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Case Series

Irreducible Radial Head in Monteggia Fracture Dislocation; Is there an Alternative to Open Reduction?

Amr A Abdelgawad[1]*, Aaron J Wey[2], Rami Khalifa[2], Saad Shoulah[3] and Ahmed M Thabet[2]

[1]*Maimonides Bone and Joint Center, Brooklyn, NY, USA*

[2]*Department of Orthopaedics, Texas Tech University Health Science Center El Paso, USA*

[3]*Department of Orthopaedics, Benha University, Egypt*

***Corresponding Author:** Amr A Abdelgawad, Attending Orthopedic Surgeon, Maimonides Bone and Joint Center, Brooklyn, NY, USA.

E-mail: amratef@doctor.com

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Abstract

Monteggia fracture dislocation include ulnar fracture and radial head dislocation. In most cases of Monteggia fracture dislocation, the radial head will reduce spontaneously with reduction of the ulnar fracture. In some cases, the radial head will not reduce with ulnar fracture reduction and these cases were classically reduced by open reduction which often resulted in elbow stiffness. We propose a new method for indirect radial head reduction by manipulation of the ulnar fracture. Two cases of irreducible radial head were successfully treated with this maneuver without the need for open reduction.

Keywords: Monteggia Fracture Dislocation; Pediatric; Elbow; Fracture; Dislocation, Indirect Reduction

Introduction

Monteggia fracture dislocation is a combination of ulnar fracture and radial head dislocation at the radio-capitellar joint. Pediatric Monteggia fracture-dislocation is a commonly missed injury affecting the elbow joint [1-5]. This injury usually involves an obvious ulna fracture, however, in some cases the ulna fracture is not easily detected in the elbow radiographs [2,6]. Mubarak describes a Monteggia equivalent injury involving dislocation of the radial head in addition to subtle radiographic plastic deformation of the ulna [7]. In fact, Mubarak sheds doubt on the mere existence of an isolated radio-capitellar dislocation [7]. Deformation of the ulnar bow has therefore been implicated in the etiology of all cases of radio-capitellar instability in the pediatric patients [7,8]. In the clinic, or the emergency room, these injuries can be easily missed, and reduction of the radial head can prove to be challenging. In most cases, the radial head will spontaneously reduce at the radio-capitellar joint with ulnar fracture reduction. In cases with failed closed reduction of the head radius, open reduction of the radial head is generally indicated which can be associated with many complications including elbow stiffness and recurrence of dislocation/subluxation. The goal of this technique paper is to describe an alternative technique for reducing radial head in cases of Monteggia fracture dislocation that fail to reduce after ulnar fracture reduction. Two case examples will be presented that describe this principle.

Case one

An eight years old girl presented to the emergency room with elbow pain, after falling onto her left upper extremity. Radiographs showed an anterior dislocation of the radial head and a non-displaced proximal ulnar fracture (Figure 1), only appreciated on the lateral radiograph. The radiographic abnormalities on the injury films were initially missed. The child was diagnosed with an "elbow sprain", placed in posterior long arm splint and instructed to follow up in the orthopedic clinic. The patient presented to clinic one week later and clinical exam and radiographs revealed the radial head dislocation, however, the non-displaced olecranon fracture was not apparent on radiographic evaluation. The patient was indicated for reduction of the radial head in the operating room the following day (Figure 2).

Surgical technique: The patient was positioned supine with the elbow and forearm resting on a hand table attachment. Intra-operative fluoroscopy was used. Multiple attempts of closed reduction of the radial head were performed; however, these trials were not successful (Figure 3). Contralateral elbow radiographs were obtained to compare the injured and uninjured anatomy. Which confirmed the radial head dislocation in the affected side compared to the contralateral elbow which had normal relation of the radial head to the capitellum. The associated proximal ulna fracture was

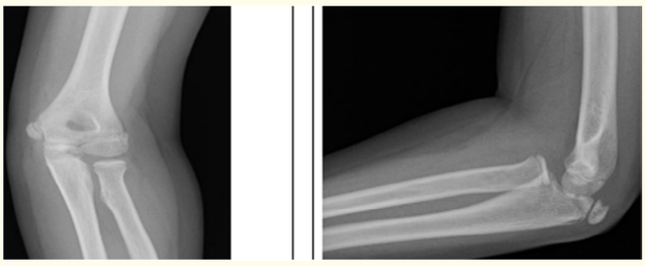

Figure 1: Radiographs at emergency department. a- Anteroposterior view of the left elbow, b- Lateral view of the left elbow shows the radial head dislocation and non-displaced proximal ulna (olecranon) fracture.

