cubital tunnel should always be considered in the differential when dealing with all athletes.

Surgical treatment in pediatric athletes was effective in this study. The MHQ scores collected during follow-up with patients indicated excellent satisfaction with their postoperative result. These results are consistent with those by Stutz who showed that DASH (Disabilities of the Arm, Shoulder and Hand) scores improved significantly when comparing pre- and postoperative values. For all of the pediatric athletes involved in the study by Stutz et al, their involved sport was either baseball or softball.¹³

With respect to returning to sport, the authors note that only one patient was unable to return to the sport and one had to change positions on the field. These results are consistent with those by Aoki, who noted that only one out of his six pediatric athletes was unable to return to playing baseball after receiving an anterior subcutaneous transposition of the ulnar nerve treatment.⁵ The case series by Stutz et al does not mention ability of return to sport for his pediatric athletes.

With respect to the type of surgical procedure, these results showed successful outcomes of anterior subcutaneous transposition treatment and in situ decompression although patient numbers for each procedure are limited. Stutz et al did not specify the type of procedure that was performed on the pediatric athletes.¹³ Aoki et al showed the success of anterior subcutaneous transposition.⁵

Out of seven patients, one required revision surgery. That particular patient was the only one out of the seven to receive anterior intramuscular ulnar nerve transposition. Preoperatively this was the only patient who met criteria for a Dellon severe classification. The results of one patient do not allow for any definitive conclusion regarding treatment efficacy in pediatric patients with different techniques of ulnar nerve release.

Interestingly, all patients included in this study demonstrated normal EMG findings. While unusual, cubital tunnel presenting with nonsuggestive EMG findings has been known to occur.¹⁴ Typically, non-EMG suggestive findings would confer a more mild pathology of the condition.¹⁴ However, this is unproven in the pediatric population. It is possible that EMG sensitivity in the pediatric population is less than that in their adult counterparts. Further studies can be conducted to determine efficacy of EMG in the pediatric population for diagnosis of upper extremity peripheral neuropathies.

There are a variety of weaknesses in this study. First, patients available for follow-up contact were limited. Owing to the prevalence of cubital tunnel in pediatric, our population size was limited as well. Second, the MHQ has not been tested for validity in the pediatric population. Future studies may assist in validating the MHQ for pediatric usage. Third, owing to the absence of a gold standard objective test for cubital tunnel, it could be argued that perhaps the diagnosis of cubital tunnel in these patients was not correct. However, their history and physical examination were strongly suggestive of the diagnosis, and they had symptomatic relief from release of their ulnar nerve.

Several important conclusions can be drawn from the study of these patients. First, although uncommon, pediatric cubital tunnel syndrome does occur, and it should be considered in the differential in young athletes with medial elbow pain and paresthesias. Second, typically electrodiagnostic studies and MRI are typically negative in these patients with an otherwise consistent history and examination. Third, unfortunately conservative treatments at least in this small patient sample did not appear to be effective. Fourth, surgical release or transposition improves symptoms and returns to activities. However, some degree of symptoms may persist, so setting appropriate expectations for patients and parents is crucial preoperatively.

Note

Institutional Review Board of St. Vincent Hospital and Health Care Center, INC, granted approval for this study. The study number is R2010-14. This study was performed at Indiana Hand to Shoulder Center.

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Conflict of Interest

None.

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