



ELSEVIER

CASE REPORTS

Bony avulsion of the medial ulnar collateral ligament in a gymnast: A case report

Robert C. Grumet, MD, Nicole A. Friel, MS, Brian J. Cole, MD, MBA*

Division of Sports Medicine, Department of Orthopaedic Surgery, Rush University Medical Center, Chicago, IL

The risk of injury in gymnastics is higher during periods of rapid growth and is directly related to the level of competition.⁸ Gymnasts spend an estimated 29% of their season altering their training routine as a result of injury.^{3,8} Most injuries in these athletes are the result of overuse, with upper extremity injuries occurring more frequently in male gymnasts and lower extremity injuries more often in females.³ Elbow injuries are relatively common in gymnasts due to the repetitive compressive varus and valgus stresses applied. These super-physiologic loads likely contribute to the development of osteochondritis dissecans of the capitellum and medial epicondylitis or apophysitis.⁵ Catastrophic injury, such as an acute dislocation, is frequently seen as a result of a missed move, a fall from the apparatus, or an improper dismount. Several case studies have described the extreme of these injuries, such as bilateral elbow dislocations, in a gymnast.⁷

In high-level gymnasts, similar to the need of the medial elbow structures in a pitcher in an effort to withstand extreme valgus force, there is a significant valgus load imparted to the elbow with weight bearing and compressive activities such as a back handspring.⁵ These forces average 3% of body weight times body height (about 18 Nm). Therefore, the integrity of the ulnar collateral ligament is vital to perform these routines and protect the lateral elbow structures. We describe a case of a young competitive-level gymnast who sustained an injury to both elbows during an uneven bars routine. She had an acute elbow dislocation on her left elbow and an avulsion of the ulnar collateral ligament from the sublime tubercle of the ulna on the right

elbow. Owing to her age, the demands of her sport, and her gross right elbow instability with valgus stress, she underwent repair of the avulsed fragment from the sublime tubercle with its attached ulnar collateral ligament.

Case report

Investigational Review Board approval is not required for a case report.

History

A 16-year-old left-hand-dominant high school gymnast was performing an uneven bars routine and missed the high bar, falling to the mat on bilateral outstretched arms. She had an obvious deformity and dislocation in the left elbow and significant right elbow pain. She was taken to the emergency department, where a closed reduction was performed of the left elbow under conscious sedation. Radiographs were taken of the bilateral elbows after the reduction maneuver to the left elbow (Figure 1).

She was placed in a posterior mold and sling for the left side and a simple sling for comfort on the right. She then presented to our office 2 days after the injury for evaluation. The right elbow showed significant swelling and ecchymosis over the medial side. She had limited range of motion secondary to pain, with flexion limited to approximately 90°, extension to -30° from neutral, pronation to 70°, and supination to 45°. She had no tenderness to palpation over the lateral side of the elbow or radial head. She was neurovascularly intact. Her forearm compartments were soft and compressible, with no pain with range of motion of the wrist or digits.

*Reprint requests: Brian J. Cole, MD, MBA, Rush University Medical Center, 1611 W Harrison St, Ste 300, Chicago, IL. 60612.

E-mail address: bcole@rushortho.com (B.J. Cole).



Figure 1 (A) Lateral and (B) anteroposterior view radiographs of the right elbow show evidence of an avulsion of the sublime tubercle of the ulna. Postreduction (C) lateral and (D) anteroposterior radiographs of the left elbow. On the lateral projection there is evidence of a small fracture of the coronoid anteriorly. There is no evidence of subluxation or fragments within the ulnohumeral joint.

The left elbow examination revealed ecchymosis and swelling over the lateral side. She had tenderness to palpation on the medial and lateral sides. Range of motion was significantly limited secondary to pain, with flexion to 90° and extension to -30° . She was intact neurovascularly and the forearm compartments were soft, with no significant pain with compression.

A review of the radiographs revealed a concentrically reduced elbow on the right side and a large bony avulsion on the ulna at the sublime tubercle, with no evidence of incarceration of the fragment (Figure 1). There was no associated fracture of the coronoid or radial head. The left elbow showed a concentrically reduced elbow with a small fracture of the coronoid associated with the elbow dislocation (Figure 1). No radial head fracture was appreciated.

Given the large bony avulsion on the right elbow, there was a concern for the integrity of the ulnar collateral

ligament insertion in this area. Bilateral elbow magnetic resonance imaging (MRI) studies were ordered to evaluate the ulnar collateral ligament on the right and any associated injury with the elbow dislocation on the left, such as loose body or chondral injury. Evaluation of the left elbow MRI did not add any additional information regarding the injury. The right elbow MRI confirmed the suspicion for avulsion of the anterior band of the ulnar collateral ligament from the sublime tubercle of the ulna (Figure 2).

