Posterolateral instability of the elbow in an adolescent boy with a lateral epicondyle fracture: a case report

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Abstract

Background Posterolateral rotatory instability of elbow is considered to be due to the disruption of the ulnar part of the lateral collateral ligament (LUCL). This instability pattern may also be induced by a fracture of components of the lateral column.

Results We present the case of a 16-year-old boy who fell on his left outstretched arm as he attempted to jump over a tennis net. On initial physical examination, the elbow had instability found on varus stress and the radial head could be felt posteriorly. With attempted valgus and supination force combined with axial loading, the elbow gapped open and the patient had a sense of increased instability. X-rays showed a fracture of the lateral humeral epicondyle and posterolateral subluxation of the elbow. In the operating room, the patient was found to have reproducible posterolateral instability of the elbow. The lateral epicondyle was found to be fractured off the humerus with the LUCL still attached to the fragment. The elbow was reduced, and the injury was stabilized with small screws and suture anchors. At 6-month follow-up, the patient was pain-free, and physical examination revealed 170° of flexion, full extension, 90° of pronation, and 65° of supination. X-rays showed healing of the fracture with concentric reduction of the elbow joint.

Conclusion In lateral epicondyle fractures, the affected elbow should be assessed for any signs of associated instability. If signs of clear instability are seen that would prohibit proper postinjury rehabilitation, then surgical reduction and fixation of the epicondyle with reinforcement of the LUCL is an effective method of treatment.

Keywords Elbow · Rotatory · Instability · Ulnar collateral ligament

Introduction

The lateral ulnar collateral ligament (LUCL) is a critical component of the lateral ligamentous complex of the elbow. It originates from the lateral epicondyle and attaches to the crista supinatoris on the proximal ulna. In microscopic examination, it is a slender structure consisting of a thick area of posterolateral capsular thickening that acts as a primary stabilizer of the elbow joint [1]. Because the common forearm extensor muscles originate from the lateral epicondyle, fractures of this region are attributed to a traction injury resulting from a varus strain on the elbow. In the majority of cases, the degree of displacement of the fracture fragment is minimal, and the injury heals after a short period of immobilization [2, 3].

Posterolateral rotatory instability (PLRI) of elbow was first described by O'Driscoll in 1991 [4]. This instability is considered to be due to the disruption of the ulnar part of the lateral collateral ligament. The majority of cases are posttraumatic, although it can also be iatrogenic or caused by repetitive strain. Here we present a case of a 16-year-old boy who sustained a lateral epicondyle fracture of humerus that resulted in acute posterolateral instability of the elbow. To our knowledge, this is the first report of such a case in the literature.

Case Report

A 16-year-old, right-handed boy presented with a history of a fall on his left outstretched arm while trying to jump over

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a tennis net after winning the match. He had been seen at an outside institution and put in a posterior splint with no attempt of any type of reduction maneuver.

He was seen in our office 3 days after the initial injury. At presentation, the patient described moderate pain in the elbow and a sensation of his elbow being “out of place.” On physical examination, his elbow was mildly swollen and tender to palpation over the lateral aspect of the elbow. His range of motion (ROM) was limited secondary to pain, but the upper extremity was neurologically intact distally. There was gapping on varus stress, and the radial head could be felt posteriorly. With attempted valgus and supination motion combined with axial loading, the elbow gapped open, and the patient had a sense of increased instability. X-rays obtained at that time revealed posterior subluxation of radial head and widening of the humeral–ulnar joint (Fig. 1). The humeral–ulnar joint was not frankly dislocated but was nonconcentric and subluxated. There was also a fracture of the lateral humeral epicondyle that appeared to extend into the capitellum. A computed tomography scan was obtained verifying that the fractured included the distal aspect of the lateral epicondyle did not extend into the capitellar joint surface and that the radial head was subluxated posteriorly (Fig. 2).

