Acute Dislocations of the Adult Elbow

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The rate of elbow dislocations is 6 to 13 cases per 100,000 people, and elbow dislocation accounts for 11% to 28% of all injuries to the elbow [1]. Elbow dislocations occur more frequently in males than in females. The highest incidence occurs in the 10 to 20 year age group. Approximately 60% of dislocations occur in the nondominant extremity [2]. Of elbow dislocations, 10% to 50% are sports-related, although they are not unique or common to any specific sport. Recurrent instability can be a complication. A retrospective review by Kenter and colleagues [3] demonstrated that 15% of professional football players experienced recurrent instability after an initial dislocation. Lateral collateral ligament (LCL) insufficiency, particularly common in young patients, is the essential lesion that results in recurrent instability [4].

Mechanism

Posterior elbow dislocations most commonly occur from a fall onto an outstretched hand or wrist. Mehlhoff and colleagues [5] reported a fall as the mechanism of injury in 75% of patients. Posterolateral elbow dislocations comprise over 90% of all elbow dislocations (Fig. 1). The more uncommon anterior dislocation may be caused by impact on the posterior forearm in a slightly flexed position.

Exactly how these forces contribute to an elbow dislocation is still a subject of debate. As the force from a fall is transmitted to the extended elbow, a resultant anterior force is generated that lever the ulna out of its trochlear articulation. With continued hyperextension, the anterior capsule and collateral ligaments are subjected to significant tensile forces and ultimately failure. Additional valgus or varus forces result in lateral or medial displacement of the posterior elbow dislocation. Cadaveric studies by O’Driscoll have demonstrated that an extension and varus moment associated with elbow dislocation disrupts that lateral ulnar collateral ligament first (Fig. 2) [6]. If this force is dissipated, a simple perched dislocation ensues; however, additional force further rotates the forearm and tears the remaining anterior capsule, and finally the ulnar collateral ligament, resulting in a complete dislocation.

Relevant anatomy

Intrinsic stability of the elbow is provided by both osseous and ligamentous structures. The ulnohumeral articulation is the cornerstone of osseous stability and mobility in the flexion–extension plane. The coronoid process resists posterior subluxation in flexion. The medial facet of the coronoid imparts an osseous stability to varus stress. The radial head also provides elbow stability as a secondary stabilizer to valgus loads [7]. Most activities in athletes rely on a combination of ligamentous integrity and bony articulation to provide stability to the elbow.

The medial ulnar collateral ligament (MUCL) is compromised of three major bundles—anterior, posterior and transverse bands (Fig. 3). The anterior band provides the primary restraint to valgus stress at 30°, 60°, and 90° of flexion (Fig. 4) [8]. It originates from the anterior inferior aspect of the
medial epicondyle and inserts onto the sublime tubercle of the coronoid. The posterior bundle is fan-shaped and also originates from the medial epicondyle. It inserts onto the medial margin of the semilunar notch.

The lateral ligament complex consists of four components: the LCL, the LUCL (ulnar part of LCL), the accessory LCL, and the annular ligament (Fig. 5). The LCL attaches to the lateral epicondyle and fans out to merge indistinguishably with the annular ligament. It functions as a varus restraint and stabilizes the annular ligament. The lateral capsule of the elbow consists of three layers: the joint capsule, annular ligament, and lateral ligament. The joint capsule is the deep layer, and the true annular ligament is the intermediate layer. The superficial layer consists of the lateral ligament, which fans out from the lateral epicondyle to attach to the anterior and

Fig. 1. (A) Anterior-posterior and (B) lateral radiographs demonstrating a posterolateral elbow dislocation. This pattern is by far the most common dislocation pattern.

Fig. 2. The ring of instability with elbow dislocations describes the progression of stresses from the lateral ulnar part of the lateral collateral ligament to the anterior capsule and finally ending with injury to the medial ulnar collateral ligament. (From O’Driscoll SW, Jupiter JB, King GJW, et al. The unstable elbow. Instr Course Lect 2001;50:89–102; with permission.)

