

Irreducible Radial Head Dislocation in a Child: A Case Report

Michael P. Bradley, MD, Robert Z. Tashjian, MD, and Craig P. Ebersson, MD

Pediatric elbow trauma and fractures account for a third of all limb fractures. Although the mainstay for most pediatric upper extremity fractures and dislocations remains closed treatment, certain injuries will need operative fixation. In fact, failed attempts for closed management of pediatric injuries are often the indications for surgery. We present a case of irreducible radial head dislocation in a young child.

CASE REPORT

A 5-year-old girl fell on her outstretched left hand while playing at school. After complaining of mild pain in the left elbow, she was evaluated by the school nurse and determined to be presumably uninjured. Two days after injury, with complaints of elbow pain persisting, she was evaluated in a walk-in emergency clinic, where plain films showed anteromedial dislocation of the radial head. The patient's arm was placed in a splint and she was sent for evaluation by a community orthopedic surgeon. After review of the plain films, the patient was sent directly to the emergency department at our institution.

The patient's elbow was swollen and tender to palpation about the lateral aspect. The forearm was held in neutral position. The skin showed some mild ecchymoses, no abrasions, and no lacerations. The patient could pronate to 90° without difficulty but was hesitant to supinate secondary to pain. She lacked about 20° of full extension and had pain with flexion beyond 50°. The sensory examination was normal in the median, ulnar, and radial distributions, and the motor examination was normal. The patient had a palpable 2+ radial pulse.

Obtained in the emergency department, anteroposterior and lateral plain films of the left elbow showed anteromedial dislocation of the radial head with no evidence of fracture in the elbow or forearm. An elbow effusion was also present with anterior and posterior fat pad signs (Figures 1, 2).

Dr. Bradley and Dr. Tashjian are Residents, Department of Orthopaedic Surgery, Brown Medical School, Providence, Rhode Island.

Dr. Ebersson is Attending Surgeon, Department of Orthopaedic Surgery, Hasbro Children's Hospital/Rhode Island Hospital, and Assistant Professor, Department of Orthopaedic Surgery, Brown Medical School, Providence Rhode Island.

Requests for reprints: Michael P. Bradley, MD, Department of Orthopaedic Surgery, Rhode Island Hospital, 2 Dudley St, COOP 1st Floor, Providence, RI 02903 (tel, 401-444-4030; fax, 401-444-6243; e-mail, michaelbradleymd@yahoo.com).

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The findings presented above led to the diagnosis of acute anterior radial head dislocation.

TREATMENT

The patient was placed under conscious sedation using the combination of ketamine and fentanyl, and closed reduction of the elbow was attempted with a combination of longitudinal traction on the forearm, forced supination of the forearm at 30° of elbow flexion, and then flexion to 100° while maintaining supination. This attempt at closed reduction failed, so another attempt was made, and films obtained before placement of a posterior splint showed a reduced radial head (Figure 3). Posterior splint films showed recurrent anterior dislocation of the radial head (Figure 4). In the emergency department, closed reduction was attempted a third time, but it also proved unsuccessful.

The patient was taken to the operating room for further management. Overall ligamentous laxity was evaluated with the patient under anesthesia, and both shoulders were noted to be able to be completely dislocated past the anterior glenoid rim. Closed reduction was attempted with traction, supination, and elbow flexion, which revealed a concentric reduction, verified by arthrogram. With the arm casted in supination, repeated images showed recurrent anterior subluxation.

The decision was made to use a Kocher approach to reduce the joint openly. After incision of the ulnohumeral capsule, the annular ligament was noted to have slipped