The patient was taken to the operating room for operative reduction of the elbow dislocation and assessment of the fracture. Under general anesthesia, the elbow was examined under fluoroscopy. The elbow was found to have posterolateral instability with a positive pivot shift test [5]. The elbow reduced easily with flexion and forearm pronation. The radial head subluxated posteriorly with minimal valgus force, axial load, supination, and extension more than 40°.

An obliquely oriented lateral incision was made centered over the lateral epicondyle. The lateral epicondyle was

found to be fractured off the humerus with the lateral collateral ligament securely attached to it. The fracture extended distally and posteriorly but did not enter the capitellar articular surface. Intraoperative supination and valgus load caused gapping of the humeral ulnar joint and lateral and posterior subluxation of the radial head. The radial head reduced easily with flexion and forearm pronation (Fig. 3). The epicondyle was reduced and secured with a smooth Kirschner wire. This resulted in stability of the elbow throughout a full ROM. There was some attenuation of the lateral collateral ligament fiber attachment to the epicondyle. For this reason, the repair was reinforced with a 5.5-mm Bio-Corkscrew (Arthrex Corp., Naples, FL) suture anchor placed just distal to the epicondyle fracture and sutured into the ligament in a Krackow locking fashion. The K-wire was then replaced with a 2.4-mm screw to secure the reduction. Elbow stability was examined again, and it was found to be stable with full supination and extension to 0°, and full pronation and supination with the elbow at 90° of flexion. The patient was splinted at 90° of flexion and pronation of 45° to reduce tension on the lateral repair.

He began protected ROM exercises within the restrictions of a structured therapy program. At 1 week, post-operation therapy began extension to 45° and flexion as tolerated with the forearm pronated. Rotation of the arm was limited to supination of 45° and pronation to 70° with the elbow flexed to 90°. His arm remained in a rigid custom-molded splint at 90° of flexion and 30° of pronation between therapy sessions. These restrictions on ROM were gradually lessened over the next 6 weeks. At 6-month follow-up, he was pain-free with no point tenderness or crepitus. Radiographs demonstrated healing of the fracture with concentric reduction of the elbow joint (Fig. 4). Physical examination of the elbow revealed 170° of flexion,

Figure 1 The AP (a) and lateral view (b) of the elbow showing the avulsion fracture of the lateral epicondyle of the left distal humerus. There is posterior subluxation of the radial head and gapping of the humeral ulnar joint.

Figure 2 Computed tomography scan of the left elbow demonstrating the fracture of the lateral epicondyle. **a** The humeroulnar joint is not dislocated but gapped laterally. **b** The fracture fragment is distal on the lateral epicondyle but does not extend into the capitellar joint surface.

Figure 3 Intraoperative images of the lateral elbow. **a** The radial head is subluxated posteriorly with minimal valgus force, axial load, and extension past 40°. **b** The radial head and elbow joint are reduced with flexion and forearm pronation.

full extension, 90° of pronation, and 55° of supination (Fig. 5).

Discussion

Posterolateral instability of the elbow is usually caused by trauma due to the disruption of the lateral ulnar collateral ligament (LUCL). An anatomic study by Morrey and An [6] demonstrated that, unlike the medial collateral ligaments, the components of lateral collateral ligament vary for each individual. In half of their specimens, a definite superficial continuation of the posterior fibers of the radial collateral ligament was observed that inserted on the ulna at the crista supinatoris. Cohen and Hastings [7] dissected 40 fresh cadavers to study the ligamentous anatomy of the lateral aspect of the elbow. This study showed a broad conjoined attachment of the lateral collateral and annular ligaments onto the proximal ulna. The LUCL was found to be the primary stabilizer of the lateral elbow.

