Radial head and neck injuries in children with elbow dislocations: a report of three cases

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ABSTRACT

In children, traumatic elbow dislocations usually occur after the epiphysis has closed and with associated radial head and neck fractures and osteochondral fragments. The fragments are also usually interposed in the joint restricting complete congruent joint motion. We report on 3 children with traumatic elbow fracture-dislocation with associated radial head and neck injuries treated with open reduction and stabilisation. All patients achieved good outcomes and returned to pre-injury level of activities.

Key words: elbow joint; radial heads, posterior dislocation of

INTRODUCTION

Traumatic elbow dislocations account for 3% to 6% of fall injuries in children, and a considerable number of these are associated with concomitant fractures and avulsions,1 of which radial head and neck injuries account for 3% to 8%.2 Careful clinical and radiological assessments are important for early diagnosis and treatment. We report on 3 children with a traumatic elbow dislocation and associated radial head and neck injuries treated with open reduction and stabilisation.

CASE REPORTS

Patient 1

In December 2009, a 14-year-old girl presented with left elbow injury after falling off her bike. She was diagnosed with a possible radial head fracture and her elbow was immobilised in a backslab. She was scheduled to see an orthopaedic specialist a week later. Her left elbow was held in flexion and the forearm was in neutral position; the range of motion was restricted. There were no neurological or vascular deficits although the elbow was painful and generally swollen.
Radiographs showed a subtle posterolaterally subluxed ulnohumeral joint with a probable intra-articular radial head fracture. Computed tomography showed the radial head fragment displaced proximally into the olecranon fossa hindering reduction (Fig. 1).

She underwent a left elbow arthrotomy via a posterolateral incision. A sizeable osteochondral fragment was found and reduced anatomically to the radial head and stabilised with wires (Fig. 1). The ruptured annular ligament was repaired. The elbow was noted to be stable on varus and valgus stress testing, with full flexion, extension, pronation, and supination. Ulnohumeral and radiocapitellar joints were reduced under an image intensifier. The elbow was protected in a backslab for one week, followed by aggressive rehabilitation. At the 3-month follow-up, the fracture had healed and the patient had regained full range of motion.

**Patient 2**

In March 2009, a 6-year-old girl presented with a painful, swollen elbow held in flexion and pronation after a fall from a slide on her left elbow. No neurovascular deficit was detected. Radiographs showed a Salter-Harris II fracture of the radial head, with the fragment inside the posterior aspect of the ulnohumeral joint impinging full range of motion (Fig. 2).

She underwent an elbow arthrotomy via a posterolateral approach. The fragment behind the capitellum was found and reduced and sutured to the radial neck with strong absorbable sutures. The annular ligament was repaired. The elbow was noted to be stable on varus and valgus stress testing, with full flexion, extension, pronation, and supination. Reduction of the ulnohumeral and radiocapitellar joint was adequate under an image intensifier.

The elbow was protected in a backslab with the forearm in supination for 4 weeks. At 5 months, the fracture had healed. At 18 months, the radial head epiphysis had remodelled. There was no early fusion of the epiphysis, radial head overgrowth, or avascular necrosis (Fig. 2). However, the patient still had slight limitation in pronation and supination, compared with the right elbow. There was no abnormal valgus deformity. Functionally, she was coping well with her activities at school and in sports.

**Patient 3**

In March 2011, a 14-year-old boy presented with a painful elbow held in extension after falling from a height on his right elbow. Radiographs showed a
posteromedial fracture-dislocation of the left elbow, with a large medial epicondyle fragment (Fig. 3). There was no obvious radial head fracture.

As the patient appeared skeletally mature, the medial epicondyle fracture was reduced and fixed with 2 half-threaded cancellous screws. There did not appear to be any radial head fractures on intraoperative imaging. Varus stress testing showed mild laxity, and the radial head slightly subluxed anteriorly when in full pronation, but it was enlocated in supination. The elbow was immobilised in 90° flexion, with the forearm in full supination for a week. This was then converted to a hinged elbow brace, and full range of motion was allowed.

At 3 weeks, the elbow joint showed a persistent, anteriorly subluxating radial head in pronation. The range of motion was also limited, and there was some lateral elbow pain on pronation and full flexion (Fig. 3). Surgical exploration was performed for open reduction and reconstruction of the annular ligament of the radiocapitellar joint. The annular ligament was completely torn and avulsed off the radial neck. A 5-mm osteochondral defect of the radial head was noted posteriorly. There was a fair bit of fibrous tissue (in which the loose fragment was attached) interposed within the radiocapitellar joint. This prevented concentric reduction of the radial head on capitellum during pronation and supination. The radial collateral and lateral ulna collateral ligaments were intact.

A Boyd incision was made, and the annular ligament was reconstructed using a slip of forearm fascia.3–6 The fragment was removed, edges of the defect were stabilised, and the base was debrided. The radial head was enlocated. With the forearm in full supination, a Kirschner wire was passed from the ulna to the radial neck transversely to temporarily immobilise the proximal radioulnar joint. The elbow was then protected with a cast for 2 weeks. The Kirschner wire was then removed, and aggressive physiotherapy was started. At 5 months, the screws were removed. At 8 months, the fracture had healed and the radial head remained enlocated. Supination was limited to approximately 45°, but flexion, extension, and pronation were full. At 18 months, full range of motion had recovered.