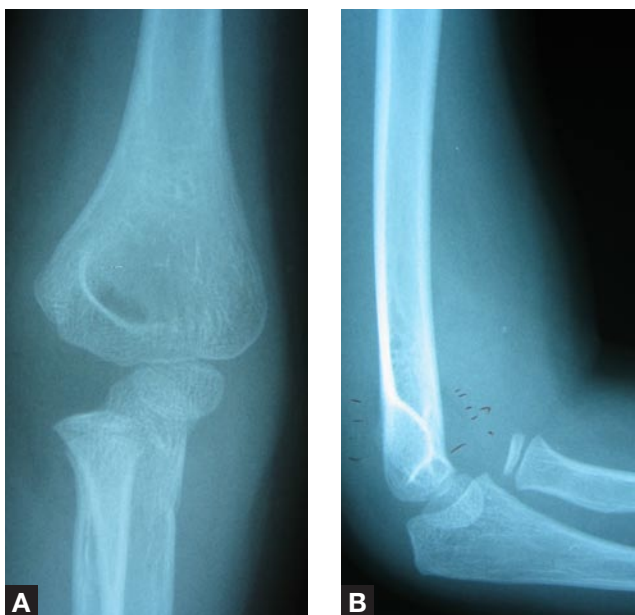


Figure 1. Anteroposterior (A) and lateral (B) plain films of the injured elbow.

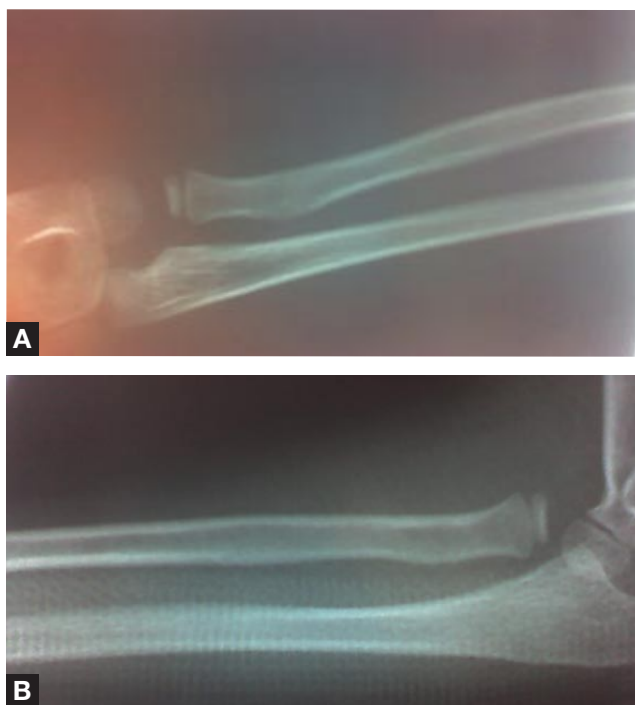


Figure 2. Anteroposterior (A) and lateral (B) plain films of the injured forearm.

posterior to the radiocapitellar joint. The annular ligament was compressed between the radial neck and capsule, pushing the radial head anteriorly when the capsule was tightened in flexion. The ligament could not be pulled over the radial head when intact. The annular ligament was transected and subsequently repaired distally at the level of the radial neck, creating a sling to prevent recurrent subluxation. The elbow was casted in supination and 90° of elbow flexion, with films showing a concentrically reduced joint (Figure 5).

Outcome

The patient was initially treated with a long arm cast for 8 weeks after surgery. Two months after surgery, she began range-of-motion and gentle-strengthening physical therapy. At 3-month follow-up, she reached full extension (Figure 6). Four months after open reduction and annular ligament reconstruction, she had full range of motion in extension, flexion, pronation, and supination. She was then progressed to full activities without restriction.

DISCUSSION

Injuries about the elbow are extremely common in children. Hanlon and Estes¹ estimated that upper extremity injuries account for 65% of all fractures and dislocations in children. In children younger than 7 years, elbow injuries account for about 30% of all limb fractures.² Traumatic injuries to the elbow occur more often in the skeletally immature than they do in adults.^{3,4} Historically, radial head subluxation has been estimated to occur in roughly 25% of all elbow injuries in children younger than 10 years.^{5,6} Even though mean age at injury classically is between 2 and 4 years, children as old



Figure 3. Lateral plain film shows reduced radial head before splinting.

as 7 or 8 years are prone to injury.

Closed reduction is the mainstay of treatment for radial head subluxation. Reduction maneuvers of supination and flexion with concurrent palpation of the radial head often reveal a click as the radial head reduces through the annular ligament. Reductions can even occur while positioning the arm for plain films in the radiology suite. However, the mechanism and pathophysiology of the subluxation are key in determining final treatment. In this report, we

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describe a traumatic radial head subluxation irreducible by closed reduction attempts, and then we describe the open treatment.

