

# Study of the Various Factors Involved in Monteggia Fractures Treated by Open Reduction and Internal Fixation in Government Medical College, Trichur

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## ABSTRACT

### BACKGROUND

The various factors involved in Monteggia fractures treated by open reduction and internal fixation (ORIF) were studied in patients presenting to Government Medical College, Trichur. Its distribution based on age, gender, and nature of trauma, were observed in the patients.

### METHODS

This study was a prospective descriptive study, conducted in Department of Orthopaedics, Medical College, Thrissur from 1, January, 2016 to 1, July, 2017. Patients were assessed according to age, sex, side of injury, co-morbidities and final functional assessment was made according to Broberg and Morrey score. A total of 37 patients were observed. The patients were assessed, deemed fit for the study, and subjected to operation. Radial head reduction, fixation if needed, then ulna fracture was opened, reduced, and fixed with plate and screws. Post-operative plaster slab was applied, then converted to full above elbow cast, and retained for as long as needed. Post-operative mobilization was by home physiotherapy only.

### RESULTS

Our study showed that open reduction and internal fixation of ulna outcome in Monteggia fractures leads to good elbow function and minimal loss of physical capacity. Immobilization of more than 2 months have very high chances of elbow stiffness. Early active mobilization after surgery is necessary for good functional outcome. Other than mild stiffness and loss of range of motion in some cases, very few other complications were found in our series.

### CONCLUSIONS

Rigid internal fixation of ulna and early active mobilization is the key to achieve a good functional outcome and minimal loss of physical capacity in Monteggia fractures. Very few of the complications that were described in the literature were seen in the study. Even with restricted resources and minimal facilities, almost no permanent or debilitating morbidity or complications were seen in our series. Early active mobilization after surgery was the most important deciding factor for good functional outcome. Prolonged immobilization of more than one month consistently produces poor results

### KEYWORDS

Monteggia, Broberg and Morrey, Bado Classification, Internal Fixation, Ulna Fracture

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## BACKGROUND

The Monteggia fracture dislocation was first accurately described in 1814 by Giovanni Battista Monteggia as fracture of ulna with a dislocation of radio capitellar articulation. This uncommon forearm injury was classified in 1967 by Bado in four types plus two types of equivalent lesion depending on the direction of dislocation of the radial head and the angulation of the fracture of ulna. Monteggia fractures represent a link between the injuries of the forearm and the elbow. In children, fractures can usually be treated conservatively by closed reduction and above elbow cast, but routinely requires open reduction in adults. Watson Jones stated - "No fracture presents so many problems, no injury is beset with greater difficulty, no treatment is characterized by more general failure", he indicated that 95 % of the patients with Monteggia fracture have permanent disability with improvement in fixation technique and by recognition of the injury, good result can be expected.

In this study, we had an experience of treating patients with Monteggia fracture. We describe our findings, results and conclusions in the following sections. We studied 37 cases of Monteggia fractures over a period of 18 months. All factors that influence the outcome including age, socio-economic status and type of fracture were assessed. The study is relevant as it is a fracture which effects activity of daily living. The study is also relevant in Indian scenario because we have minimal facilities, equipments and post-operative conveniences (physiotherapy, etc, compared to western facilities). We need to find out whether our patients are getting comparative results, given the limitations that we are facing like delay in surgery, locally manufactured instruments and unstructured physiotherapy following surgery, since many patients are from remote areas.

## Objectives

The study is to assess the distribution of Monteggia fractures based on age, gender, side involved, type and mode of injury and next objective is to determine the complications and functional outcomes of Monteggia fractures treated by ORIF.

## METHODS

This study is a longitudinal study, conducted in Department of Orthopaedics, Medical College, Thrissur from 1 January 2016 to 1 July 2017.

## Sample Size

All patients (Outpatient/Inpatient) presenting to medical college hospital treated with internal fixation (age 10 – 50 years) meeting inclusion and exclusion criteria in the study period were included, averaging 37 patients.

## Inclusion Criteria

Male and female patients with Monteggia fracture dislocation who have given their consent for the procedure. Physical fit for surgery.

## Exclusion Criteria

Patients not fitting in inclusion criteria.

## Methodology

Operative treatment

### Indications

1. Failure of ulnar reduction.
  - Soft tissue preventing reduction.
  - Reduced – but not stable.
2. Failure of radial head reduction.
  - Torn annular ligament/capsule.
  - Interposed cartilaginous or osteochondral fractures.

## Surgical Approach

### Incision

- Lateral border of the triceps posteriorly to lateral condyle
- Extent along radial side of the ulna
- Continued under the anconeus & extensor carpi ulnaris in an extraperiosteal manner,
- Elevating the fibers of the supinator & reaching interosseous membrane.

