

# Functional Outcomes of Paediatric Missed Monteggia Fractures Managed with Angulation Distraction Osteotomy of Ulna - A Case Series

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**Abstract:** *Introduction:* The aim of our study is to evaluate the medium- and long-term functional outcomes of missed Monteggia fractures managed with angulation distraction osteotomy of ulna without annular ligament reconstruction. *Methods:* This is a single centre prospective study conducted in 10 patients who were followed up for 2 years. Patients were evaluated postoperatively using Mayo elbow performance index and radiologically using radiocapitellar line. *Results:* Mean duration of presentation was 13 months with a mean age of 7 years and the mean followup of the patients were 2 years. 90% of cases were Bado type-I and 10% of cases were Bado type-III. The results were excellent in 40%, good in 50% and poor 10%. *Conclusion:* Angulation distraction osteotomy of the ulna provides good functional outcomes in missed Monteggia if intervened early. Annular ligament reconstruction is not a dictum.

**Keywords:** Paediatric Missed Monteggia Fracture, Angulation Distraction Osteotomy, Ulna

## 1. Introduction

Monteggia fractures account for 2 % of all paediatric forearm fractures. Yet up to 40 % of cases are missed due to failure to identify plastic deformation of ulna, inadequate X-rays and late presentation of patients to the hospital. Missed Monteggia fractures are associated with debilitating complications if its natural course is not interfered with. Missed Monteggia fracture is defined as a fracture that is neglected for more than 4 weeks, where the radial head becomes irreducible by closed methods.

Various surgical procedures have been defined for the management of missed Monteggia fractures which include annular ligament reconstruction, external fixator assisted reduction of the radial head, hyperangulation and lengthening of ulna, sliding angulation osteotomy of ulna or a combination of these techniques.

The aim of this study is to analyze the functional outcomes of missed Monteggia fractures managed with angulation distraction osteotomy of ulna with open reduction of the radial head without annular ligament reconstruction.