Precise history-taking, thorough physical examination, and plain films are essential to making a correct diagnosis of acute radial head subluxation. Several entities (eg, acute radial head dislocation, chronic radial head dislocation, acute radial head subluxation) must be distinguished. Acute traumatic radial head dislocations usually reflect a mechanism of direct injury to the elbow. These injuries are rare, as the annular ligament and anterior capsule must be torn for anterior dislocation to occur. In addition, the close relationship of radius and ulna through the interosseous membrane has led many authors to believe that such inju-

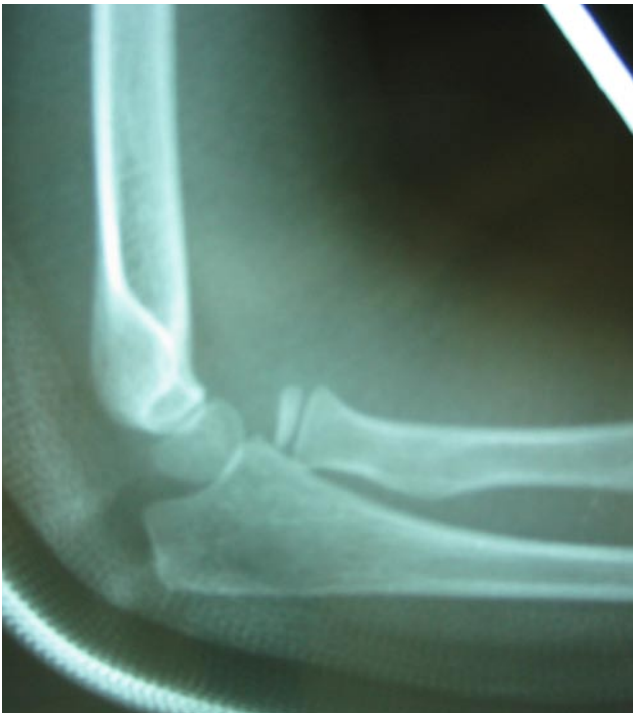


Figure 4. Lateral plain film shows persistent subluxation after application of posterior splint.

ries are Monteggia type I injuries, with anterior bowing of the ulna in almost all cases.⁷⁻⁹

Congenital subluxations and dislocations have also been widely described. Some authors believe that most congenital radial head dislocations are also the result of unrecognized trauma. However, the natural history and management differ greatly. Many children are asymptomatic with congenital radial head dislocations, and surgical intervention has not proved beneficial. These dislocations may be bilateral and associated with syndromes of ligamentous laxity (eg, Ehlers-Danlos syndrome).

There have been reports of idiopathic subluxation,¹⁰ but a history of trauma is usually present. Salter and Zaltz¹¹ elegantly described the pathoanatomy as longitudinal traction of the wrist and forearm with pronation creating a transverse tear just distal to the annular ligament in the subannular membrane.

A partial tear of the annular ligament may or may not be present. Salter and Zaltz¹¹ felt that tear size actually determines injury management. A small tear allows the radial head to sublux through the ligament, but less than 50% of the radial head is exposed. Simple maneuvers (eg, longitudinal traction, extension, and forced supination followed by flexion) usually reduce the ligament. Splinting or immobilization in flexion allows correct placement of the annular ligament around the radial neck and allows healing of the subannular membrane.

