

A STUDY ON SURGICAL MANAGEMENT OF MONTEGGIA FRACTURE-DISLOCATION IN ADULTS

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ABSTRACT

Objectives: The objective of the study was to study the functional outcome of Monteggia fracture-dislocation in adults by surgical management. Open reduction and internal fixation of the ulna with dynamic compression plate and screws not only prevent malunion or non-union but also achieve rapid union of the fracture site.

Methods: Twenty cases of simple Monteggia fracture-dislocation in adults were treated by open reduction and internal fixation with a minimum six-holed AO 3.5 mm dynamic compression plate of the ulna with closed reduction of the radial head. In a case with a delayed presentation, the radial head was removed. The follow-up ranged from 5 to 15 months.

Results: Right elbow affliction was more common in males than left. The majority of fracture-dislocation cases resulted from auto accidents. With an average age of 35.9 years, fracture dislocations were more prevalent in the third and fourth decades of life. According to Bado's categorization, Type 1 fracture-dislocation accounted for the majority of the cases. To avoid radial head redislocation, the upper limb was immobilized with the elbow flexed 110–120° and the forearm supinated. We had 13 (65%) instances with great results using the Anderson *et al.* grading system, six (30%) with good results, one (5%) with bad results, and no cases with failure. The only problems were a superficial infection and posterior interosseous nerve damage, both of which healed on their own when the radial head dislocation was closed down and the ulna was internally fixed with an AO 3.5 mm dynamic compression plate.

Conclusions: Adults with Monteggia fracture-dislocation can be treated simply and effectively with a high level of functional result utilizing the approach of early closed reduction of the radial head and open reduction and internal fixation of the ulna using a minimum of six holes AO 3.5 mm dynamic compression plate.

Keywords: Monteggia fracture, Interosseous nerve injury, Bado's classification.

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INTRODUCTION

In 1814, Giovanni Battista Monteggia of Milan wrote his traditional account of the fracture that bears his name, the Monteggia fracture. Less than 5% of forearm fractures are Monteggia-dislocations, which are uncommon injuries. These fractures have a range of specific consequences, such as radioulnar synostosis, redislocation of the radial head, and diagnostic mistakes. No fracture presents so many issues, no injury is treated with greater difficulty, and no therapy is more generally marked by failure, according to Watson-Jones in 1943 [1,2].

It can result in consequences including joint stiffness and nerve damage and is a dangerous disease to treat. Orthopedic surgeons are well aware of this issue, in large part due to the infamously subpar outcomes of treating these injuries in adulthood.

In the past, radial head dislocation was treated debatably and Monteggia lesions were treated by closed reduction and plaster cast application. All Monteggia fractures, according to Bohler, may be managed without surgery. However, several research on Monteggia lesions shown that if conservative care is chosen, outcomes are subpar. Including a number of side effects such as posterior interosseous nerve palsy, recurrent radial head dislocation, and ulnar malunion or non-union.

Therefore, it has become crucial to act surgically in light of this. It is advised to have a thorough diagnosis and fast, appropriate treatment for this potentially dangerous injury. After surgery, vigorous mobilization will help the patient return to normal function as soon as feasible. Active motions have a significant impact on the quality and speed of fracture union in addition to protecting the tissue from fracture disease [2-4].

The aim of treating a Monteggia fracture is to reduce the radial head anatomically while also reducing and fixing the ulna. In addition to preventing malunion or non-union, open reduction and internal fixation of the ulna with dynamic compression plate and screws also leads to quick healing of the fracture site. The purpose of this study is to confirm the statements made by various writers on the surgical treatment of Monteggia fracture-dislocation in adults as well as to determine its benefits and drawbacks.

METHODS

The present study consists of 20 cases of Monteggia fracture-dislocation in adults treated by 3.5 mm Dynamic compression plate and screws in the Department of Orthopaedics, Government General Hospital, Mahabubnagar, during the study (2019–2021). There were eleven male patients and nine female patients who underwent surgery. Seven of the male patients had right-side involvement and four had left-side involvement. Five of the female patients had right-side involvement and four had left-side involvement.

Of the 20 cases, two-wheeler incidents resulted in road traffic accidents for eleven of the patients. One patient was hurt while defending himself with a stick against an attack and eight patients had fallen from a height and hit the ground.

