

Anterior Dislocation of the Radial Head With Fractures of the Olecranon and Radial Neck in a Young Child

A Monteggia Equivalent Fracture-Dislocation Variant

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Summary: We present a case of a type I Monteggia equivalent lesion in a 7-year-old child consisting of anterior dislocation of the radial head, radial neck fracture, and a fracture of the olecranon without an associated fracture of the ulnar diaphysis or metaphysis. After a review of the literature, we report this fracture pattern as a rare type I Monteggia equivalent fracture-dislocation variant. This report describes delayed surgical treatment and outcome after close follow-up of a rare type I Monteggia equivalent lesion. Diagnostic challenges with and treatment options for pediatric Monteggia equivalent fracture-dislocations are discussed.

Key Words: children, Monteggia fracture-dislocation, olecranon fracture, radial neck fracture, type I Monteggia equivalent lesion

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Monteggia, in 1814, first described the association of radial head dislocation with a concomitant fracture of the ulna.¹ Several classifications^{1–5} have been presented for Monteggia fracture-dislocations. Bado's classification² is well established in clinical orthopaedic practice, subdividing Monteggia fracture dislocations into true Monteggia lesions (types I–IV) and equivalent lesions.

Bado type I lesions, with anterior dislocation of the radial head and concomitant anterior angulation of the ulnar diaphyseal fracture, are the most common Monteggia fracture-dislocations in the pediatric population and constitute approximately 70% of Monteggia fracture-dislocations in several series.^{3–10} In a retrospective review of 102 children, Olney and Menelaus⁸ concluded that type I equivalent lesions involving the proximal radius accounted for 14% of acute Monteggia

lesions, suggesting that equivalent lesions may be more common than previously thought.^{11–14} Although early diagnosis and closed reduction of Type I Monteggia lesions usually yield good to excellent results,^{2,4,5,9,10,15,16} Olney and Menelaus⁸ suggested that type I equivalent injuries may require open reduction and internal fixation.

We report a case of a child with a rare type I Monteggia equivalent fracture-dislocation requiring operative management following failure of closed reduction.

CASE REPORT

A 7-year-old right-hand-dominant male presented to our institution 6.5 weeks after sustaining a hyperextension injury to his right elbow after falling on an outstretched forearm. His elbow injury, including concomitant fractures of the olecranon apophysis and radial neck, were initially treated at an outside institution with closed reduction and casting for 2 weeks (Fig. 1). It is unclear if the radial head dislocation was appreciated and closed reduction achieved by the initial treating physician. However, radiographs obtained after 1 week revealed an anteriorly dislocated radial head despite cast immobilization. This was not treated further at the referring institution.

The patient then presented to the senior author's office 6.5 weeks after the initial injury. On examination, the patient had significantly reduced range of motion at the ulnohumeral joint from 35° of extension to 90° of flexion. A cubitus valgus deformity measuring 25° was appreciated, and his forearm was fixed in pronation. Movement of the elbow was associated with significant pain. The child's upper extremity was neurovascularly intact. Radiographs revealed persistent disruption of the radiocapitellar relationship and the associated fractures of the radial neck and olecranon (Fig. 2). A decision was made to perform open reduction and internal fixation with reconstruction of the annular ligament using the ulnar aponeurosis.

At surgery, an arthrogram of the elbow joint was done to optimally define the fracture. The olecranon fracture had healed anatomically, and the radial head remained anteriorly dislocated. A Boyd incision was made and the radiocapitellar joint and radial neck fracture were exposed. The olecranon fracture was visualized and found to be healed in an anatomic position. The radial neck fracture remained unhealed and anteriorly angulated at 45°.