A decision was made to treat the left elbow dislocation and coronoid fracture conservatively, with early range of motion in a hinged elbow brace. This decision was based on a repeat examination 5 days after the injury. This examination revealed improved range of motion, -20° to 110° , no mechanical block to motion, no evidence of instability with elbow extension, and stability to varus and valgus stress. These findings were later confirmed with an examination under anesthesia. Given the



Figure 2 (A, B) Coronal-T1 and T2-weighted magnetic resonance images of the right elbow show a large bony fragment displaced from the sublime tubercle. (A) The ulnar collateral ligament is attached to the bony fragment (*arrow*). (C) An axial T2-weighted magnetic resonance image shows a bony fragment avulsed from medial ulna (*arrow*).



Figure 3 Medial approach to the elbow. Exposing the medial epicondyle and flexor pronator mass revealed an obvious rent in the flexor pronator origin (*arrow*).

large bony avulsion on the right elbow, we decided to proceed with an examination under anesthesia to evaluate the degree of valgus instability. The examination confirmed significant instability to valgus stress at 0° and 30° of elbow flexion with gapping of the medial joint space.

A preoperative discussion with the parents included the possibility of performing an open repair of the bony avulsion if significant instability was found at the time of examination. Given the instability and the size of the bony fragment with the attached anterior band of the ulnar collateral ligament, we decided to proceed with open repair.

Surgical technique

The patient was positioned supine with the arm supported by a hand table. A nonsterile tourniquet was placed on the arm. The arm was prepared and draped in the standard

sterile fashion. The arm was elevated, exsanguinated using an Esmarch bandage, and the tourniquet inflated to 250 mm Hg. A 5-cm incision was made centered over the sublime tubercle on the medial elbow, just posterior to the medial epicondyle. The skin was bluntly dissected to identify and protect the medial antebrachial cutaneous nerve. The flexor pronator origin was identified on the medial epicondyle.

There was an obvious rent through the common flexor origin (*Figure 3*). This rent was extended proximally and distally to the underlying medial capsule and ulna. There was again a large rent in the medial elbow capsule.

The anterior band of the ulnar collateral ligament with the attached bony fragment was easily identified in the base of the wound (*Figure 4, A*). The bony fragment was retracted anteriorly, exposing the medial ulna, sublime tubercle, and the fragment bony bed (*Fig 4, B*). The fibrous tissue was removed from the fragment and bony bed. Two 2.4-mm Bio-sutureTac (Arthrex, Naples, FL) were placed in the base of the bony bed, 1 proximal and 1 distal. The suture set was passed at the insertion of the ulnar collateral ligament to the bony fragment, and the second was passed through the fragment itself (*Figure 5, A*). The sutures were tied with the elbow in 20° flexion with a slight varus stress applied (*Figure 5, B*).

The wound was irrigated and closed in the standard fashion. A sterile dressing was applied, followed by a posteriorly molded plaster splint with the elbow in 30° of flexion.

Postoperative course

The patient was given a prophylactic dose of indomethacin for 2 weeks postoperatively in an effort to reduce heterotopic bone formation. The patient was kept in the elbow splint for 2 weeks, after which she was placed in a hinged elbow brace with restricted motion from 30° to 105°. Passive range of motion exercises were started at this time.