Immediate management

As soon as the patient was brought to the hospital, a comprehensive clinical examination was performed to determine the patient's overall health, any underlying systemic diseases, and any accompanying injuries.

Every patient arrived with their elbow flexed around 30° and the other hand supporting it. The instances were all straightforward fracture-

dislocations. Clinically, ulna deformity, crepitus, and bone irregularity were detected. The radial head was felt anteriorly in fourteen cases, and rotatory motions supported this finding. One of the patients who arrived at the hospital after hours had just minor discomfort and mobility limitations. The radial head was palpated anteriorly in two individuals and posterolaterally in four patients who reported proximal ulna and proximal radius fracture symptoms.

Radiographic examination

For the purpose of confirming the diagnosis and determining the kind of fracture, standard X-rays were obtained in the anteroposterior and lateral views. Out of 20 patients, 14 had an upper third ulnar diaphysis fracture with anterior angulation at the fracture site and an accompanying anterior radial head dislocation. According to Bado's categorization, this was a Type 1 fracture-dislocation. Two of the fourteen instances had comminuted fractures, six involved transverse fractures, and six involved short oblique fractures. Four patients had Type 3 fractures of the ulnar diaphysis, which included posterior angulation at the fracture site and posterolateral dislocation of the radial head. Three of the four instances were transverse, while the fourth was short oblique. The proximal third of the radial and ulnar bones in two individuals were fractured at the same level with anterior radial head dislocation, resulting in a Type 4 fracture-dislocation. The ulna in this example had a slight oblique fracture. There were no Type 2 fracture-dislocations.

The above elbow POP posterior slab was used to immobilize the upper limb. Keep the injured limb elevated. Oral analgesics like Brufen 400 mg twice a day and Diclofenac sodium 50 mg with serratiopeptidase were used to treat pain and inflammation.

Urine was routinely checked for the presence of albumin and sugar. Hemoglobin percentage, total and differential white blood cell counts, fasting blood sugar, blood urea, serum creatinine, and bleeding and clotting time were all tested in the blood examination. The tests included HIV, HBsAg, and electrocardiogram.

Neurosurgeons treated one of the patients who had suffered a brain injury. After receiving an extradural hemorrhage diagnosis, she had surgery. Another patient underwent surgery for a contralateral ulnar shaft fracture at the intersection of the middle and lower third.

One of the female patients was hurt when she fell to the ground. The patient was seen 10 weeks following the injury. Before arriving at the hospital, the patient had not received any therapy anywhere.

In every instance, physician fitness was attained. After completing the pre-anesthetic checkup, patients were then ready for surgery.

Surgical procedure

(a) Anesthesia: General anesthesia was used for the procedure.

(b) Position and tourniquet: The injured leg was exsanguinated after being held in an elevated posture for 2 to 3 min. The patient was then placed in a lateral posture with the elbow flexed 90° and supported by a wooden block covered in sterile cloth after a mid-arm pneumatic tourniquet was applied. The surgical site was meticulously cleaned before being wrapped and coated with iodine and spirit.

(c) Technique: First, traction on the forearm and counter traction on the arm were used to try and minimize the dislocation of the radial head. When the elbow is bent between 110° and 120°. After the radial head dislocation had been minimized, the radial head could be felt immediately below the lateral epicondyle. A vertical incision was made along the ulna's subcutaneous boundary, 10 cm or so distally from the olecranon. Along the skin's incision line, fascia was cut. An opening was created between the flexor and extensor carpi ulnaris, and the fracture site was exposed by making an incision into the ulna's periosteum. Each fracture end had enough periosteum scraped off of it utilizing a

periosteal elevator. The fracture site was gently curetted with a little curette after the fracture hematoma was removed. The AO universal bone-holding forceps helped to accomplish and maintain accurate anatomical reduction.

The fracture site was then covered with a narrow, six-holed 3.5 mm dynamic compression plate, which was then tightly clamped to the two pieces with two tiny self-retaining forceps. A hole was made in the closest bone fragment from one end of the bone using a hand drill or power drill equipped with a 2.5 mm drill bit and a neutral drill guide. The length of the screw was measured using a depth gauge. To attach the plate to one piece, the hole was then tapped, and a 3.5 mm cortical screw was then inserted into the hole using a hexagonal screwdriver. Later, using an eccentric drill guide, a hole was made in the second fragment through the plate's hole located directly next to the fracture.