Reduction of the radiocapitellar joint was initially prevented by the interposed capsule, torn annular ligament, and scar tissue. These soft tissues were resected, and anatomic reduction of the radial head was achieved only in full supination. As the forearm was pronated, the malunited radial neck fracture caused redislocation of the radial head. Anatomic reduction of the radial neck was achieved with gentle manipulation after placing a small osteotome in the original fracture site, which was not completely united. Two 2.045-inch Kirschner

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FIGURE 1. Anteroposterior (A) and lateral (B) radiographs obtained at the time of initial injury. The fracture-dislocation pattern includes anterior dislocation of the radial head with concomitant fractures of the radial neck and the olecranon apophysis (arrows). No distal injuries were found.

wires (K-wires) were used for fixation of the fracture site. Because the annular ligament was completely torn, reconstruction was necessary to achieve maximal stability. A 1.0 cm × 8.0 cm thick aponeurotic fascial strip covering the extensor carpi ulnaris was released distally and the proximal attachment left intact. The fascial strip was then passed around the radial neck, and the radial head was held reduced. The annular ligament reconstruction graft was fixed after being tensioned to allow for smooth pronation and supination without any dislocation of the radial head throughout a full range of motion. The capsule of the radiocapitellar joint was repaired, and the wound was closed. Reduction was then confirmed fluoroscopically. Final intraoperative range of motion demonstrated full pronation and supination and ulnohumeral motion from 10° of extension to full flexion. An above elbow splint was applied with the forearm in full supination with the elbow maintained in 90° of flexion.

Radiographs obtained 7 days postoperatively confirmed anatomic alignment and reduction of the radial head (Fig. 3). At 4 weeks postoperatively, the patient was brought to the operating room for removal of the K-wires. Fluoroscopy revealed a stable radiocapitellar joint throughout a full range of motion. At 6 months postoperatively, radiographs revealed that the fractures of the radial neck and olecranon had fully healed anatomically and the radiocapitellar relationship was maintained (Fig. 4). Clinically, the patient had 5° of residual cubitus valgus, ulnohumeral motion from 0° of extension to 120° of flexion, full supination, and 50° of pronation. The patient was pain free, and his postoperative course had been uncomplicated.

DISCUSSION

Monteggia equivalent lesions, first described by Bado² in 1967 and expanded by other authors,^{10,17} consist of various radiographic patterns of fracture-dislocations about the elbow and forearm. Several authors^{2,5,8,9,14,18-23} have described anterior or lateral dislocation of the radial head with fracture of the olecranon as a Monteggia equivalent. Ring et al²⁴ proposed that this pattern represents a buckle-type fracture through the metaphysis of the proximal ulna. In a series of 39 pediatric olecranon fractures, Caterini et al²⁵ reported 3 cases of olecranon fracture associated with radial head dislocation, but no cases with concomitant radial neck fracture were found. Carl



FIGURE 2. Anteroposterior (A) and lateral (B) radiographs, obtained at the time of presentation to our institution 6.5 weeks after the initial injury, demonstrating persistent anterior dislocation of the radial head and the fractures of the radial neck (50% anterior displacement) and the olecranon apophysis.

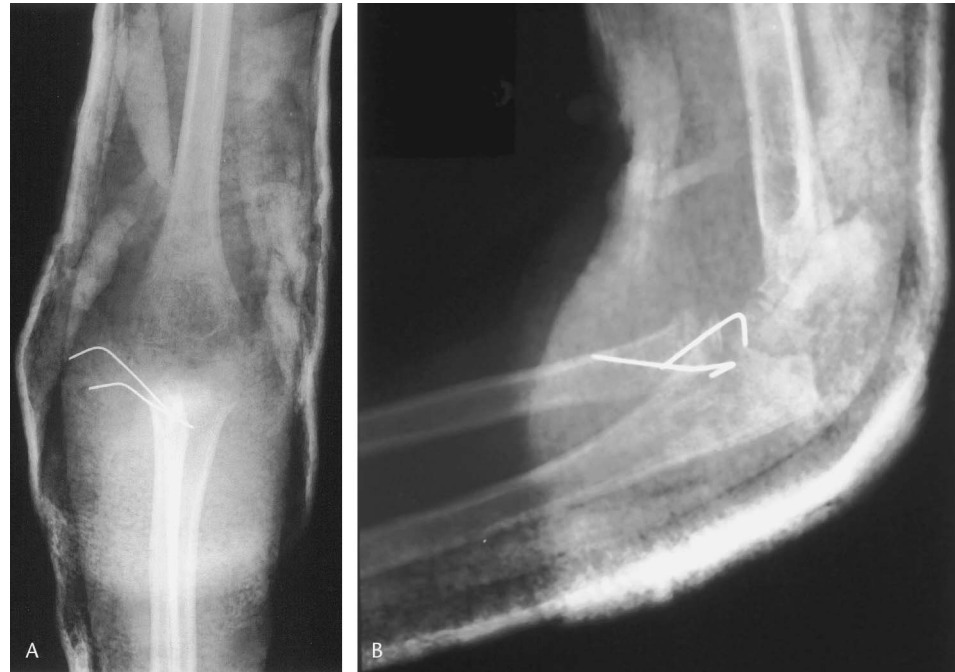


FIGURE 3. Anteroposterior (A) and lateral (B) radiographs obtained 7 days postoperatively confirming anatomic alignment and reduction of the radial head and radial neck fracture fixation with 2 K-wires.

