Research Article
Missed Monteggia fracture

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Missed Monteggia fracture in children- A case series

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Background: Missed Monteggia fractures in children may cause pain, deformity, decreased range of motion, and neurological symptoms. Various surgical techniques have been advised to reconstruct long-standing Monteggia injuries to get long-term upper limb function. The purpose of this study was to assess the clinical and radiographic results of surgical technique for missed Monteggia fracture-dislocations.

Material and method: A prospective evaluation of 5 patients who underwent surgical reconstruction of missed Monteggia fracture-dislocations was performed. The median patient age at the time of surgery was 10 years, and the median time from injury to surgery was 13 weeks. Median clinical and radiographic follow-up was one year.

Results: The median elbow range of motion improved from 90 degrees of flexion and 5 degrees short of full extension preoperatively to 120 degrees of flexion and full extension postoperatively. Forearm range of motion also improved from a median of 80 degrees of pronation and 60 degrees of supination preoperatively to 80 degrees of pronation and 80 degrees of supination postoperatively. Congruent radiocapitellar alignment was maintained in 4 patients. One patient had redislocation of the radiocapitellar joint, and 1 patients had radiographic re-subluxation. One of the 5 patients who experienced redislocation underwent early revision and achieved uncomplicated long term result.

Conclusion: Good improvements in elbow motion and radiocapitellar stability can be safely achieved in the majority of children following surgical reconstruction of missed Monteggia lesions.

Keywords: Khare et al. Missed Monteggia fracture in children

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Introduction

Monteggia fracture, characterized by proximal one third of ulna shaft fracture combined with radial head dislocation, was first described by Monteggia et al. in 1814, while recent studies included fracture of the olecranon (1). With an incidence of less than 2% of forearm injuries in children and adults, this rare combination injury could eventually lead to forearm deformities and dysfunction, if not diagnosed at an early stage, resulting in neglected Monteggia fracture (NMF) (1).

Though Monteggia fracture is well defined as radial head dislocation combined with proximal ulna fracture, the exact time point to consider a chronic phase Monteggia fracture is controversial. Recent studies recommended over 4 weeks after injury as the dividing line for Neglected Monteggia Fracture, as malunion of the ulna had already formed. If not diagnosed at an early stage, these lesions can gradually lead to forearm deformities and dysfunction, finally resulting in neglected Monteggia fracture. When the radial head is not reduced, several deformities develop at the humeroradial joint, including cubitus valgus and osteoarthritis. Adequate radiographs are crucial when the surgeons deal with forearm injuries. Opening-wedge osteotomy of the ulna restores normal ulnar length and corrects the angulation of the ulna in patients with chronic Monteggia fracture-dislocations. In addition, this eases the reduction of the radial head. Morbidity caused by annular ligament reconstruction surgery can be prevented by preserving the intact annular ligament. After dilatation and mobilization of the annular ligament, reduction of the radial head can be accomplished. Patients who receive repair of the native annular ligament were more likely to achieve lasting radiocapitellar joint stability when compared with patients who received annular ligament reconstruction or if the annular ligament was not addressed. (2) This study evaluated the effectiveness of corrective opening-wedge ulnar osteotomy and radial head relocation into the intact annular ligament in the treatment of pediatric chronic Monteggia fracture-dislocation. (4)

Our patients functionally benefited from the procedure with significant improvement in elbow pain and stability, as well as improved flexion of the elbow with stable radial head reduction. Fracture dislocations are classified according to the Bado radiological classifications. (5)

Type	Radial head dislocation	Ulnar fracture	Pediatric proportion (%)
Bado I	Anterior	Anterior angulation	70
Bado II	Posterior/posterolateral	Posterior angulation	6
Bado III	Lateral/anterolateral	Metaphyseal fracture	23
Bado IV	Anterior	Concomitant radial fracture	1

Figure 1: Bado classification of Monteggia fractures and characteristics.

Material and method

We prospectively studied the clinical and radiographic outcomes for five children with a missed Monteggia fracture. The study group included three boys and two girls who had a mean age of ten years (range, four years to sixteen years) at the time of open reduction.

Each patient had been managed with open reduction of the radial head combined with a posterior bending elongation ulnar osteotomy and without annular ligament reconstruction. Clinical and radiographic outcomes were reviewed over a mean duration of follow-up of one year.

Case 1:

Figure 2: Missed Monteggia in 5 yr old girl

Figure 3: Elbow hyperextension

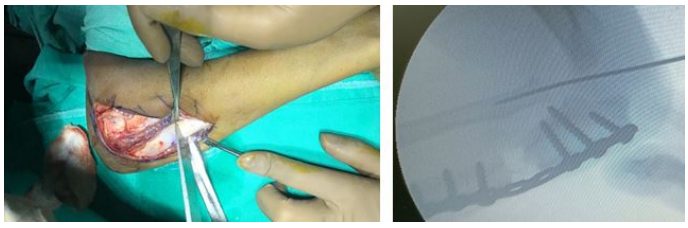

Figure 4 and 5: Intra operative pictures

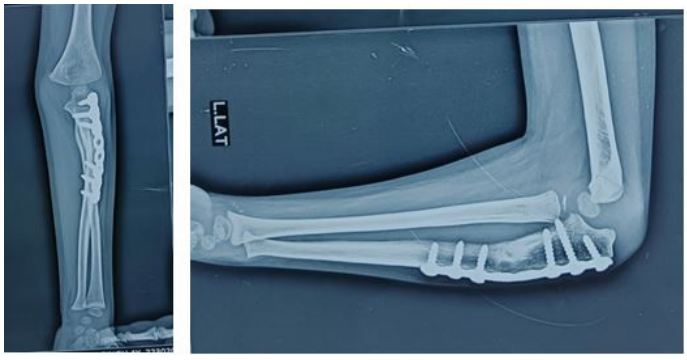

Figure 6 and 7: Follow up xray


Figure 8 and 9: Follow up clinical pictures

Case 2:

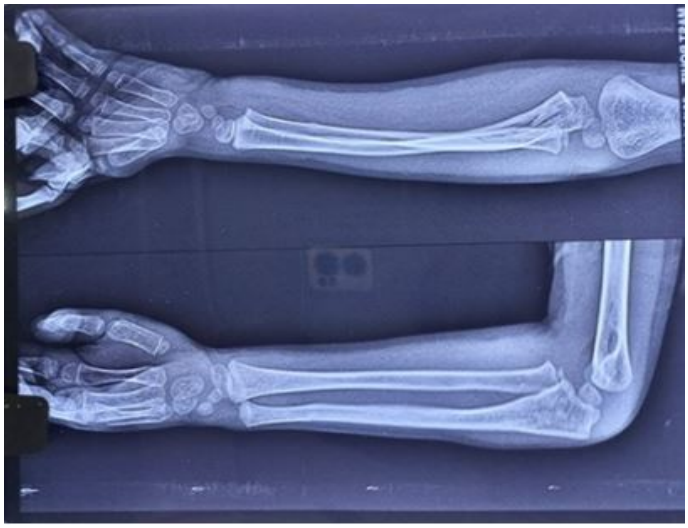

Figure 10: Pre op X-ray

Figure 11: Post op xray


Figure 12: Follow up of patient with nonunion and deformity



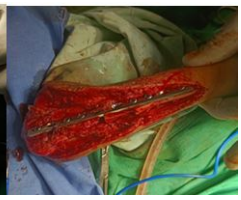

Figure 13, 14 and 15: Revision surgery of patient



Figure 16, 17 and 18: Follow up of patient

Results

The postoperative Mayo Elbow Performance Index at the time of follow-up ranged from 65 to 100, with three excellent, one good, one fair, and no poor results. The radial head remained in a completely reduced position in four patients and was subluxated in one patient at the time of the latest follow-up. Radiographically, there were four good, one fair, and no poor results. A good radiographic result was obtained in one of the patients who had undergone open reduction within three months after the injury or before the age of twelve years, whereas a fair result was obtained in one of the remaining four patients.

Disscussion

Monteggia's fracture-dislocation is rare in pediatric traumatology and pose a problem of elapsed time before management and of prognosis. Fracture dislocations are classified according to the Bado radiological classifications. For functional assessment, the choice of treatment was based on the type of fracture. The average age of our study population was 10 years; 3 cases of fractures were classified as Bado I and 2 cases as Bado III. At present, proximal ulnar osteotomy and open reduction of chronic radial head dislocation provides satisfactory functional outcomes because of anatomic alignment reconstruction(7). Park et al. (8) noted that the location of ulnar bow and its magnitude could likely determine whether osteotomy should be performed. Reduction of the radial head could be performed alone in patient whose maximum ulnar bow is less than 4 mm or whose ulnar bow lies in distal 40% of the ulna (9).

Di Gennaro et al. (10) reported that proximal one-third ulnar osteotomy presents significantly lower rate of nonunion than osteotomy of middle and distal ulna. However, in NMF patients with severe curvature of the ulna, osteotomy could be performed where the deformity is most obvious or based on the center of rotation angulation.

Internal or external fixation should be applied to stabilize the ulnar or to proceed further correction of the deformities.

Locking compression plate could guarantee adequate stability in younger patients with mild deformities, while the gap between two osteotomy sites often requires bone graft (11)

Bor et al. (12) reported four patients who were treated with closed reduction, proximal ulnar osteotomy, and Ilizarov external fixator received good clinical outcomes. Similar results were then reported by Take et al. (13) and Yuan et al. (14). Minimally invasive operation with external fixation allows gradual and spatial correction of the ulnar deformity to reduce the displaced radial head without invading the humeroradial joint, but long duration of wearing the frame could bring certain inconvenience to daily activities and needs higher compliance of the patients (12).

Open reduction of the radial head was employed by most studies. Gallone et al. (15) found no significant difference in the rate of recurrence of dislocation between close and open reduction of the radial head.

The repositioning and reconstruction of annular ligament should be taken into consideration in NMF patients because it stabilizes the radial head during forearm rotation and prevents redislocation (16).

In NMF cases with intact annular ligament, different studies reported improved elbow mobility and stability with or without reconstruction of the annular ligament (17, 18). Other studies suggested that the reconstruction of annular ligament could be avoided unless there was detectable rotational instability of the radial head after reduction intraoperatively (19).

Excessive angulation after osteotomy of the ulna could lead to re-dislocation of the radial head and requires a second surgery to enhance stability of the radiocapitellar joint. Besides, Bado III NMF was reported with higher rate of recurrence of radial head luxation, indicating that annular ligament repair is unavoidable (20).

Conclusion

Monteggia fractures become challenging if not noticed within 4 weeks after injury. Patients then require surgery to reduce the radial head and correct forearm deformities. Classification system should take dislocation of PRUJ in to consideration, which would direct management and prognosis. Also, detailed examinations, especially radiographs, should be taken when the surgeon deals with forearm trauma. Surgical intervention, including osteotomy and angulation of the ulna, reduction of the radial head, internal or external fixation and reconstruction of the stability of the PRUJ and radiocapitellar joint, could bring satisfactory outcomes to NMF patients, while site for osteotomy of the ulna, fixation method, and whether the annular ligament needs reconstruction varies from studies.

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