The screw was fitted with a hexagonal screwdriver after the depth gauge was used to measure the screw's length. The underlying bone moves toward the fracture site when the screw is inserted, creating compression at the fracture site. The fracture site was right-angled and clamped with a third bone gripping forceps. After drilling holes through the dynamic compression plate into the bone on each side, 3.5 mm cortical screws were placed to firmly hold the plate to the bone. On either side of the fracture site, a total of 3 screws were installed.

Once stiff fixation was attained, the incision was stitched up in layers and a sterile compression dressing was placed with the elbow flexed 100–110° and the forearm supinated to stop the radial head from realigning. After the tourniquet was released, a posterior POP slab was used to immobilize the limb. To ensure that the radial head has stayed decreased and the ulna is adequately secured, a check X-ray was obtained.

Post-operative management

After administering injection Cefotaxime 1 g twice daily for 5 days, all patients received tablet. For 5 days, use cefixime 200 mg twice a day. Amikacin 500 mg was administered intravenously twice a day for 5 days in certain situations.

Anti-inflammatory analgesics, such as injection Diclofenac for 3 days, followed by oral Diclofenac sodium 50 mg with serratiopeptidase twice daily or Brufen 400 mg twice daily, were used to treat post-operative pain and inflammation. On day 1 and every day after, the patient was requested to do finger motions while the affected limb was maintained elevated.

The posterior slab and the sutures were taken out on the 10th day, a long arm cast with the elbow flexed was put on, and the patients were then allowed to go home.

When the cast was taken off after 4 weeks, the elbow was kept between 110° and 120°, and the extremity was supported by a cuff and collar sling. Gentle supination and pronation motions were allowed, but extension below 90° was not until 6 weeks following the injury.

A thorough clinical examination was performed during the 6-week checkup, and the patient's subjective complaints including discomfort and joint mobility limitation were evaluated. During a clinical examination, the elbow joint's motions, nutrition, and the strength of the muscles operating on the joint were recorded. For radiological examination of the fracture union, check X-rays were performed. Active exercises such as active flexion, extension, pronation, and supination without loading were prescribed for the patients to perform at home.

Patients were thereafter instructed to return for follow-up visits after 12 weeks and then every 3 months. Three months following the operation, the results were evaluated. Patients were evaluated identically after 6 weeks' follow-up and at 12 weeks' and 3 months' follow-up. A check set of X-rays was performed to evaluate the radiological union.

The “Anderson *et al.*” grading system (1975) was used in the study to evaluate the outcomes of all treated Monteggia fracture-dislocations.

The outcomes were rated based on Anderson *et al.*'s standards. A favorable outcome was defined as a union of the fracture, a reduction in wrist or elbow flexion and extension of <10°, as well as a reduction in pronation and supination of <25%. A successful outcome included the union of the fracture, a loss of wrist or elbow flexion or extension of less than 20°, and a loss of pronation and supination of <50%. When there was a union of the fracture and either a loss of pronation and supination of more than 50% or a loss of flexion and extension at the wrist or elbow of more than 20°, the outcome was considered poor. A non-union or untreated persistent osteomyelitis was a failure.

Anderson *et al.*, scoring system (1975) [5].

| Results | Union | Flexion/Extension at the elbow joint | Supination and pronation |
|----------------|---|--------------------------------------|--------------------------|
| Excellent | Present | <10° loss | <25% loss |
| Satisfactory | Present | <20° loss | <50% loss |
| Unsatisfactory | Present | >20° loss | >50% loss |
| Failure | Non-union with/with or without loss of motion | | |

Nineteen of the cases were new fractures, in which the radial head was closed down and the ulna was secured with a dynamic compression plate. No annular ligament restoration was performed in any of the instances, and there was no instance of radial head redislocation.

The radial head was removed from the patient who arrived late to the hospital, and the margins of the ulnar pieces were cleaned and secured with a six-holed dynamic compression plate. This patient did not have any bone transplantation.

During the healing process for one patient, finger drop symptoms (injury to the posterior interosseous nerve) appeared. After 3 weeks, this patient experienced a spontaneous recovery.

