Section: Orthopaedics

Original Research Article

# A RETROSPECTIVE CASE SERIES OF CLINICAL, DEMOGRAPHIC CHARACTERISTICS AND TREATMENT OF MONTEGGIA FRACTURES IN A RURAL TERTIARY CARE HOSPITAL

*Shubham Nagre[1], Santosh Borkar[2], Manas Pusalkar[3], Abhinav Prabhu[4], Govind Tidke[5], Bhushan Adhari[6]*

[1,4,5,6]*Post Graduate Resident, Department of Orthopaedic, M.I.M.E.R Medical College Talegaon, Pune India*
[2]*Professor & HOD, Department of Orthopaedic, M.I.M.E.R Medical College Talegaon, Pune India.*
[3]*Assistant Professor, Department of Orthopaedic, M.I.M.E.R Medical College Talegaon, Pune India.*

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**Corresponding Author:**
**Dr. Abhinav Prabhu,**
Post Graduate Resident, Department of Orthopaedic, M.I.M.E.R Medical College Talegaon, Pune India.
Email: abhinav7597@gmail.com

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ABSTRACT

**Background:** Prompt diagnosis and treatment are crucial to prevent long-term disabilities in Monteggia fracture. Treatment varies from closed reduction in children to open reduction and internal fixation in adults. **Objectives:** The study aims to analyse outcomes and complications across Bado classifications.
**Material and Methods:** Retrospective analysis of 43 Monteggia fracture cases from July 2022 to December 2023 included demographic data, injury mechanisms, surgical details, and follow-up evaluations up to 9 months. Parameters assessed included m-DASH scores, complications, and functional outcomes.
**Results:** Out of 43 patients we got 22, 16, 3 and 2 patients' with Bado type 1,2,3 and 4 respectively. The m-DASH score at 9 months showed better functional outcome in Type 1 and Type 2 Bado classification patient as compared to Type 3 and Type 4 patient.
**Conclusions:** Timely surgical intervention and individualized approaches are critical for managing Monteggia fractures. Anatomical reduction, implant selection, and complications are essential for optimizing patient outcomes and minimizing long-term disabilities.
**Keywords:** Monteggia fracture, PIN palsy, open reduction, observational, Non-union.

## INTRODUCTION

Although rare, Monteggia fracture is a documented significant injury that is characterized as an accompanying fracture at any segment of the ulna associated with a radial head dislocation. In adult patients Monteggia fracture accounts for 0.7% of all elbow fractures and dislocations. [1-2]
Giovanni Battista Monteggia in 1814 was the first to describe these fractures and have since been a subject of significant interest among Orthopaedic surgeons due to its complications, complexity and severity.[3]
Dr. Mario Bado, an Orthopaedic surgeon from Argentinian 1956 classified theses fractures as follows: Type I which involved anterior dislocation and angulation; Type II which involved posterior dislocation and angulation; Type III which involved lateral dislocation and angulation; and Type IV which involved proximal third fracture of both bones along with anterior dislocation of the radial head. Type III which primarily affects children, is characterized by an ulna metaphysis fracture and lateral dislocation of the radial head (typically in greenstick). Type IV is exceedingly rare type of fracture. [4-5]
Treatment options include closed reduction in children, open reduction and internal fixation (ORIF) and in some cases, radial head arthroplasty. As compared to paediatric population adult patients present with more complex Monteggia fractures which require surgical intervention and management.[6]
The assessment of treatment outcomes for Monteggia fractures involves evaluating various clinical and radiological parameters.[7] Pain relief,

normal range of motion, and other functional outcomes are crucial indicators of surgical success. Additionally, the incidence of complications such as nerve injuries, non-union, periarticular ossification, radial head instability must be carefully monitored and treated. In contrast closed reduction and casting are typically reserved for paediatric patients with Type I Monteggia fractures. Prompt management with accurate initial diagnosis is crucial to achieve favorable outcomes, as delayed or inadequate treatment leads to long term outcomes such as chronic pain, limited range of motion, and deformities leading to disabilities in carrying out every day work.[8] The success of this method depends on multiple factors such as the age of the patient, the extent of ulnar angulation, and the presence of any associated injuries that may affect the outcome of the management.

There are relatively few studies in literature which document outcomes in Monteggia fractures and different studies have reported various outcomes in relation to the fracture type in Bados classification. Thus, fracture remains problematic and thus there is no consensus as such on ideal treatment method based Bados classification type. Hence, we decided to do retrospective study to analyse clinical, demographic characteristics and treatment of Monteggia fracture in a tertiary care hospital. We aimed to identify trends, challenges, potential area for improvement in management of Monteggia fracture and shed light on factors associated with good or poor outcomes of treatment.