A large subannular tear allows the radial head to button-hole distally, and, when more than 50% of the radial head is through the membrane (past the equator), the annular ligament flips proximally, making closed reduction very difficult.¹¹ With reduction attempts, the annular ligament



Figure 5. Postoperative anteroposterior (A) and lateral (B) plain films.

is locked between the capitellum and the radius. The few reported cases of failed closed reductions confirm this finding at time of surgery.^{12,13}

We believe that most of these injuries to the elbow involve a distal subannular membrane disruption, as described by Salter and Zaltz.¹¹ This disruption is usually amenable to closed reduction. The reduction maneuver for “pulled elbow,” early on (1833) described by Hugh Owen Thomas,¹⁴ is the same today. The combination of gentle traction, supination, and flexion with concurrent palpation

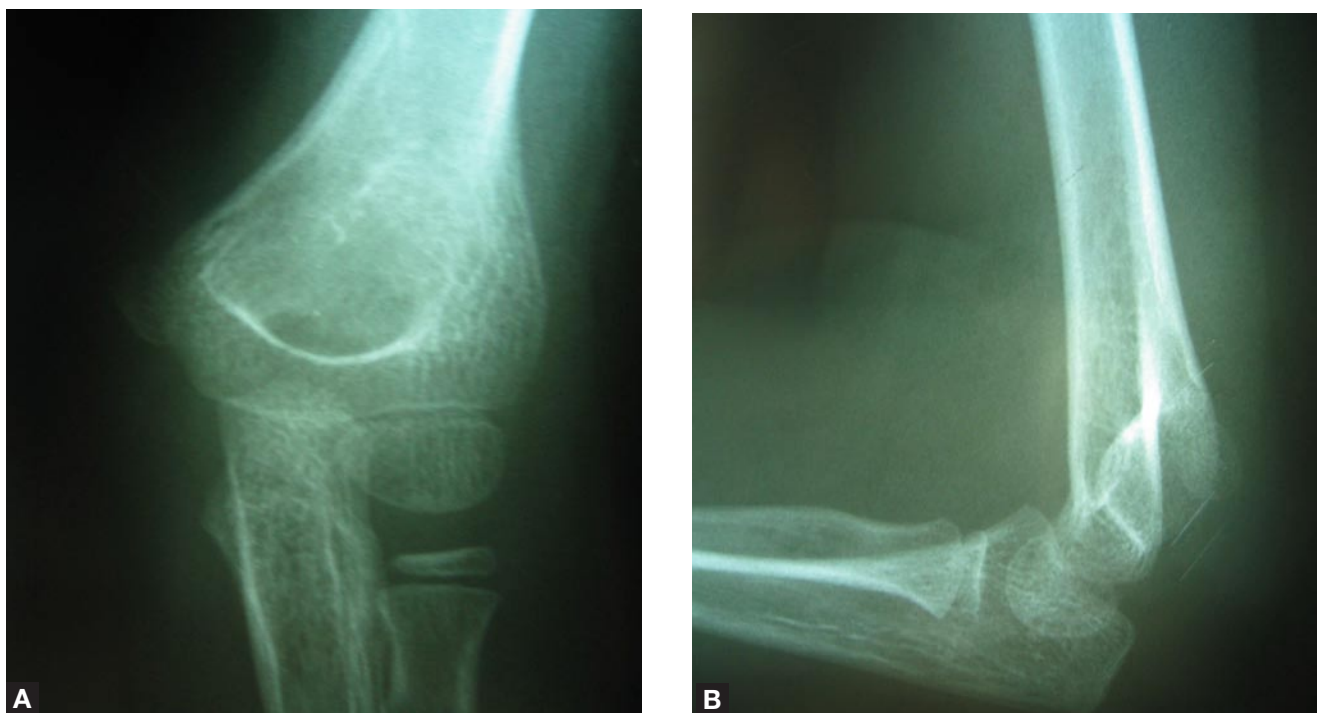


Figure 6. Four-month follow-up anteroposterior (A) and lateral (B) plain films.

of the radial head is a simple and successful reduction maneuver for these injuries. In fact, the true incidence of radial head subluxation is difficult to determine because emergency department physicians and pediatricians may initiate care and treat these injuries without orthopedic consultation. Undiagnosed injuries and spontaneous reductions also complicate the true number of these elbow injuries.

On rare occasions, the character and size of the subannular membrane disruption and the attached annular ligament may make closed reduction very difficult, if not impossible. These tears, which extend to allow the radial head to translate anteriorly through the subannular membrane (past the equator),¹¹ may lock the annular ligament posteriorly. We believe that, in these rare cases, only open reduction will allow restoration of the anatomic relationship of the elbow joint.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.