Figure 2: Lateral radiograph of the elbow taken in the clinic shows that the line drawn along the radius does not run through the capitellar ossification center, indicating dislocation of the radial head.

Figure 3: Intra operative fluoroscopic image shows a lateral view of the left elbow in maximum flexion with the radial head is still dislocated.

not apparent in the fluoroscopic evaluation (Figures 3,4). A 2 mm K-wire was introduced percutaneously into the proximal tip of the olecranon directed anteriorly towards but not crossing the presumed fracture site (Figure 5). The K-wire in the proximal fragment was then utilized as a joystick to create a flexion moment at the fracture site. The wire was advanced to engage into the distal dorsal cortex. Immediately with this angular correction, the radial head was reduced, and the reduction was noted to be very stable throughout a range of motion (Figure 5).

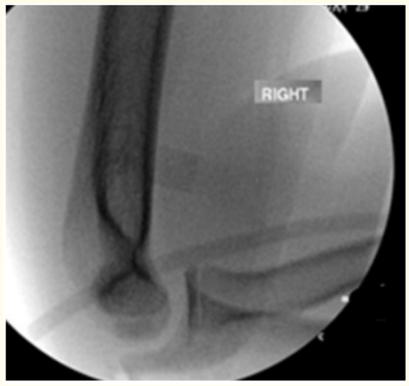

Figure 4: Fluoroscopic image shows a lateral view of the normal right elbow shows the radial head in the normal position.

Figure 5:

a- Fluoroscopic image shows a lateral view of a flexed left elbow shows a 2 mm Kirshner wire was used via a small snip in the triceps tendon over the olecranon.

b-Fluoroscopic image shows a lateral view of a flexed left elbow, noticed the direction of the K-wire in comparison to figure 5a (the K wire is pointing more dorsal). This flexion at the fracture had resulted in reduction of the radial head.

c-Fluoroscopic image shows advancement of the wire to engage the distal part of the fracture with maintenance of the reduced radial head.

d-Fluoroscopic image shows an anteroposterior view of the left elbow used to confirm the redial head is in the normal position. The K wire is fixing the fracture and engaging both cortices.

Post-operatively, a posterior splint was applied for three weeks. The wire was removed in the clinic at 3 weeks, and at the final follow-up, the patient's radiocapitellar reduction was stable throughout a range of motion and the olecranon fracture had healed (Figure 6a and 6b).

Figure 6: Radiographic lateral and AP views of the left elbow after the fracture healed and removal of the K-wire showing maintenance of the reduction of the radial head.

Case two

A 6-year-old male presented to emergency room with a widely displaced ulnar fracture and dislocated radial head (Bado type I Monteggia fracture dislocation) (Figure 7a and 7b). A closed reduction was attempted in the emergency room, however, the radial head was persistently dislocated (Figure 8). Due to failure to obtain a congruent reduction of the radiocapitellar joint, the patient was indicated for an operation to restore the ulnar length to aid in the reduction of the radiocapitellar joint.

(a) (b)

Figure 7: Injury film of Bado type I Monteggia fracture dislocation:
(a) lateral
(b) anteroposterior.

Figure 8: Post-reduction attempt radiograph demonstrating persistent radiocapitellar joint dislocation.

Surgical technique: Reduction of the fracture was first attempted with an antegrade intramedullary K wire in the ulna. The IM K wire was introduced in a way to create mild flexion of the fracture The entry point was (more dorsal and distal than the normal entry of the ulnar medullary canal), however, the dislocation of the radial head persisted (Figure 9). An open reduction of the ulnar fracture was performed and an anatomic reduction of the ulna was obtained. However, even with an anatomic reduction, the radial head was still not reduced (Figure 10). A mini fragment plate was prebent to intentionally deform the fracture site 10° into flexion, applied to ulna fracture, and preliminary fixed to the bone using bone holding forceps. The radial head continued to be dislocated (Figure 11). The procedure was repeated with a 20° bend in the mini-fragment plate, and only then, the radial head was reduced and stable (Figure 12). 3-week postoperative follow up radiographs in the office showed maintenance of reduction (Figure 13).

Figure 9: Antegrade intramedullary ulnar K wire attempted percutaneous reduction failure. The radius (dotted line) is not aligned with the capitellar head (arrow).