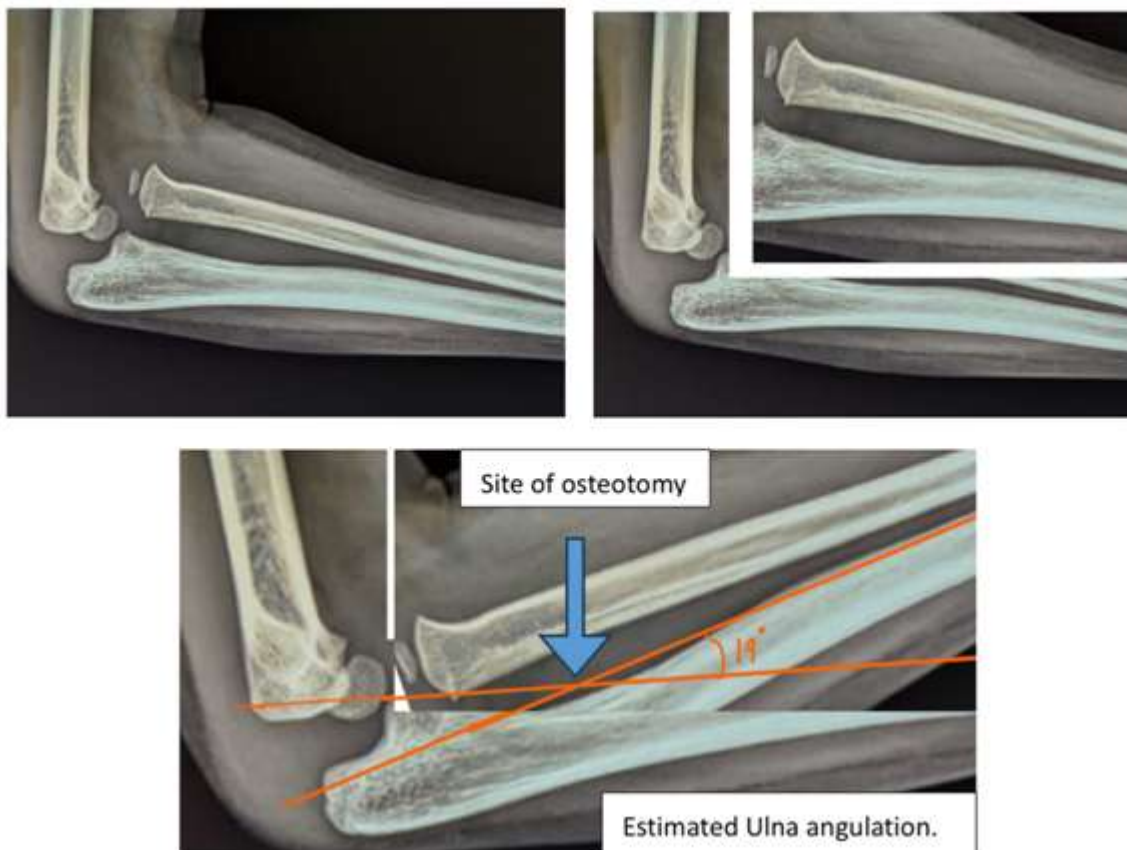
## 2. Materials and Methods

We did a single centre study at Institute of Child Health,

Egmore, Chennai, Tamilnadu. We had 10 cases of missed Monteggia fractures between 2016-2023 with a mean age of 7 years. Most common type was Bado type-I (9 cases) followed by Bado type-III (1 case). There were no cases of Bado type-II and Bado type-IV was not included. Male: Female ratio was 7:3. Right side was involved in 6 patients. The mean duration of presentation from the time of injury was 13 months. We followed the standard procedure of open reduction of radial head with angulation distraction osteotomy of ulna with reconstruction plate fixation in all patients. We did not perform annular ligament in any of the cases. Post operatively, functional outcomes of the patients were calculated using Mayo Elbow Performance Index (MEPI) and patients were categorized into one of the four categories as excellent, good, fair or poor. The mean duration of followup of patients were 2 years.

### Preoperative planning:

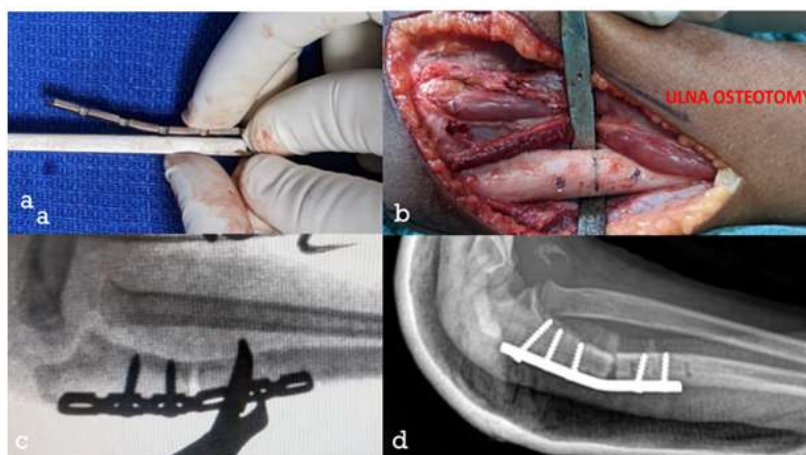
Pre-operative X-ray were used for PowerPoint templating in order to estimate the required angulation in ulna after osteotomy and the site of osteotomy in the ulna as described in the study by Hsuan-Yu Chen et.al., using Microsoft PowerPoint. This technique was used in BADO type-I fractures. The values obtained via templating were used as a reference, but the Intra operative radial head stability was the deciding factor in the amount of angulation and distraction in the ulna.



### 3. Surgical Technique

Procedure was done under tourniquet control with general anesthesia. We used the Boyd approach to expose both the proximal ulna and the radial head simultaneously. We used the Kocher's interval to access the proximal radius. A reconstruction plate was pre-bent to the angle measured in the Preoperative templating. Ulna osteotomy was done at the predetermined length from the olecranon tip using a saw and the pre-bent plate was fixed using screws to the proximal fragment. Ulna was distracted and angulated approximately to the predetermined angle. The direction of ulna angulation

was opposite the direction of radial head dislocation. After radial head reduction, distal ulnar fragment was held to the plate using AO clamps and the elbow was taken through the range of motion to check the stability of the radial head. Minor adjustments were done to the plate angulation and amount of ulna distraction based on the intra operative radial head stability. After that, distal ulna fragment was fixed using screws to the plate. Annular ligament reconstruction or condyloradial pinning was not required in any of the cases. Bone grafting was not done in any of the cases. Post operatively patient's arm was immobilized in above elbow slab with forearm in supination for 4 weeks.



a-Prebending of plate, b-Boyd approach to expose radius and ulna and ulna osteotomy done, c-Proximal ulna fragment fixed to plate and ulna angulated, d-Final plate fixation done after radial head reduction

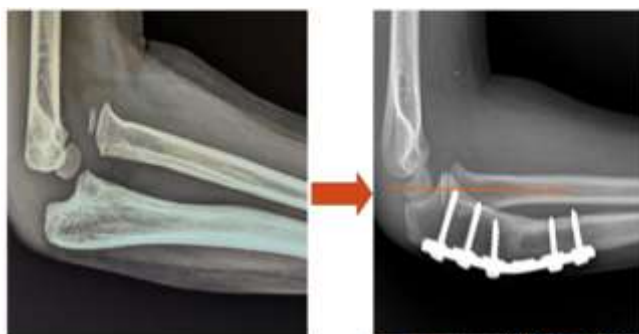


**Bado type-III Missed Monteggia where ulna was angulated medially and fixed. Good radiological and functional outcome and implant exit was done at 2 years.**



#### 4. Results

Functional outcome analysis was done using MEPI at one year post surgery which included evaluation of pain, range of motion, stability, daily function with a total score of 100. Preoperatively MEPI score was fair in 4 patients and poor in 6 patients. Post operative MEPI score at 1 year was excellent in 4 patients, good in 5 patients and poor in 1 patient. Post operative radial head position was assessed using the radio-capitellar line. One patient had radial head re-dislocation anteriorly and had a poor MEPI score. We experienced transient posterior interosseous nerve palsy in one patient which recovered. The average time for complete radiological union of the ulna osteotomy site was 10 weeks. We faced delayed ulna union in one patient which united at around 16 weeks.