Staphylococcus aureus and *Klebsiella* organisms were shown to be sensitive to Cefoperazone in three individuals who had superficial infections. These patients were treated with injection Cefoperazone 1 g twice a day. The superficial infections in all three cases disappeared within 10 days. No patient developed a severe infection.

RESULTS

The present study consists of 20 cases of Monteggia fracture-dislocations in adults treated by closed reduction of the radial head with open reduction and internal fixation of the ulna with dynamic compression plate and screws in Government General Hospital, Mahabubnagar during the study, September 2019 – February 2021. All the cases were simple fracture-dislocations. All cases were followed up periodically during the period 2019–2021.

The following are the observations made and the available data are analyzed as follows.

In this study, seven (35%) patients were between 21 and 30 years, eight (40%) patients were between 31 and 40 years, three (15%) were between 41 and 50 years, one (5%) patient was between 51 and 60 years and patients below 61 years were one (5%). Out of 20 patients, 11 (55%) were male and nine (45%) were females showing male preponderance with a ratio M: F-1.2:1. Monteggia fracture-dislocations on the right side of the patient in 12 (60%) and left side of patients in eight (40%) cases. In this study, there were 11 (55%) patients with road traffic accidents, eight (40%) patients with falls, and one (5%) patient with assault. In the study 14 (70%) of the cases were of Type I Bado’s classification, four (20%) of cases Type III, two (10%) Type IV, and none in Type II (10%) fractures. All the cases were operated on our regular operation theater days, at the earliest possible time average duration of hospital stay is 5.13 days and

Table 1: Demographic details in the present study

| Age in years | No. of cases | Percentage |
|--|--------------|------------|
| 21–30 | 7 | 35 |
| 31–40 | 8 | 40 |
| 41–50 | 3 | 15 |
| 51–60 | 1 | 5 |
| 61–70 | 1 | 5 |
| Gender | | |
| Male | 11 | 55 |
| Female | 9 | 45 |
| Side | | |
| Right | 12 | 60 |
| Left | 8 | 40 |
| Mechanism of injury | | |
| Road traffic accidents | 11 | 55 |
| Fall from height | 8 | 40 |
| Assault | 1 | 05 |
| Type | | |
| I | 14 | 70 |
| II | 0 | 0 |
| III | 4 | 20 |
| IV | 2 | 10 |
| Duration | | |
| 2–10 days | 20 | 100 |
| Associated injuries | | |
| Head injury | 1 | 5 |
| Contra lateral fracture shaft of ulna and ipsilateral upper tibia fracture | 8 | 40 |

Table 2: Duration of fracture union

| Time of union | No. of cases | Percentage |
|-----------------|--------------|------------|
| < 4 months | 15 | 75 |
| 4–6 months | 5 | 25 |
| 6 months–1 year | - | - |
| Non-union | - | - |
| Total | 20 | 100 |

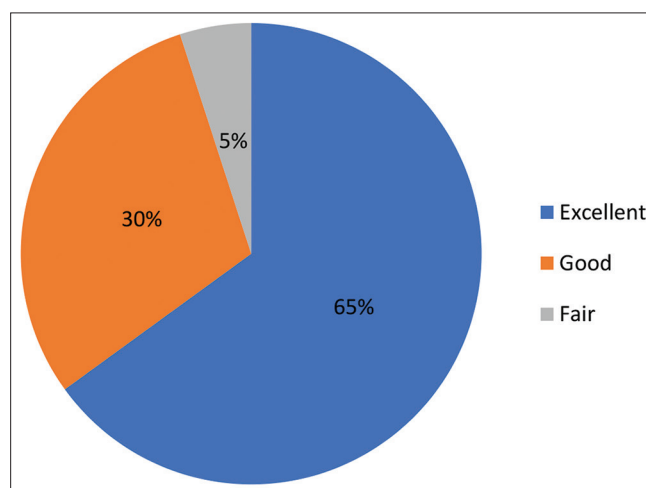


Fig. 1: Range of motion in the present study

range from 2-10 days. All the cases were fixed with AO 3.5 mm dynamic compression plates and screws (Table 1). In the present study, the radial head was reduced in 19 (95%) of cases, and radial head excision in one (5%) of cases. Annular ligament reconstruction was not done in any of the cases. There was no case of redislocation of the radial head. In the present study, one patient had a head injury, treated by a neurosurgeon, who was diagnosed to have an extradural hemorrhage, and she was operated for the same. The patient who had a fractured shaft of the ulna was treated by a 3.5 mm dynamic compression plate and screws and