### In Cases Where Needed, Allow Exposure to

- Radio capitellar joint & orbicular ligament,
- Proximal fourth of the entire radius, and
- Ulnar fracture, all through the same incision

### Plate & Screws

- Most appropriate in unstable ulnar #
- 6 to 10-hole 3.5 mm DCP or LC-DCP & 3.5 cortical screw
- Incision made along subcutaneous border of ulna
- Fracture reduced, held & fixed

### After Treatment

- A/E plaster splint with 120° flexion till suture removal
- Followed by long arm cast in flexion till 4 weeks
- After which forearm was supported in cuff & collar permitting pronation and supination
- Extension limited to until 90° till 6 weeks

After proper history taking, clinical examination, radiological work up, pre-operative work up and informed written consent, Monteggia fracture were treated with internal fixation. Operation details were recorded and post-operative rehabilitation was done and recorded. Patient was discharged from hospital with appropriate advice regarding immobilisation, range of movements exercises as necessary.

Patient was reviewed at 6 weeks, 3 months, 6 months and on each review, evaluation was done. Evaluation-Monteggia fracture is ulna fracture & radial head dislocation.

1. Bony union - through X-RAY
2. Elbow function – Broberg and Morrey classification
3. Wrist function - least affected, if any effect, then specify.

### Broberg and Morrey Rating System

Motion (total for each plane) (degrees) Flexion ( $0.2 \times \text{arc}$ ) 27 Pronation ( $0.1 \times \text{arc}$ ) 6 Supination ( $0.1 \times \text{arc}$ ) 7  
Strength Normal 20 Mild loss (appreciable but not limiting; strength 80 % that of contralateral side) 13 Moderate loss (limits some activity; strength 50 % that of contralateral side) 5 Severe loss (limits everyday tasks, disabling) 0.  
Stability Normal 5 Mild loss (perceived by patient, no limitation) 4 Moderate loss (limits some activity) 2 Severe loss (limits everyday tasks) 0. Pain None 35 Mild (with activity, no medication) 28 Moderate (with or after activity) 15 Severe (at rest, constant medication, disabling) 0. Umile Giuseppe Longo, et al. Rating systems for evaluation of the elbow. British Medical Bulletin 2008

| Variable   | No. of Points |
|--|---------------|
| Motion (total for each plane) (degrees)  |               |
| Flexion ( $0.2 \times \text{arc}$ )  | 27            |
| Pronation ( $0.1 \times \text{arc}$ )  | 6             |
| Supination ( $0.1 \times \text{arc}$ )   | 7             |
| Strength   |               |
| Normal   | 20            |
| Mild loss (appreciable but not limiting; strength 80 % that of contralateral side) | 13            |
| Moderate loss (limits some activity; strength 50 % that of contralateral side)     | 5             |
| Severe loss (limits everyday tasks, disabling)                                     | 0             |
| Stability  |               |
| Normal   | 5             |
| Mild loss (perceived by patient, no limitation)                                    | 4             |
| Moderate loss (limits some activity)   | 2             |
| Severe loss (limits everyday tasks)  | 0             |
| Pain   |               |
| None   | 35            |
| Mild (with activity, no medication)  | 28            |
| Moderate (with or after activity)  | 15            |
| Severe (at rest, constant medication, disabling)                                   | 0             |
| <b>Broberg and Morrey Rating System</b>  |               |

### Ethical Considerations

The study commenced after obtaining clearance from Institutional Ethics Committee and Institutional Review Board with IEC No. 15 / 21.12.2015 / IEC and written informed consent from patients.

## RESULTS

Majority belonged to active and employed age group. There were no patients below 10 years. [Table - 1] Absence of cases above 50 may indicate that this is a fracture of active, employed individuals. Males involved were 21 (56.7) and females were 16 (43.3). Females were lesser in the series, maybe showing that outdoor activity was contributory to the injury. [Table - 2] Right side involvement was 23 (62.2) and

left side were 14 patients (37.8). The right side, was predominantly affected in most cases. [Table - 3]

The mechanism of injury by fall was 18 (48.6) Road traffic accident 10 (27.0) and others 9 (24.3). We can assume that this is a common workplace injury, due to the male preponderance, and the mechanism of injury. [Table - 4]

- Type I: 24 cases (64.8 %).
- Type II: 9 cases (13.51 %).
- Type III: 6 cases (16.2 %).
- Type IV: 2 cases (5.49 %). [Table 5]

Time of immobilization varies depending on the severity of injury, and also on the experience of the surgeon, and the pain tolerance of the patients. Of these, the pain can be dealt with painkillers, titrated according to the demand and requirements of the patients. Surgeons should recognize the need for early mobilization and the adverse effects of retaining the cast for too long. Hope this study will help us know the need for early mobilization of the affected arm. In patients, it was long arm cast in 90-degree flexion 15 (40.5) 6 - 10 weeks and 7 (19) more than 10 weeks. [Table 6]. Of the complications in table - 7, the eminently avoidable complication was shoulder stiffness. Shoulder mobilization can be easily achieved even before the removal of the cast. We recommend simple pendulum exercises for the shoulder as soon as possible. Hardware prominence was probably the least expected complication in this series.