Figure 10: Open reduction of ulna fracture with persistent radiocapitellar instability.

Figure 11: 10º intentional flexion deformity at the fracture site with persistent radiocapitellar instability

Figure 12: 20º intentional flexion deformity at the fracture site with a stable and congruent radiocapitellar reduction.

Figure 13: 3-week post-operative follow up radiograph demonstrating continued congruent reduction of radiocapitellar joint.

The patient was immobilized in an above-elbow cast for 3 weeks. Then he was placed into a removable splint for 3 more weeks during which the radiocapitellar reduction remained stable. The plate was removed after the ulnar fracture was healed and the patient had stable and congruent radiocapitellar reduction, full pronation, supination, flexion, extension elbow range of motion at final follow up (Figures 14, 15).

Figure 14: 6 months clinical follow up showing full range of supination pronation.

Figure 15: 6 months XR follow up after plate removal showing persistent of good reduction.

Discussion

The pediatric Monteggia fracture is a common injury but can be easily missed on the first presentation. Chronic missed Monteggia injuries can lead to serious complications including loss of elbow and forearm range of motion [4]. Bado type 1 injuries with apex-anterior ulna fracture angulation and anterior radial head dislocation is the most common variant of the Monteggia fracture-dislocation injuries in the pediatric population [1,9]. Sometimes, this anterior apex deformity of the ulna fracture is extremely hard to detect in the lateral radiographs of the elbow and/or forearm and it only shows itself as loss of the normal posterior bend of the ulna or very mild anterior bend [7]. The innocuous appearance of a non-displaced ulnar fracture or of a plastically deformed ulna may be underappreciated in its role of impeding reduction of a radio-capitellar dislocation [7,8]. As noted by Mubarak, any very small deviation of the ulnar bow > 0.01 mm from a straight line drawn along the dorsal ulnar border, from the level of the olecranon to the distal metaphysis on the true lateral projection of the ulna is considered abnormal [7]. This explains how even a subtle deformation can impede reduction of the radial head.

In cases of Monteggia fracture-dislocation, operative intervention is recommended if there is a failure to obtain and maintain an acceptable ulnar fracture reduction or (more importantly) to obtain and maintain a congruent reduction of the radio-capitellar joint [4,5,10,11]. In some cases, closed reduction of the radio-capitellar joint cannot be achieved, even after intramedullary or plate fixation of the ulna [4]. In these situations, an open reduction of the radio-capitellar joint is the recommended treatment with or without restoration of the annular ligament to its normal position [1,3]. Using the previous recommendations, our two cases would have required an open reduction of the radial head. Open reduction of the radial head has its possible complications especially elbow stiffens and re-dislocation [1,5,7].

Recently, the management of chronic radial head dislocations after missed Monteggia lesion started to shift to lengthening and flexing an ulnar malunion utilizing either external fixator (gradual lengthening and flexion) or wedge grafting and plate fixation (acute lengthening and flexion) without having to openly reduce the radio-capitellar joint. Reported outcomes are very promising with minimal loss of elbow range of motion [12]. Using the same principle, we have implemented the flexion moment to achieve "indirect" reduction of the radial head. This flexion moment resulted in a very stable and immediate reduction of the radial head with the added benefit of avoiding an open reduction [3]. Creating "flexion moment" in the ulna by manipulation of the proximal or the distal fragment allowed for a spontaneous reduction of the radial head in our cases. Reduction in both cases was extremely stable and did not need any added radio-capitellar pinning. We believe this method has the advantages of avoiding the complication of open reduction and in the same time being stable and avoiding the complication of using a crossing pin between the capitellum and radial head.

Conclusion

We describe a closed indirect technique for reduction of the irreducible radial head dislocations as a part of Monteggia fracture-dislocations that fail to spontaneously reduce with ulnar reduction. Creating a flexion moment at the ulnar can reduce the anteriorly dislocated Bado type I Monteggia fracture-dislocation. This technique offers the advantages of avoiding complications associated with of open reduction of the radio-capitellar joint and being extremely stable without need for radio-capitellar fixation.

Disclosure of Interest

The authors declare that they have no competing interest.

Acknowledgements

The authors do not have any acknowledgements at this time.

Conflict of Interest

E.P., S.D., R.Y., A.A. and A.T. declare that they have no conflict of interest.

Ethical Approval

All procedures performed in study was in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained.

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