AT: The Bony Tommy John Injury – Medial Epicondyle Fractures in Throwing Athletes

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Abstract
The optimal method of treatment for medial humeral epicondyle fractures in pediatric patients is still controversial. This injury can occur due to excessive valgus stress placed on the elbow by the pronator muscle mass that have a common point of origin at the medial epicondyle. In throwing athletes such as baseball pitchers this can occur during a pitch. Non-operative as well as operative management have been reported to have positive outcomes and lack consensus about when either is indicated. This disparity is the root of the controversy. The only consensus for operative intervention exists when there is incarceration of the fracture fragment in the joint space, ulnar nerve involvement or dislocation. This report outlines the injury of a 15-year-old baseball player who injured his elbow while pitching. His physical examination and x-rays confirmed a right-sided medial humeral epicondyle fracture and treatment options were discussed. With the intention of a speedy return to baseball and normal function, the patient and his family opted for open reduction and internal fixation (ORIF).

Keywords: Medial epicondyle fracture; Elbow fracture; Throwing athletes

Introduction
The medial epicondyle serves as the origin of the flexor pronator musculature and the proximal attachment of the medial ulnar collateral ligament (UCL). The flexor pronator mass functions as a dynamic stabilizer of valgus stress to the elbow while the UCL acts as static stabilizer of static stress to the same region. The UCL is comprised of 3 components or bundles: the anterior oblique, posterior oblique, and transverse ligaments. The anterior oblique bundle resists most of the valgus stress throughout both flexion and extension [1-3]. The median epicondyle is the third of six main ossification centers which usually develops between the ages of 4-6 [4]. However, an open apophysis is often present until the age of 14 to 15. The apophyseal cartilage is relatively weaker than the ligaments that attach to it, and therefore, is a major determinant of possible injury to the medial epicondyle in a subpopulation of individuals.

Fractures of the medial humeral epicondyle account for approximately 12% of all pediatric elbow fractures [5]. These injuries most frequently occur within the age range of 9-14 and are four times more common in males [5]. Avulsion fractures may result in young athletes who experience a mechanical overload of the medial epicondylar apophysis [6]. This injury is especially common amongst youth baseball players in particular, pitchers. A recent trend in single sport concentration and year-round participation renders these young athletes more susceptible to ulnar nerve dysfunction and avulsion fractures of the elbow [6].

The mechanism for acute avulsion fractures of the medial humeral epicondyle during baseball pitching is a sudden increase in tension of the flexor pronator muscles and valgus stress on the elbow, which in turn pulls the medial epicondyle from the humeral attachment site [7]. Repeated valgus force can also successively contribute to an avulsion injury in this manner [8]. Treatment for the fracture can be either non-operative or operative, with there being a fair amount of disagreement about which of these two options is preferred [4]. Generally, avulsion fractures of the medial humeral epicondyle with more than 5mm of displacement, presence of significant instability, or containing fragments that are incarcerated in the joint space are treated with ORIF followed by range of motion and strength rehabilitation [8]. For those fractures with minimal displacement or no instability, treatment consists of immobilization in a long arm cast at 90 degrees for 3-4 weeks followed by similar rehabilitation [9].

Here we describe a case of an avulsion fracture of the medial epicondyle which serves as an...
excellent example one of the most common injuries among baseball pitchers [8]. The focus of this case report will be to educate the reader on the evaluation, diagnosis, treatment and prognosis of this injury, with particular focus on the controversy that surrounds operative vs. non-operative treatment.

Case Presentation

A 15-year-old male, A.T., previously in good health, presented to an urgent care facility with a history of non-contact injury to his right elbow suffered earlier that day. A long-time baseball player, A.T. was throwing a pitch when he heard a loud pop immediately followed by intense pain. Plain anterior-posterior (AP) X-ray (Figure 1) examination of the elbow showed a complete avulsion fracture with mild displacement of the medial epicondyle, and he was referred for consultation with a pediatric orthopedic surgeon.

Physical examination results revealed tenderness on the medial aspect of the right elbow and valgus laxity. Hoping to quickly return to baseball, A.T. elected to undergo open reduction and internal fixation (ORIF) of the fracture (Figures 2 and 3), which was performed 4 days after injury.

