Ulnohumeral dislocation despite intact radiocapitellar joint: a rare Monteggia variant

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Abstract

We treated one patient with a mid-diaphyseal radius fracture and concomitant anteromedial facet fracture of the coronoid. The ulnohumeral joint was severely unstable by complete ligament detachment and interosseous membrane rupture. Despite this gross instability, the radiocapitellar was congruent and stable. The possible mechanism of radiocapitellar stability is discussed and the concept of concavity-compression stability across the radiocapitellar joint is emphasized.

Keywords

concavity compression, elbow posteromedial instability, Monteggia variant, radiocapitellar

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Introduction

Diaphyseal forearm fractures usually involve both the radius and the ulna. Isolated fractures to either bone may occur in combination with separation of the bones proximal or distal to the fracture. As a consequence of this, there will also be a dislocation of either the proximal or distal radio-ulnar joints. These injuries follow typical patterns well described in the literature: Monteggia fracture – ulnar shaft fracture and proximal radio ulnar joint (PRUJ) dislocation; Galeazzi fracture – radial shaft fracture and distal radio ulnar joint (DRUJ) dislocation. Exceptions to this are the isolated shaft fractures that may occur as a result of direct trauma, typically ulnar fractures without injury to either joint (nightstick fracture). We treated a patient with an unusual injury pattern: isolated radial shaft fracture in combination with PRUJ instability and ulnohumeral dislocation but without radiocapitellar dislocation.

Case report

The patient, a 55-year-old woman, fell on her outstretched arm when dismounting her bicycle. She sustained a mid-shaft radial fracture at the level of pronator teres insertion. The fracture was moderately

displaced but no injury to the DRUJ could be seen on physical examination or with plain radiographs. Scrutinizing her radiographs for possible radio-ulnar dissociation, a minor undisplaced medial coronoid fragment was noted (Figure 1).

During surgery the following day, the radial shaft fracture was reduced and fixed with a plate through a volar approach. Fluoroscopy was used to verify congruency of the elbow and wrist.

When tested for stability, the elbow joint was found unstable and the elbow was explored through a dorsal approach. Elbow exploration showed an anteromedial facet fracture of the coronoid (O'Driscoll type 2.3),¹ with one medial fragment carrying the medial collateral ligament, and an adjacent fragment just lateral to the first. The anterior insertion of the annular ligament, as well as the lateral ulnar collateral ligament, were torn off the ulna.

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The central coronoid fracture was reduced and fixed with a K-wire and a suture anchor placed for later repair of the annular ligament. Stability testing was again performed before repair of the ligaments or fixation of the anteromedial facet.

The elbow was now fully congruent but, when grasped by fracture forceps, it was possible to dislocate the ulna from the trochlea and from the radius in either dorsal or ulnar direction by 2 cm. Interestingly, during this manoeuvre, the radial head still remained congruent with the capitellum, without any preventive measures from the surgeon. By the wide separation possible between radius and ulna, it was obvious that there

also was a substantial proximal interosseous membrane rupture in addition to the ligament ruptures (Figures 2 and 3).

Final repair/reinsertion of the annular ligament and collateral ligaments were performed. After surgery, the patient was allowed early range of motion (ROM) exercises. At follow-up 14 months later, she had a fully restored elbow function, without restrictions in ROM or noticeable instability (Figure 4).

Discussion

Isolated radial shaft fractures are often combined with a dislocation of DRUJ (Galeazzi injury) even if this is not always the case.² Other injury patterns have been reported, especially in the growing patient.^{3–7} A few cases have been reported having radial shaft fractures combined with ulnohumeral dislocation but intact radiocapitellar joint.^{8,9}

The most striking observation in this case is that, despite the large displacement of ulna during the intra-operative stress test, the radial head still maintained its congruency in the radiocapitellar joint. It is normally understood that the radius is connected to the ulna through the ligaments of the PRUJ and DRUJ and also the interosseous membrane, whereas no ligamentous connection exists between the radius and the humerus. The ulna, on the other hand, is stabilized to humerus via the medial and lateral collateral ligament complexes and radius, being connected to ulna, is therefore properly aligned to the capitellum. In the present case, all the ulnohumeral ligaments were obviously disconnected because the ulna could readily be dislocated from the trochlea. Also, a significant portion of the

Figure 1. Initial radiographs (a) lateral (b) anteroposterior views.

Figure 2. Intraoperative fluoroscopy. Radius repaired but not the ligaments (a). Ulna displaced posteriorly by the pull of a fracture clamp, whereas radiocapitellar congruency is maintained (b).

Figure 3. Intraoperative fluoroscopy. Radius repaired but not the ligaments (a). Ulna displaced medially by the pull of a fracture clamp, whereas radiocapitellar congruency is maintained (b).

Figure 4. Postoperative radiographs (a) lateral (b) anteroposterior views.

radio-ulnar connection (annular ligament and proximal components of the interosseous membrane) had to be ruptured, as demonstrated by the separation possible between the radius and the ulna.

Despite the extensive injury, the radiocapitellar joint was perfectly reduced even when ulna was dislocated. We know of two earlier reported cases similar to this,^{8,9} although the mechanism behind the radiocapitellar congruency was not discussed in either of these reports.

Three muscles that span the elbow joint and attach to the radius: the biceps, pronator teres and brachioradialis. The biceps, by its direction of pull usually tends

to displace the proximal radius anteriorly/proximally, particularly in the flexed elbow. However, the pronator and the brachioradialis exert an axial pull of the radius towards the capitellum. We suggest that this axial force in combination with the ball and socket shape of the radiocapitellar joint centralizes the radial head on the capitellum and that this is an important stabilizer of the radius. A recent report by Shukla et al.¹⁰ demonstrated that marginal fractures of the radial head severely reduced the concavity-compression¹¹ stability of the radiocapitellar joint. The idea that the radial head has a role of a secondary constraint in the absence of the primary constraint (e.g. coronoid fracture) is clearly demonstrated in the present case. Absence of the concavity-compression stability may also explain the successive drift of the radius in patients with an amputated radial head not only in the axial direction, but also in the medial direction.⁷

A proposed sequence for elbow dislocation is external rotation of the forearm under compressive/valgus stress with sequential lateral collateral ligament rupture, successive disengagement of the radial head and the coronoid (with or without fracture) and, finally, rupture of the medial collateral ligaments.¹² Another mechanism is suggested by Schreiber et al.,¹³ who, after evaluation of 62 videos on YouTube (www.youtube.com) concluded that most dislocation occurred through a valgus moment on the extended elbow. However, the fracture-dislocation mechanism in this case is likely to be that of an anteromedial facet injury: a varus posteromedial rotational force, causing a compression/shear fracture of the anteromedial facet.¹⁴ Further internal rotation of the forearm would have allowed the ulna to escape from the

trochlea while radiocapitellar contact could have been maintained. A continued compressive force may now have pushed the ulna posteriorly, past the trochlea, splitting the interosseous membrane and causing the diaphyseal fracture of the radius.

Conclusions

Isolated radial shaft fractures without DRUJ injury may have proximal radio-ulnar joint injuries instead of the pattern usually seen with the well-known Galeazzi injury. It is obvious from the present case that even extensive disruption of the elbow ligaments may have a very quiet presentation and that not only should patients who have sustained isolated fracture of the radial shaft be evaluated for a possible DRUJ injury, but also elbow injuries should be ruled out. The contribution of concavity-compression stability across the radiocapitellar joint to overall elbow stability is clearly demonstrated.

Declaration of Conflicting Interests

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