Fig. 3. The ulnar collateral ligament is comprised of three bands—anterior, posterior, and transverse bands. (From Morrey BF, Tanaka S, An KN. Valgus stability of the elbow. A definition of primary and secondary constraints. Clin Orthop 1991;265:187–95; with permission.)
posterior aspects of the proximal ulna [9]. The LUCL is a thickening of the capsule that attaches proximally to the lateral humeral epicondyle and distally to the tubercle of the supinator crest of the ulna [10]. The humeral attachment of the LUCL is at the isometric point on the lateral side of the elbow. The distal attachment of the ligament is deep to the fascia surrounding the extensor carpi ulnaris and supinator muscles. Besides stabilizing the lateral aspect of the elbow, the LUCL also acts as a posterior buttress for the radial head to prevent its subluxation.

Joseffson and colleagues demonstrated that all 15 patients who underwent surgical exploration after acute complete elbow dislocation demonstrated injury to both the medial and lateral ligamentous complex [11].

Classification

Multiple classification systems have been proposed for elbow dislocations. Chronologically, elbow dislocations can be described as acute, chronic (unreduced), and recurrent. The temporal definition of chronic elbow dislocation is not defined clearly, but if a joint remains unreduced for more than 7 days, the utility of closed reduction is minimal. Anterior dislocations of the elbow without associated fractures are exceedingly uncommon. Medial and lateral dislocations are likely to be incompletely reduced posterior dislocations. Consequently, classification of simple elbow dislocations into anterior, medial, lateral, and posterior is not very useful. O’Driscoll and colleagues [6] have proposed a classification system with clinical relevance (Fig. 6). This describes a spectrum of instability, from subluxation to
dislocation. The three stages correspond with the pathoanatomical stages of the capsuloligamentous disruption. A perched dislocation is one in which the elbow is subluxed but the coronoid is impinged upon the trochlea.

**Evaluation**

It is of paramount importance that the neurovascular status of the dislocated elbow be assessed and documented before manipulation. Specifically, the status of the brachial artery and median and ulnar nerves should be determined as they are most vulnerable to entrapment during manipulation. Serial neurovascular examinations should be considered in cases in which massive antecubital fossa swelling exists or in which the patient is believed to be at risk for a compartment syndrome. If clinical signs are indicative of a compartment syndrome, the patient should be admitted for observation.

**Treatment options**

*Closed reduction for simple dislocation*

In a perched dislocation, an analgesic with intra-articular local anesthetic is often adequate to perform a reduction maneuver. Direct pressure is applied over the olecranon while the elbow is extended slightly and gentle axial distraction is performed.

For complete elbow dislocations, closed reduction should be performed under conscious sedation in a monitored emergency department setting. This will allow for relaxation of muscle spasm such that with slow, continuous, gentle, longitudinal traction combined with gradual flexion with an anterior directed force over the olecranon, the elbow should reduce without difficulty. Some authors report hyperextension of the deformity first to unlock the olecranon, but the potential danger remains of median nerve entrapment. Repeated attempts at reduction should be avoided, as soft tissue injury and swelling can worsen.

After obtaining a reduction, the elbow should be taken through a range of motion to evaluate the arc of stability. Simple dislocations usually are stable throughout a full range of motion;
however, subluxation or dislocation in extension must be ruled out. If the elbow subluxates or dislocates in extension, the forearm should be pronated fully and the stability reassessed. If forearm pronation eliminates instability in extension, a hinged brace should be applied with the forearm in full pronation. Residual instability in full extension or near full extension will necessitate an extension block. However, if an extension block of more than 30° to 45° is required, surgical repair should be considered [12]. Neurovascular status is evaluated after reduction. Postreduction radiographs should be obtained to confirm a congruent reduction.

Open reduction

The need for open reduction after simple, acute dislocation is uncommon. Operative intervention is required when closed reduction proves unsuccessful or is otherwise contraindicated. Radial head entrapment can occur as the head becomes entrapped in the soft tissues of the forearm or even buttonholed through the forearm fascia. Medial epicondyle fractures also can become incarcerated within the joint and prevent closed reduction.

The surgical approach of arthrotomy and removal of incarcerated tissue should be tailored to the specific injury pattern. For example, radial head entrapment causing a locked elbow dislocation should be approached through a lateral Kocher approach.