**DISCUSSION**

The elbow consists of the ulnotrochlear, radiocapitellar, and proximal radioulnar articulations held together by the joint capsule, medial and lateral collateral ligament complexes, and musculotendinous complexes. Close congruent conformity of the joints and dynamic pull of the ligaments and soft tissue during elbow movement confer upon it an inherent stability. 50% of the stability depends on the bony articulations, and the rest depends on soft tissue.7 The muscle complexes also exert axial compressive forces on the joint, coapting the cristae of the humeral trochlea against the semilunar notch of the ulna to prevent dislocation. Posterolateral instability is a result of disruption of the lateral collateral ligaments and the annular ligament. This lateral ligamentous complex is often disrupted in dislocations, either avulsed from the lateral humeral epicondyle or torn, especially in radial head fractures.7

In children’s elbows, the sequential appearance of ossification centres and their subsequent fusion may make the diagnosis difficult. The capitellum usually appears first at age 1 to 2 years, followed by the radial head at age 2 to 4 years, the medial epicondyle at age 4 to 6 years, the trochlea at age 9 to 10 years, the olecranon at age 9 to 11 years, and finally the lateral...
and then medial epicondyle at age 10 to 12 years. The onset of ossification is earlier in females than in males. The timing of ossification varies from children to children; proper evaluation of the injured elbow on radiographs is difficult.8–10

As high as 64% of traumatic elbow dislocations are associated with concomitant elbow fractures and injuries.1 The most common associated injury is posterior avulsion of the medial epicondyle by pull of the origin of the common flexor mass and the medial collateral ligament, with an incidence of 25% to 36%,1,2,7 followed by lateral condylar fractures with an incidence of up to 17%,2 and then radial head and neck fractures, with an incidence of 3% to 8%.1,2,11 Other associated injuries include olecranon avulsions, osteochondral fragments or cartilage flaps from the ulna or trochlear articular surface, coronoid fractures, medial condyle fractures, and proximal radioulnar translocations.2,12–14

In the first 2 patients in our series, the elbows were probably dislocated at initial impact on the outstretched arm, which subsequently attempted to spontaneously reduce. In patient 1, as the elbow attempted to self reduce, the anterior lip of the radial head impacted against the capitellum, resulting in an intra-articular osteochondral fracture. The fragment then migrated into the posterior space of the olecranon fossa and hindered congruent reduction. As the epiphysis appeared closed radiologically, 2 threaded pins were used to hold the reduction. Longer-term follow-up is necessary to evaluate further changes in cubital alignment or development of complications (heterotopic ossification or flexion contractures). However, the patient did not return for further follow-up. Osteochondral fractures of the radial head in children are rare, as the cartilage cap is thicker. When the epiphysis is fused, the fractures usually do not go through the radial neck. Intra-articular fractures appear to be more common in patients whose epiphyses had fused.15

Figure 3  Patient 3: (a) posteromedial fracture-dislocation of the left elbow, with a large medial epicondyle fragment, (b) a persistent anteriorly subluxating radial head in pronation at 3 weeks after fixation with 2 half-threaded cancellous screws for the medial epicondyle fracture, (c) surgical exploration for open reduction of an osteochondral defect of the radial head and reconstruction of the torn annular ligament of the radiocapitellar joint. A Kirschner wire is passed from the ulna to the radial neck transversely to temporarily immobilise the proximal radioulnar joint, and (d) recovery of full range of motion at 18 months.
Patient 2 had a perched type elbow dislocation with intact medial collateral ligaments, according to O’Driscoll classification. The fragment of the Salter-Harris type-II radial neck fracture was separated and wedged in the posterior aspect of the ulnotrochlear joint, possibly after attempted spontaneous reduction. After open anatomic reduction and suture fixation, followed by immobilisation and then aggressive physiotherapy, the epiphysis did not appear to be irregular despite remodelling, suggesting avascular necrosis of part of the fragment. Nonetheless, there was no non-union despite some limitation of pronation and supination. The patient was pain-free and functionally problem-free.

In patient 3, a high energy transfer through the elbow resulted in the fracture-dislocation of the medial condyle and concomitant injury of the lateral structures. The lateral structures appeared sufficiently stable to enable healing with cast immobilisation. However, it was not so and the patient required another surgical procedure to resolve the instability. The unexpected osteochondral fracture was not noted on radiographs. In retrospect, the presence of the osteochondral defect and severe injury to the lateral structures were in keeping with the nature of the injury. The epiphysis had already fused, and hence osteochondral fracture and ligamentous injuries were more likely to occur.

Magnetic resonance imaging should have been used to assess the articular surfaces and integrity of ligaments and capsular structures. Intra-operatively, after fixation of the medial epicondyle, tests for elbow joint stability and range of motion of the elbow under an image intensifier are mandatory. Any subluxation in the ulnohumeral or radiocapitellar joint in any position on any view should raise suspicion of a loss of integrity of the stabilising structures. The threshold for open exploration to investigate and repair should have been lower. We failed to explore the lateral side, as we believed that the structures would heal. Postoperatively, temporary immobilisation is recommended to facilitate the healing process. More importantly, regular follow-up with serial radiographs of the elbow in extreme ranges of motion is necessary. Poor outcome is associated with degree of displacement, associated elbow injury, open treatment, and poor reduction. We minimised such risks by prompt anatomic reduction and annular ligament repair, with minimal soft-tissue injury.

DISCLOSURE

No conflicts of interest were declared by the authors.

REFERENCES