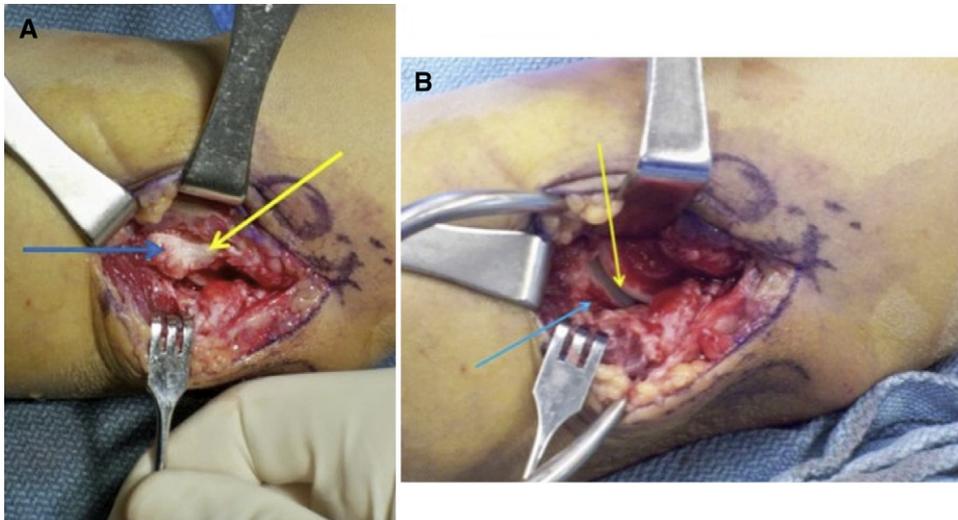


Figure 4 (A) The dissection was continued through the traumatic rent in the flexor pronator mass to the medial ulna. There was an obvious loose fragment (*blue arrow*) consistent with the avulsed portion of the sublime tubercle. Attached to the fragment was the ulnar collateral ligament (*yellow arrow*). (B) The bony fragment was retracted anteriorly, exposing the underlying bony bed (*blue arrow*) and the ulnohumeral joint (*yellow arrow*).

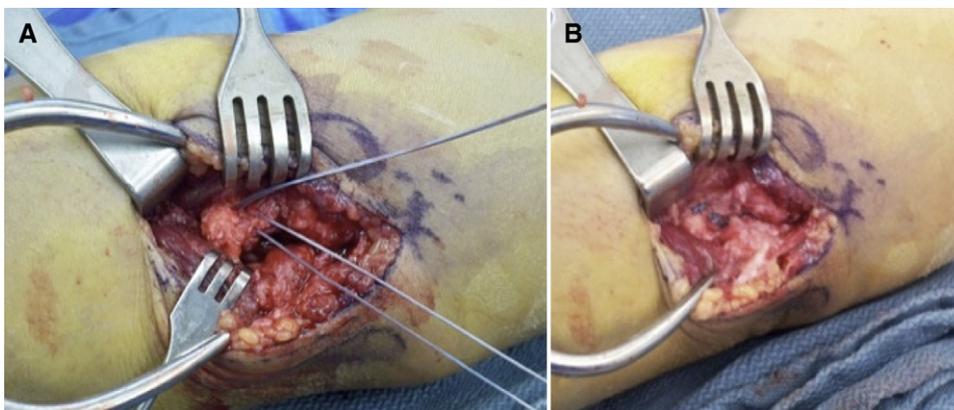


Figure 5 (A) Two single-loaded suture anchors were placed in the bony bed. The suture of 1 anchor was placed into the bony fragment at the insertion of the ulnar collateral ligament. The second suture was placed within the substance of the ulnar collateral ligament in a horizontal mattress fashion. (B) With the elbow in 20° of flexion and slight varus, the sutures were tied securing the bony fragment into its base.

At 1 month postoperatively, the elbow brace was unlocked, and she was allowed full range of motion with progression to active-assisted and active range of motion. The brace was removed 2 months after surgery, and a strengthening program was initiated.

Follow-up

At her final postoperative follow-up at 6 months, she had full elbow range of motion on the right (operative), from 0° to 145° (Figure 6). She was stable to valgus stress with no pain on direct palpation or with stress testing. The left elbow (nonoperative) revealed a 4° to 5° flexion contracture and 145° of flexion (Figure 6). There was no ligament laxity appreciated to varus or valgus stress. Bilateral upper extremity examinations showed full strength on manual motor testing.

In an elbow survey at the final follow-up, the patient denied pain in either elbow at rest or at night. She rated her pain at 1 out of a possible 10 on the visual analog scale with heavy lifting or repeated elbow movements. She denied any functional limitation in either elbow in activities of daily living. She described a slight limitation in her ability to do her usual sport, with a score of 4 out of 5 (0 = unable to do; 5 = no difficulty) with her left (nonoperative) elbow. She ultimately returned to full competition at her preinjury level.

Final radiographs at 1 year revealed no evidence of degeneration of the ulnohumeral or radiocapitellar joints. A small calcification was identified on the ulnar aspect of the elbow, which may represent a deposit within the insertion of the ulnar collateral ligament or a fibrous union of the bony avulsion (Figure 7). The left elbow (nonoperative)