This study is conducted at our hospital, which serves as a center for Orthopaedic trauma in our region. Over the years our institution has accumulated a substantial database of Monteggia fractures allowing for a comprehensive analysis of patient demographics, injury mechanisms, clinical presentations, radiological findings, treatment modalities, and long-term outcomes.[9]

Our study contributes to the existing knowledge and helps to fill the existing void in literature on Monteggia fractures by providing insights into the epidemiological characteristics and treatment outcomes of these injuries within our hospital's patient population. As previous studies have reported variations in treatment approaches and outcomes, our findings may offer valuable information to Orthopaedic surgeons and researchers worldwide. By analysing this case series of 43 patients, we aim to identify trends, challenges, and potential areas for improvement in the management of Monteggia fractures. The data collected in this study will also help guide clinical decision making and improve patient care in our institution and will help other Orthopaedic surgeons as well.

## MATERIAL AND METHODS

We carried out a retrospective observational study at M.I.M.E.R Medical College, Talegaon Pune over a period of 18 months from July 2022 till December 2023. We included patients of all age groups diagnosed with Monteggia fractures whose clinical data, radiological images and complete medical records were available for analysis. Institutional ethics committee approval was taken.

Fractures were classified according to Bado classification. A total of 43 patients were taken in the study. Patients who were managed conservatively or operatively were included in the study.

Patients' follow-up records on 2 weeks, 6 weeks, 4 months and final follow-up upto 9 months after treatment was collected. The data was analysed using m-DASH functional score at each visit. Variables studied were age, sex, time of hospitalization since injury, mechanism of injury, associated injury, nerve injury, operative time, time required for wound healing, image intensifier time in minutes, implant used for surgery, type of fracture reduction, intraoperative blood loss, length of incision, range of motion of elbow in degrees, time for union, implant related complications. Infection, skin necrosis, non-union at fracture site along with heterotrophic ossification, radioulnar synostosis etc.

Final reduction status of radial head was analysed as good (complete reduction), fair (reduction with subluxation or osteolysis) or poor (radial head dislocation)

Elbow performance was also based on 3 parameters besides m-DASH score

1) Pain according to VAS score.
2) Range of Motion. (Flexion)
3) Time to return to work

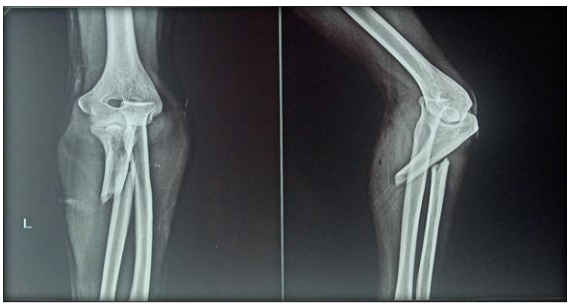

**Figure 1: Preoperative x ray anteroposterior and lateral view**

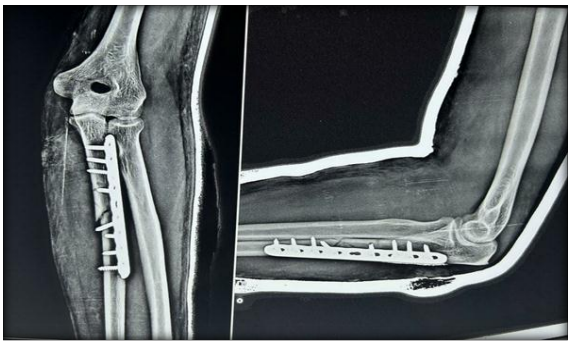

**Figure 2: Immediate postoperative x ray anteroposterior and lateral views**

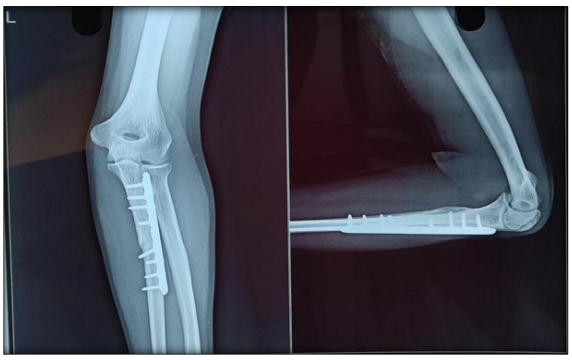

**Figure 3: 9months postoperative x ray anteroposterior and lateral views**

## RESULTS

The total sample size was 43 individuals. Among these 35 individuals were identified as male, comprising 81% of the total. In contrast, 8 individuals were identified as female, constituting 19% of the total sample.