The sequence of forces acting on the elbow joint to produce PLRI involves valgus, supination, and axial loading. If a completed elbow dislocation occurs, the cascade begins with LUCL disruption, but then progresses to anterior and posterior capsule disruption, and finally the tearing of the medial collateral ligament. In an isolated lateral injury, the radial head subluxates posterior to the capitellum and the ulna supinates on the humerus. If presented chronically, this injury is usually associated with clicking, snapping, or recurrent dislocation [8]. Because the common extensor muscles of the forearm arise from the lateral epicondyle, the mechanism of most

Figure 4 Postoperative x-rays of the left elbow. AP (a) and lateral (b) views show that the elbow joint is concentrically reduced and the radial head is in line with the capitellum.

lateral epicondyle fractures is believed to be traction resulting from a varus elbow stress [9].

A fracture of the lateral epicondyle may occur from a direct blow, or from a large tensile force on the lateral ulnar collateral ligamentous complex that is typically caused by an episode of elbow joint instability creating an avulsion fracture. If the fracture and soft tissue does not heal adequately, it predisposes the elbow to PLRI. However, detecting minimal forms of elbow instability clinically might be difficult [10]. Thus, these seemingly small fractures should be evaluated carefully for subtle instability.

In 1966, Osborne and Cotterill [11] described an osteochondral fracture of the posterolateral margin of the capitellum which might result in recurrent and chronic dislocation of the elbow. However, they did not describe the associated ligamentous pathology of the LUCL. In 2008, reporting four cases of a similar injury, Jeon et al. [12] described the mechanism of injury as involving disruption of the LUCL, as we have stressed. However, their patients presented in a chronic fashion following elbow dislocations more than 2 years prior to presentation. Our case may be a pediatric and acute variation of an Osborne-Cotterill type lesion.

Figure 5 Clinical photographs at 6 months following surgical repair. The active elbow ROM is 170° of flexion, full extension, 90° of pronation, and 55° of supination. The surgical incision is seen laterally and is well healed.

Nondisplaced fractures of the lateral humeral epicondyle usually heal following a short period of immobilization [2, 5]. Various complications of lateral humeral epicondyle fracture have been reported such as a block to extension [9], delayed union [13], medial elbow dislocation and detachment of the medial epicondyle [14], and physeal fractures [15]. Malunion of this kind of fracture in children has rarely been reported. Zionts and Mirzayan [9] described a malunion of lateral epicondyle fracture in a 10-year-old girl. The patient had a displaced fracture of the lateral epicondyle, which was treated with immobilization in a cast. At 6 months postinjury, the fracture fragment was found to be healed in a posterior and inferior position causing a block to extension. Excision of the malunited lateral epicondyle was done, and the patient gained full ROM of the elbow. There is no consensus regarding the amount of displacement which mandates operative reduction and fixation of a lateral epicondyle fracture. Operative intervention is clearly indicated when the fractured fragment is incarcerated within the elbow joint.

Ligament avulsions, which result in PLRI, are typically repaired using various soft tissue techniques including reinsertion of the avulsed ligament at the isometric point through bone tunnels or with suture anchors and augmentation or replacement of the ligament with a tendon autograft or allograft [5]. The concept of these techniques was used in our case with repair of the fracture fragment to its anatomic location and reinforcement of the ligament with a suture anchor.

Since such injuries might be easily missed, the presence of instability should be carefully evaluated in lateral epicondyle fractures. However, even with the presence of potential instability, conservative management (a period of immobilization and therapy) might be the only treatment necessary. As healing occurs, with the elbow reduced, the instability may resolve. The age of the patient is an important consideration, as a very young child can tolerate prolonged elbow immobilization, while an adolescent or adult may have significant residual elbow stiffness if treated with casting for several weeks. Our speculation is that if proper bone healing occurs while the elbow is concentrically reduced, conservative management may be an option in young children with these injuries. The following conditions should be met: minimal displacement of the fracture, no block to joint motion, the fragment is not incarcerated in the joint, and there is no elbow instability.

In conclusion, these small fractures of the elbow may involve the origin of the lateral collateral ligament complex and result in instability. If this occurs, and closed treatment is not appropriate, then surgical reduction and fixation of the epicondyle with reinforcement of the LUCL is an effective method of treatment.

Conflict of Interest The authors declare that they have no conflict of interest with the subject of this report.

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