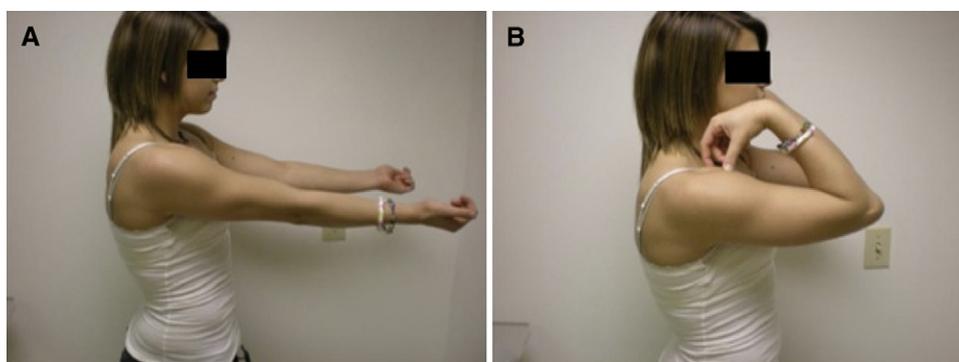


Figure 6 (A) At 6 months postoperatively, the patient displays full extension on the operative elbow (*right*) and a 5° flexion contracture on the nonoperative elbow (*left*). (B) The right and left elbows flex to 145° at the last follow-up visit.

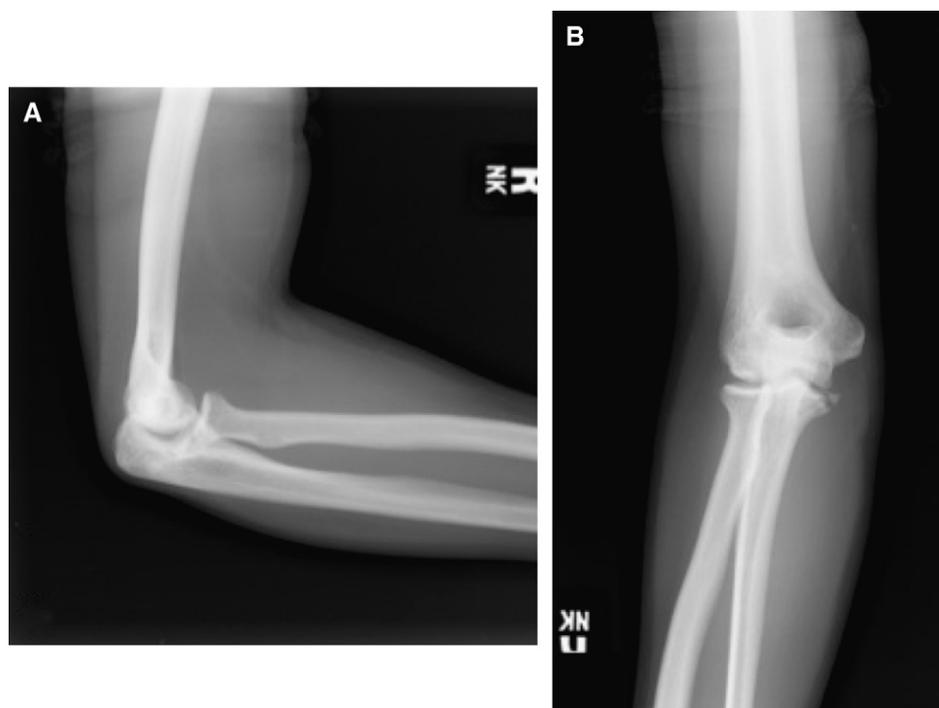


Figure 7 (A) Lateral and (B) anteroposterior radiographs of the right elbow 6 months postoperatively show evidence of calcification within the ulnar collateral ligament medially. The bony fragment is well approximated and united.

showed evidence of heterotopic bone formation within the anterior capsule (Figure 8).

Discussion

The simple elbow dislocation in the gymnast is a relatively common injury that typically does not warrant surgical intervention. Unfortunately, athletes with this type of injury exhibit some loss of terminal extension, such as was observed in this patient.⁶ Injury to the ulnar collateral ligament can be a catastrophic injury for the throwing athlete due to the repetitive valgus load imparted on the elbow. Because of the demands placed on this ligament,

rupture generally requires surgical reconstruction, especially in elite-level athletes, in order to return them to their previous level of play.¹

Valgus elbow instability in the gymnast is less well understood. However, Argo et al² described the successful treatment of persistent elbow instability with ulnar collateral ligament reconstruction in 19 female athletes, including soft ball players, gymnasts, and tennis players. Only one of the 19 athletes was a pitcher. This case series, in addition to the biomechanical studies described previously, help us to realize the vital role of the medial elbow structures in other athletic activities. In addition, as is the case with other bony avulsion injuries in adolescent athletes, the literature supports an attempt to restore normal