The total sample size comprises 43 patients. Among these, 4 patients were less than 18 years old. The remaining 39 patients were more than 18 years old.

**Table 1**

| Bado classification | No of patients | Vascular injury | Nerve injury |
|---|---|---|---|
| 1 | 22 | 0 | 5 |
| 2 | 16 | 0 | 4 |
| 3 | 3 | 0 | 1 |
| 4 | 2 | 0 | 0 |

Above table 1 categorizes patients based on the Bado classification system, detailing the number of patients in each classification along with incidents of vascular and nerve injuries. Bado Classification 1 includes 22 patients none of whom suffered from vascular injuries while 5 patients had nerve injuries. Bado Type 2 comprises 16 patients, with no reported cases of vascular but 4 cases of nerve injuries. Only 3 patients fall under Bado Type 3 with no vascular injuries reported but 1 patient had a nerve injury. Bado Type 4 included 2 patients but no vascular or nerve injuries were reported.

Specifically, 32 cases, constituting 74.40 % of the total sample were attributed to fall from bike at high speed. This mechanism involves individuals falling and instinctively extending their hands, often resulting in injuries to the elbow joint. In contrast, direct injury to the elbow accounted for 4 cases, representing 9.30% of the sample. This category encompasses injuries directly caused by impact or trauma to the elbow region, which can occur due to various reasons such as accidents or sports-related incidents. Remaining 7 patients had a fall from height. Understanding these mechanisms is crucial in clinical settings for diagnosing and treating elbow injuries effectively, as each mechanism may lead to distinct types of injuries and complications.

**Table 2**

| Implant used for surgery | |
|---|---|
| Proximal ulna locking plate | 4 |
| Limited contact Dynamic compression plate 3.5 mm | 32 |
| Ulna nail | 4 |
| Closed Reduction with Cast | 3 |

Above table provides a breakdown of the types of implants used in surgeries, detailing the specific implants and their corresponding quantities. The "Proximal ulna locking plate" was used in 4 surgeries indicating its application in stabilizing fractures or injuries near the elbow joint's proximal end. A larger proportion of surgeries, 32 in total, utilized the "Limited contact Dynamic compression plate 3.5 mm," highlighting its versatility and effectiveness in treating various types of fractures and Orthopaedic conditions requiring stable fixation. Additionally, the "Ulna nail" was employed in 4 surgeries out of which 1 was a paediatric patient. 3 out of 4 paediatric patients were managed conservatively by Closed reduction and Casting. These implants provided anatomical reduction, restoration of length of ulna, which provided structural support and stability to facilitate the healing process and restore functionality to the affected upper limb.

In our series we encountered "Non-union of ulna or radius" which accounted for 6 cases. Post-operative nerve dysfunction was reported in 2 patients. Another complication noted was Malunion of ulna affecting 2 cases due to implant breakage, suggesting instances where the ulna bone healed incorrectly. Additionally, "Heterotrophic ossification" and "Instability of radial head" were each reported in 1 case, pointing to rare instances of abnormal bone growth or instability around the radial head. respectively due to poor selection of implants (ulna nail). These complications underscore the complexities and potential risks associated with Orthopaedic surgeries involving implants, necessitating careful consideration of implant selection, surgical technique, and post-operative management to mitigate such issues and ensure optimal patient outcomes.

**Table 3**

| m-DASH Score post-operative 9 months | I Total patients 22 | II Total patients 16 | III Total patients 03 | IV Total patients 02 |
|---|---|---|---|---|
| MINIMAL | 20 | 13 | 0 | 0 |
| MILD | 02 | 03 | 02 | 0 |
| MODERATE | 0 | 0 | 01 | 02 |
| SEVERE | 0 | 0 | 0 | 0 |
| | | | | |

The data presented in this table illustrates how m-DASH scores are distributed among different Bado types (1,2,3,4) categorized into minimal, mild,

moderate, and severe levels of disability. For Bado Type 1 fractures the majority (90.90%) scored in the minimal disability category. Conversely, only 2 cases (9.10%) fell into the mild disability category. Type 2 lesions showed a split distribution, with 81 % categorized as minimal disability (13 cases) and 19% as mild disability (3 cases). Bado Type 3 lesions exhibited more severe outcomes, with two cases falling into the mild (66.67%) and moderate 1 case (33.33%) disability categories. Type IV lesions exclusively fell into the moderate disability category without representation in the other categories. This distribution highlights the varying degrees of functional impairment associated with different types of Monteggia lesions with Type 3 and 4 lesions generally resulting in more severe disability compared to types 1 and 2.