The patient’s elbow was immobilized in a removable posterior splint for 1 week post-operatively, after which it was removed and converted to a sling. Early protected active range of motion exercises were also started 1 week post-operatively. By 8 weeks A.T. had regained full strength and range of motion in the injured elbow, see (Figures 4 and 5), and was cleared to participate in tryouts for his fall baseball team.

Discussion

The management of medial epicondyle fractures in the pediatric population has remained controversial for some time with some studies showing positive results for both operative and non-operative management [4,6,10,11]. Traditionally, indications for operative versus non-operative management are dependent upon the degree of displacement of the fracture fragment from the fracture bed with displacement <5mm managed non-operatively and those 5mm-15mm managed operatively [4,6,10,11]. The Rang Medial Epicondyle Classification system has four categories: I minimally displaced II rotated III trapped fragment in joint space and IV dislocated elbow and can guide surgeons’ decision making [12].

Youth baseball pitchers are playing for larger parts of the year now and are especially prone to developing avulsion fractures of the medial epicondyle depending on their degree of usage [4,6,11]. In an increasingly competitive sporting culture and with the prospect of earning a collegiate scholarship, overhead athletes and their families, through a shared decision making process, are considering all options for speedy return to sports following these injuries. We assert that open
reduction and internal fixation is the optimal treatment for athletes who desire a quick return to normal function regardless of degree of displacement and patients and families such as AT’s are selecting it as a treatment option. Despite the lack of high level evidence studies, there are a few lower level studies that show there is an earlier return to play in those athletes treated operatively [7,13]. Studies have also shown a 9.33 odds of union for operative management as compared to non-operative treatment [15]. Non-operative treatment such as prolonged casting might result in stiffness of the elbow as well as inappropriate lengthening of the ulnar collateral ligament as a result of misalignment of the fracture fragment which can result in increased valgus instability at the elbow [14].

Displacement as a means for determining the proper course of management is mainly determined by the use of anterior-posterior (AP) and lateral elbow X-rays [15]. Disagreement when measuring fracture displacement on an X-ray was defined as a reading greater than 2mm difference between observers [15]. Surgical team members were shown to disagree 54%, 87% and 64% on AP, lateral and oblique X-ray views, respectively [15]. These figures indicate an inherent controversy especially for surgeons who prefer non-operative treatment for less displaced fractures as the fragment might be more displaced than originally thought. Surgeons preferring to proceed with management based on degree of displacement will be better served by using a 45-degree internal oblique X-ray to improve their accuracy at judging the degree of displacement [15]. This angle has been shown to have less disagreement amongst observers [15]. More accurate than X-rays is computed tomography (CT) see (Figures 6 and 7), however, access and cost might be a deterrent to adaptation of this modality. A.T. regained full range of motion and strength in 8 weeks. After surgery he was placed in a cast and then was able to complete physical therapy to help restore his elbow function. Different types of ORIF can assure speedy return to full range of motion such as cannulated screw with washer fixation, also Kirschner (K-wires) wires can be used but should be removed being 2 and 6 months after placement [12]. A cannulated screw and washer interfragmentary compression construct was used for A.T.

There have been some documented cases of late ulnar nerve palsy after ORIF; however, this was absent in our patient. If a patient initially presents with an ulnar nerve palsy noted on initial physical examination, then ORIF is indicated. The ulnar nerve may be damaged during the initial trauma or via iatrogenic means such as during surgery or compressive effects of casting on the nerve [16]. For the cases illustrated the nerve was compressed by the deep fascia between the heads of the flexor carpi ulnaris (FCU), release of compression was achieved by early release of the aponeurosis of the FCU as well as the fascia between the heads of the FCU [16].

**Conclusion**

Throwing athletes such as baseball pitchers who play year round are often seeking to return to play quickly. Patients such as A.T. and his family opted for surgery to achieve this goal. ORIF has been proven to provide bony union at significantly higher rates and has been shown to restore range of motion more quickly and allow for speedy return. Though there is a place for non-operative management with some minimally displaced fractures, athletes faced with the decision between operative and non-operative treatment can be assured that operative management can reliably expedite return to function and sport.

**References**