and Ain²⁶ described a radial neck fracture accompanied by fractures of the olecranon and medial epicondyle without disruption of the radiocapitellar joint. Faundez et al²⁷ reported a type I equivalent lesion, which included fractures of the radial neck and ulnar diaphysis but without radial head dislocation. Kamali¹² presented an injury pattern comprised of radial head displacement, fracture of the radial neck, and proximal third ulna shaft fracture without olecranon involve-

ment. Of the 14 Monteggia equivalent lesions involving the proximal radius and ulna presented by Olney and Menelaus,⁸ 7 cases had fractures through the radial neck or proximal epiphyseal plate with complete dislocation of the radial head, and 5 had fractures of the olecranon. It is unclear if a case with concomitant fractures of the olecranon and radial neck/proximal epiphyseal plate with radial head dislocation was observed. In our case, an anterior dislocation of the radial head



FIGURE 4. Anteroposterior (A) and lateral (B) radiographs obtained 6 months postoperatively showing that the radiocapitellar relationship is maintained, and the fractures of the radial neck and olecranon are fully healed anatomically.

with concomitant fractures of the radial neck and the olecranon apophysis without ulnar diaphyseal or metaphyseal involvement is presented. After a review of the literature, we report this fracture pattern as a rare type I Monteggia equivalent fracture-dislocation variant.

In the presented case, it is unclear if the radial head dislocation was appreciated and closed reduction achieved by the initial treating physician. However, serial radiographs revealed a dislocated radial head 1 week after closed reduction and cast immobilization for the associated fractures. The high incidence of redislocation of the radial head after either spontaneous^{28,29} or closed reduction^{3,15} requires serial anteroposterior and lateral radiographs of the elbow be obtained and the radiocapitellar relationship evaluated with the radiocapitellar line on each film. The patient's dislocation was not addressed until the patient presented to our institution 6.5 weeks after the initial injury. Intraoperatively, reduction of the radiocapitellar joint in our patient was possible only after resections of the interposed capsule, torn annular ligament, and fibrous scar tissue and reduction of the radial neck fracture.

Operative treatment of Monteggia fracture-dislocations becomes necessary when closed reduction is unsuccessful in patients seen more than a month after the injury. In the series of Olney and Menelaus,⁸ 10 of the 14 (71.4%) patients with type I equivalent lesions involving the proximal radius required operative treatment. In contrast, Papavasiliou and Nenopoulos¹⁵ reported normal flexion–extension range of motion at the ulnohumeral joint in 24 of 25 patients treated nonoperatively for type I Monteggia equivalent fractures. However, 18 of the 25 patients treated nonoperatively required multiple closed reductions within 14 days after the initial injury. A restriction of 20° in pronation was seen in all of these 18 patients. Open reduction of the radial neck fracture with reconstruction of the annular ligament was necessary in our patient because the anterior displacement of the radial neck fracture resulted in dislocation of the radial head as the forearm was ranged out of supination. Despite delayed diagnosis and failure of initial nonoperative treatment, at 6 months postoperatively, excellent clinical and radiographic results were obtained.

CONCLUSION

Monteggia fracture-dislocation equivalents can be misdiagnosed in children because of multiple atypical presentations. An understanding of the various fracture patterns of Monteggia equivalent lesions is necessary for early diagnosis and treatment to minimize complications in the pediatric population. The described Monteggia equivalent fracture-dislocation is likely to be unstable and require operative management as the anteriorly displaced radial neck fracture causes persistent dislocation of the radial head. The high incidence of redislocation of the radial head after reduction is achieved requires serial anteroposterior and lateral radiographs of the elbow to re-evaluate the radiocapitellar relationship throughout the healing process.

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