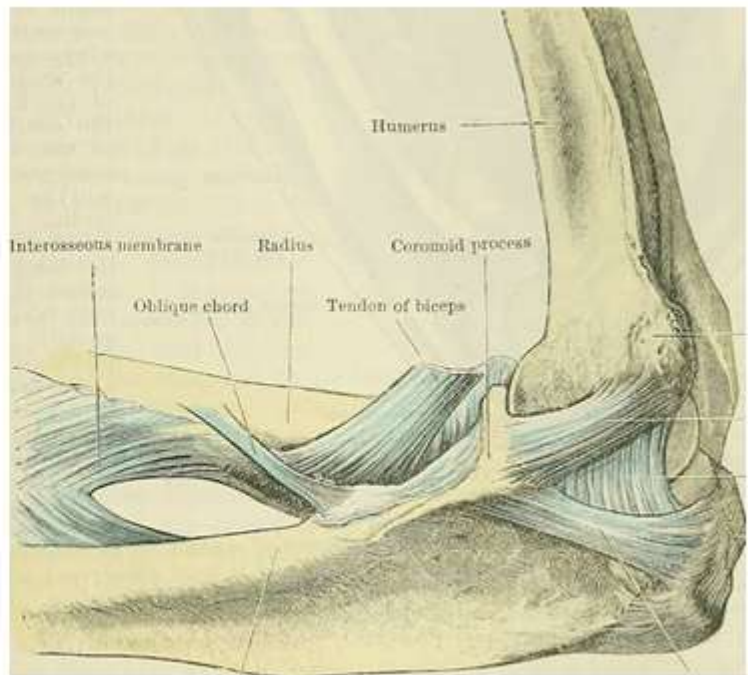
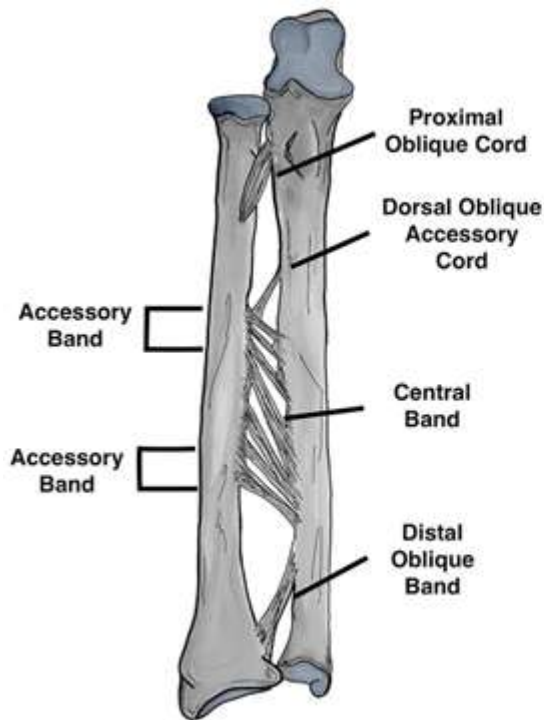


**Bado type -I Monteggia corrected with posterior ulna angulation. Excellent MEPI score at 1 year followup**



#### 5. Discussion

The complications of the missed Monteggia fractures include pain, stiffness, late osteoarthritis, progressive cubitus valgus, reduced range of movements, tardy ulnar nerve palsy. The rationale behind the angulation distraction osteotomy of ulna followed in our surgery is that the reduced radial head is kept in position by the pull of the interosseous membrane due to angulation of the ulna in the direction diametrically opposite the direction of the radial head displacement. As described by Kazuo Noda et al., proximal membranous portion of the interosseous membrane is made taut by the angulation of the ulna which in turn maintains the radial head in its position. Special mention should be given to the proximal oblique cord or the ligament of Weitbrecht originating from Anterolateral aspect of coronoid process and inserted distal to the radial tuberosity. According to Shane tubbs et al., the oblique cord of forearm was most taut in supination, so we immobilized the patient's forearm in supination after the procedure. Another factor to be taken into consideration is the amount of ulna angulation. The Preoperative angle calculated didn't always correlate with the Intra operative ulna angulation that was required to maintain the radial head in position. We had to increase the angulation in a few cases to achieve stability. This takes us to the concept of overcorrection of ulna angulation. Theoretically overcorrection must ensure that the radial head is well reduced. But according to Piyanch Musikachart et al., overcorrection of ulna angulation by more than 10 degrees resulted in dislocation of radial head in the opposite direction. The maximum overcorrection that we faced was 7 degrees more than what was calculated in the Preoperative templating. In one of the cases, we faced radial head red is location in the same direction due to under correction of the ulna angulation. We recommend avoiding both under correction and overcorrection by more than 10 degrees.



## 6. Conclusion

Ulna angulation distraction osteotomy provides very good results in missed Monteggia fractures without the need for annular ligament reconstruction provided that we achieve adequate angulation and fixation.

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