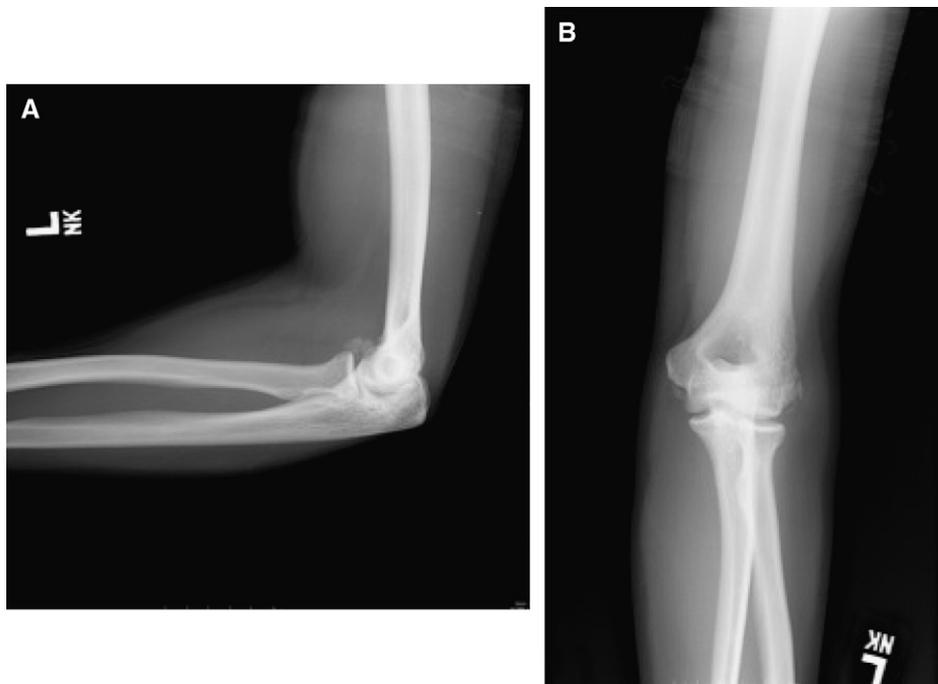


Figure 8 (A) Lateral and (B) anteroposterior radiographs of the left elbow 6 months postoperatively show heterotopic bone within the anterior capsule likely contributing to the patient's loss of motion observed postoperatively.

anatomy and therefore function with surgical fixation of the bony fragment.⁴ Although the radiographs for this patient may appear to show a fibrous union of the avulsed fragment, the clinical examination and functional assessment show the elbow is stable to valgus stresses and an adequate result has been obtained.

This case report describes only a single method of fixation for this type of bone fragment. Alternative methods may include suture fixation alone or perhaps screw fixation in cases of a larger bony fragment. We choose suture anchor fixation over suture fixation because of the patient's activity level and large valgus load on the elbow as a gymnast. The overall long-term concerns for suture anchor fixation include cyst formation with the anchor resorption as well as increased cost compared with suture fixation through bone tunnels.

Conclusions

This case report describes a relatively uncommon injury to the elbow in a gymnast. However, our experience and review of the literature has shown surgical fixation is warranted, with minimal surgical morbidity and an excellent postoperative outcome.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Ahmad CS, ElAttrache NS. Elbow valgus instability in the throwing athlete. *J Am Acad Orthop Surg* 2006;14:693-700. PMID: 17077341.
2. Argo D, Trenhaile SW, Savoie FH 3rd, Field LD. Operative treatment of ulnar collateral ligament insufficiency of the elbow in female athletes. *Am J Sports Med* 2006;34:431-7. doi:10.1177/0363546505281240
3. Caine D, Cochrane B, Caine C, Zemper E. An epidemiologic investigation of injuries affecting young competitive female gymnasts. *Am J Sports Med* 1989;17:811-20.
4. Iobst CA, Stanitski CL. Acute knee injuries. *Clin Sports Med* 2000;19:621-35. vi.
5. Koh TJ, Grabiner MD, Weiker GG. Technique and ground reaction forces in the back handspring. *Am J Sports Med* 1992;20:61-6.
6. Martin BD, Johansen JA, Edwards SG. Complications related to simple dislocations of the elbow. *Hand Clin* 2008;24:9-25. doi:10.1016/j.hcl.2007.11.013
7. Syed AA, O'Flanagan J. Simultaneous bilateral elbow dislocation in an international gymnast. *Br J Sports Med* 1999;33:132-3.
8. Zetaruk MN. The young gymnast. *Clin Sports Med* 2000;19:757-80.