Table 3: Complications in comparison to the present study

| Complications | Reckling[10] (%) | David and Waters[9] (%) | Bruce et al.[8] (%) | Chapman et al.[6] (%) | Present series (%) |
|---------------------------------|------------------|-------------------------|---------------------|-----------------------|--------------------|
| Proximal radio-ulnar synostosis | 6.25 | 6.25 | 6 | - | - |
| Superficial infection | - | - | 6 | - | 15 |
| Nerve palsy | - | 8.3 | 17 | - | 5 |
| Non-union | 6.25 | 2.1 | 35.5 | - | - |
| Delayed union | - | 4.1 | - | 7.5 | - |
| Malunion | 31.25 | - | - | - | - |

Table 4: Functional results in comparison with other studies

| Results | David and Waters[9] (%) | Bruce et al.[8] (%) | Reckling[10] (%) | Chapman et al.[6] (%) | Present series (%) |
|----------------|-------------------------|---------------------|------------------|-----------------------|--------------------|
| Excellent | 37.5 | - | - | 67 | 13 (65%) |
| Satisfactory | 43.75 | 30 | 23 | 15 | 6 (30%) |
| Unsatisfactory | 8.3 | 20 | 58 | 18 | 01 (5%) |
| Failure | 10.45 | 50 | 19 | - | - |

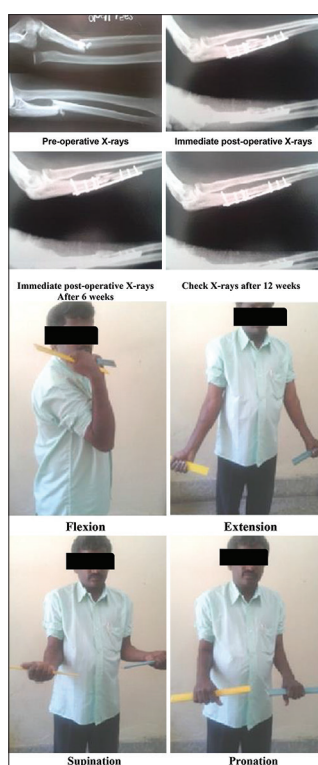


Fig. 2: Images of cases in the present study

the fracture upper tibia was treated with IMIL nail fixation and both the fractures united by 6 weeks after the surgery.

When there was no clinically detectable discomfort or subjective complaints, as well as no fracture line apparent on radiographs, the fracture was regarded to be healed.

Fractures that healed 6 months later without the need for additional surgery were deemed to have a delayed union. Non-union was defined as a fracture that did not heal after 6 months or that required extra surgical intervention to heal.

15 (75%) patients had a sound union in <4 months, 5 (25%) had a union between 4 and 6 months, and no patient developed non-union (Table 2).

Using Anderson et al., scoring system, we had 13 (65%) excellent results, six (30%) satisfactory results, one (5%) unsatisfactory results, and no failure 51 (Figure 1).

No patients had intraoperative complications (Figure 2). Three patients experienced superficial infections, which were treated with an injection of Cefoperazone 1 g twice daily for 10 days. Culture and sensitivity tests revealed that the patients' *Klebsiella* and *S aureus* infections were susceptible to Cefoperazone. One side effect of posterior interosseous nerve damage – finger drops – recovered on its own after 3 months (Table 3).

DISCUSSION

Adult Monteggia fracture-dislocations are a difficult condition to manage. As one of the more challenging fractures that orthopedic surgeons are aware of, fracture dislocations are notoriously difficult to cure and have been linked to a number of problems. Although casts and closed manipulations have historically been used to treat Monteggia injuries, these techniques are currently only thought to be effective in pediatric patients [6].

Bado and Evans [7] all used closed reduction and casting, but Speed and Boyd found that this method did not produce optimum results in adults. Most recent authors such as Anderson et al., Reckling[10] recommend open reduction and compression plate fixation of the ulna and closed reduction of the radial head [5].

The term “fracture of necessity” refers to these fractures, which must be treated in fresh instances with open reduction, internal fixation of the ulna, and closed reduction of the radial head. This is accomplished by internal fixation of the ulna with a dynamic compression plate and screws and open reduction of the ulna.