Surgical treatment

As previously stated, surgical repair should be considered if the elbow requires more than 45° of flexion to remain congruent. This is seen uncommonly in simple elbow dislocations, but it can result with high energy trauma. In this situation, the full spectrum of ligamentous and capsular disruption has occurred from lateral to medial, stripping the entire distal humerus of soft tissue.

A universal posterior skin incision is used, allowing access to both the medial and lateral sides of the elbow. The avulsed lateral collateral ligament and common extensor origin are reattached to the lateral epicondyle using suture anchors. Care is taken to ensure that the repair is performed through the point of isometry of the lateral ulnar collateral ligament. Stability in extension then is evaluated. If the elbow continues to dislocate in extension, the anterior and medial soft tissue injuries must be repaired. A medial subcutaneous flap is elevated, and the ulnar nerve is transposed. The anterior capsule then is secured to the coronoid with sutures passed through drill holes into the coronoid entering from the dorsal surface of the ulna. The medial collateral ligament and common flexor origins then are repaired to the medial epicondyle using suture anchors. Stability in extension then is reassessed. If the elbow continues to dislocate, a hinged external fixator is applied (Fig. 7). Application of the hinged

Fig. 7. (A, B) The hinged external fixator is a useful adjunct in the setting of gross instability. Again, this is seen with high-energy mechanisms; often, major soft tissue trauma as well as fracture dislocations are seen. (Image provided courtesy of Stryker Orthopaedics, Mahwah, NJ; with permission.)
external fixator will allow full unrestricted motion while maintaining a congruent reduction.

Usually, the lateral soft tissue repair is sufficient to restore stability, especially in older patients. High-energy injuries in the young patient, however, can require repair of the anterior capsule, medial collateral ligament, and common flexor origin in addition to the lateral repair.

Weighing the evidence

Closed treatment of simple elbow dislocations in adults has demonstrated satisfactory results. Van der Ley [13] showed 80% good or excellent results in 20 adults who had simple elbow dislocations treated by closed methods. There was no long-term instability with a minimum of 5 years follow up.

Some authors have advocated acute surgical repair of the medial ulnar collateral ligament and/or the lateral collateral ligament complex following simple elbow dislocations [14]. Josefsson and colleagues [11], however, showed that no benefit was gained from acute ligamentous repair of simple dislocations when compared with closed methods. Surgical repair of medial or lateral ligament disruption rarely is indicated in the treatment of uncomplicated elbow dislocations. In the unlikely setting of persistent instability with more than 30° to 45° of flexion, however, soft tissue disruption has occurred to a degree that will require ligamentous repair as described previously.

The use of the hinged elbow external fixator for uncomplicated elbow dislocations has not been evaluated critically in the literature. There are multiple studies to validate its use in the setting of complex elbow fracture dislocation, however [15,16]. The fixator does provide for a concentric reduction to be maintained while range of motion exercises are begun. The soft tissue repairs also are protected from early varus or valgus stress.

Mobilization recommendations

For simple elbow dislocations, the elbow is immobilized for a maximum of 5 to 7 days in slightly less than 90° of flexion depending on the degree of anterior soft tissue swelling in a posterior splint. If the elbow was stable on the postreduction examination, full unprotected motion should be started no later than 1 week after injury. If forearm pronation was required to prevent extension instability, full range of motion is allowed in a hinged brace with the forearm fully pronated. The patient may only come out of the brace for motion exercises in full pronation under the guidance of a skilled therapist. The brace is worn for 4 weeks. If an extension block was required, the block should be reduced gradually so that by 4 weeks the brace allows full motion. The brace is discontinued at 4 weeks. If surgical repair is required, the elbow is changed from a posterior splint to an unlocked hinged brace at 1 week after surgery. The patient only is allowed out of the brace for motion exercises under the guidance of a skilled therapist. The brace is discontinued at 4 weeks. If a hinged external fixator is required, it is removed 4 to 6 weeks postoperatively.

Summary

The intrinsic stability provided by the bony articulations of the elbow make recurrent instability an uncommon problem after simple dislocations. These injuries usually can be managed by closed reduction and early motion. Special attention to stability immediately after reduction is necessary to guide treatment. Protected motion in full pronation and/or with a block to full extension may be required. Although uncommonly necessary, the surgeon must be prepared for open surgical repair of soft tissue injury to restore stability.

Further readings


References