Average surgical time since injury was approximately 4.3 days with average intraoperative blood loss being approximately 137ml for average incision length of approximately 9.8cm. In our institution we have to wait for local health insurance scheme for its approvals which can take easily between 4-6 days. There were 2 patients in our series who didn't present initially with nerve dysfunction but subsequently after waiting for definitive fixation developed nerve dysfunction. Hence, we strongly recommend to fix this fracture as soon as possible.

Average intraoperative time for surgery was approximately 1hr57 min with image intensifier time being approximately 23 min.

Pain according to average VAS score at 1 month was 6.2, at 3 months 4.2 and at 9 month was 1.3.

Average time of union of fracture was 18 weeks and patients returned to daily work at approximately 6 months with average Elbow flexion of 120 degrees.

## DISCUSSION

Monteggia fracture has incidence of approximately 1 to 2% of all forearm fractures.[10] We did retrospective study of Monteggia fracture in our tertiary care hospital from July 2022 to December 2023.

In our study, there was higher preponderance of Type 1 Bado fractures in patients above 18 years. Radial head was not reduced in 10 patients after ulna fixation which needed an open reduction and in 5 such patients there was soft tissue interposition which was cleared after open reduction and 2 patients who had comminuted radial head fractures needed radial head replacement and rest 3 required transfix K wire. In 2 patients radial head replacement solved the problem. In the remaining 3 patients we put intra articular K wire for ulnohumeral instability which was removed after 4 weeks. We didn't repair medial collateral ligament in any case.

Results of our study are consistent with other studies in the literature where we got good to excellent results in 88.37 % of cases (38 out of 43). Ring et al. followed 48 patients for 6.5 years got good to excellent results 83 % of patients.[3] G.G Konrad et al. reported good to excellent results in 32 out of 47 patients (73%) of cases.[11] In study by Suarez R et al. good to excellent results were noted in 84.09 % patient.[12]

In study by Roberto Suarez et al. closed reduction of radial head was possible in 93% cases after ulna open reduction internal fixation but in our study, it was possible in 76.74%cases.[12] This was due to interrupted soft tissue or non-comminuted radial head fracture in 5 cases and comminuted radial head fracture in 2 cases which needed radial head replacement and ulnohumeral instability due to comminuted coronoid fracture or medial collateral ligament injury in 3 cases. In these cases of ulnohumeral K wire and radiocapitellar K wire used for reduction and was necessary for 4 weeks. However radial head instability remained in 1 case in spite of taking all the precautions after removal of K wire.

According to Hubbard J et al. regarding posterior interosseous nerve palsy in Monteggia fracture dislocation due to direct trauma or entrapment of nerve between ulna and radius, stretching around radial neck while doing closed reduction.[13] Unreduced radial head can lead to tardy Posterior interosseous nerve palsy according to Sigamoney kv et al.[14] Also, most of the time injury is neuropraxia and there is no need to explore the nerve even if palsy in Monteggia fracture dislocation except in Type 3 Bado classification where attempting closed reduction can lead to PIN interposing into a radiocapitellar joint. Accordingly, out of 10 cases of posterior interosseous nerve palsy we encountered 5 cases in Bado's type 1 and none needed nerve exploration, 4 cases of posterior interosseous nerve palsy in Bado's Type 2. Full nerve recovery was the outcome in all patients in our series, average time of recovery was around 14 weeks. In one case with Type 3 Bado we explored radial head and Posterior Interosseous Nerve and we found Posterior Interosseous Nerve was intact and protected during reduction of radial head. This case also went into full recovery.

In our study second surgery was needed in 8 cases for non-union (6 cases) and malunion (2 cases). Out of all the patients underwent second surgery they recovered fully. This was similar to studied by Speed JS, Boyd HB.et al. [15]

In one patient, infection and delayed healing of the wound was observed. In this patient we continued wound management till fracture union and then infection settled after implant removal of plate and screw.

In cases of instability of radial head after removal of trans articular K wire, we had to do radial head excision later followed by physiotherapy. This patient had a poor outcome. This procedure was

done as recommended in the literature by Mazher F N et al,[16] However, we got poor results unlike them.

## CONCLUSION

Spectrum of injury of Monteggia varies from simple ulna fracture with radial head dislocation to complex fracture pattern with Comminution of ulna or radial head. This is a fracture associated with very high complication rates like nerve dysfunction, non-union and we strongly recommend to fix this fracture as soon as possible. Anatomical reduction of ulna fracture by plate given satisfactory results in most cases. In a few complex cases repair of soft tissue, radial head replacement or excision of radial head and transarticular K wire may be needed for good results in Monteggia fracture management.

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