The purpose of the present study was to corroborate the statements made by many authors on the surgical therapy of Monteggia fracture-dislocations and the effectiveness of utilizing 3.5 mm dynamic compression plates and screws to treat these fractures.

These findings were contrasted with those of several other researchers that used diverse therapeutic techniques. The analysis is shown below. With an average age of 35.9 years, fracture-dislocation was prevalent in this study's third and fourth decades.

These findings are comparable to a study made by Bruce et al. [8], showing the fracture-dislocation being common in the third and fourth decade of life. In David and Waters [9] conducted studies which showed an average age of 52 years (18–88) and this series showed an average of 35.9 years (21–70 years). This series had a male preponderance of 55% and 45% female patients, which could be compared to studies of David and Waters with similar observations. In the series conducted by David and Waters [9] average duration of follow-up was 6.5 years (2–14 years), (Table 4) in Reckling [10] study, the average duration of

follow-up was 2.5 years (6 months–5 years). In this series the average follow-up was from 9.5 months (5–15 months). David and Waters accounted to 33.5% of his cases of road traffic accidents. About 64.5% to fall and none to assault. Bruce *et al.* observed that 43.0% of cases were due to road traffic accidents; about 31.7% were due to falls and 25.3% to assault. The study conducted by Reckling showed road traffic accidents in 29.75% fall in 64.84% and assault in 5.5% of cases. In the present series, road traffic accidents were in about 55% of cases, fall in 40% of cases, and assault in 5% of cases.

Based on Bado's classification, a study conducted by Henry showed 79% of cases to be Type I, 12% of cases Type II, 6% of cases Type III, and 3% of cases Type IV. David and Waters noted about 14.5% Type I fracture-dislocations in 79.25% of cases Type II, 2.09% of cases Type III, and Type IV in 4.16% of cases. Fredrick noted that 70% of cases are Type I, 18% are Type II, 12% of cases Type IV, and no cases in Type III. In the present series, we had 70% of fracture-dislocations to be Type I, no cases in Type II, 20% cases in Type III, and Type IV comprising 10% of cases which correlated with studies of Bruce *et al.* and Reckling [10].

In a series conducted by Reckling [10], radial head reduction was done in 63.45% of cases and excision in 36.55% of cases. In the present series 95% of cases, the radial head was reduced, and in 5% of cases it was excised.

In a series conducted by Reckling [10], 6.25% of cases had proximal radioulnar synostosis, 6.25% non-union, and 31.25% malunion. David and Waters noted 6.25% of cases had proximal radioulnar synostosis, 8.3% nerve palsies, 2.1% non-union cases, and 4.1% delayed union cases. Bruce *et al.* stated that 6% of cases in his study had proximal radioulnar synostosis, 6% superficial infection, 17% nerve involvement, and 35.5% of cases went for non-union. Chapman *et al.* [6] noted 7.5% delayed union cases. In this study, superficial infection in 15% of cases, and posterior interosseous nerve injury were noted.

The functional result was assessed by determining the range of motion and evaluated using Anderson *et al.* [5], scoring system. David and Waters reported that 37.5% of excellent results, 43.75% of satisfactory results, 8.5% of unsatisfactory results, and failure in 10.45% of cases. Henry reported 30% of cases to be satisfactory, 20% unsatisfactory, and 50% failure. Reckling reported that no case had excellent results. About 23% of cases were satisfactory, 58% unsatisfactory and 19% of cases to be non-union. Chapman *et al.* reported that 67% have excellent results, 15% satisfactory, and 18% unsatisfactory results. The present series had 65% of cases to be excellent, 30% satisfactory, 5% unsatisfactory and no cases went for failure.

CONCLUSION

The goal of the present study was to assess the problems associated with the kind of Monteggia fracture-dislocation—and the functional result following closed reduction of the radial head and open reduction and internal fixation of the ulna.

According to the findings of the present study, adults with Monteggia fracture-dislocation can be successfully treated with the early closed reduction of the radial head and the open reduction and internal fixation of the ulna using a minimum of six holed AO 3.5 mm dynamic compression plates. According to Bado's categorization, Type 1 Monteggia fracture-dislocation occurs more frequently in adults. To avoid radial head redislocation, the upper limb should be immobilized with the elbow flexed 110°–120° and the forearm supinated.

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