### Range of Motions

28 patients (75.6) with full flexion functional range and 34 patients (91.8) with full range of pronation and supination. The results according to Broberg & Morrey score obtained were excellent in 18 patients (48.6), good in 10 patients (27.0), fair in 6 patients (16.2) and poor in 3 patients (8.2). The study showed decrease in range of motion as the main complication. Early mobilization and aggressive physiotherapy is the need of the day for good results in Monteggia fracture.

| Age          | No. of Cases | Percentage |
|--------------|--------------|------------|
| 10 - 20      | 9            | 25.8       |
| 20 - 30      | 14           | 37.8       |
| 30 - 40      | 8            | 24.2       |
| 40 - 50      | 6            | 18.2       |
| <b>Total</b> | <b>37</b>    | <b>100</b> |

**Table 1. Age Distribution**

| Sex          | No. of Cases | Percentage |
|--------------|--------------|------------|
| Male         | 21           | 56.7       |
| Female       | 16           | 43.3       |
| <b>Total</b> | <b>37</b>    | <b>100</b> |

**Table 2. Gender Distribution**

| Side         | No. of cases | Percentage |
|--------------|--------------|------------|
| Left         | 14           | 37.8       |
| Right        | 23           | 62.2       |
| <b>Total</b> | <b>37</b>    | <b>100</b> |

**Table 3. Side Predominance**

| MOI           | No. of Cases | Percentage |
|---------------|--------------|------------|
| Domestic fall | 18           | 48.6       |
| RTA           | 10           | 27.0       |
| Others        | 9            | 24.3       |
| <b>Total</b>  | <b>37</b>    | <b>100</b> |

**Table 4. Mode of Injury (MOI)**

| MAYO Class | No. of Cases | Percentage |
|------------|--------------|------------|
| Type I     | 24           | 64.8       |
| Type II    | 5            | 13.51      |
| Type III   | 6            | 16.2       |
| Type IV    | 2            | 5.49       |

**Table 5. Type of Monteggia Fracture Distribution<sup>1,2,3,4</sup>**

| Time          | No. of Cases | Percentage |
|---------------|--------------|------------|
| Up to 6 weeks | 15           | 40.5       |
| 6 - 10 weeks  | 15           | 30.5       |
| > 10 weeks    | 7            | 19.0       |
| <b>Total</b>  | <b>37</b>    | <b>100</b> |

**Table 6. Time of Immobilization**

| Complications       | No. of Patients | Percentage |
|---------------------|-----------------|------------|
| NIL                 | 29              | 78.3       |
| Infection           | 3               | 8.1        |
| Shoulder stiffness  | 2               | 5.4        |
| Delayed union       | 1               | 2.7        |
| Hardware prominence | 1               | 2.7        |
| Infected non union  | 1               | 2.7        |
| <b>Total</b>        | <b>37</b>       | <b>100</b> |

**Table 7. Complications**

## DISCUSSION

Monteggia fracture dislocations may be caused by direct injury to the posterior part of the elbow joint or indirectly. The clinical picture is obvious and conventional radiographs are usually sufficient to depict the lesion and the potential associated injuries - the findings, the end results and various other data have been analysed and compared in the following discussion. In our study, the mean age of the patients was 30.41, with patients ranging from 10 - 40 years while in Bruce et al. study, maximum incidence of fracture was in first three decades.<sup>5</sup>

- Males are more involved in a ratio of 1.4 : 1
- In Bruce et al. series of 35 patients, male to female ratio was of 3 : 1

In our study, 18 (48.6) cases were due to domestic fall, 10 (27 %) cases were due to road traffic accidents (RTA) and 9 (24.3 %) cases were due to other reasons.

In Bruce et al. study, RTA and fall accounted for 70 % of injuries. Regarding the side of injury, 23 cases (62.2 %) of fractures in our series were located in the right limb and 14 (37.8 %) cases sustained it in the left limb. Similarly, in Bruce et al. dominant hand was more frequently involved than left.<sup>5</sup> Based on BADO classification system,<sup>6</sup>

- 24 cases (64.8 %) were type I,
- 5 were (13.51 %) type II,
- 6 were type III (16.2 %) and
- 2 were type IV (5.49 %)

Absolute majority of cases were type 1 showing that direct blow is the most probable cause of injury for this fracture. Hyper pronation mechanism of injury is another distinct possibility, but difficult to prove. This is in concordance with the old literature which shows the same percentage distribution of fracture type.

In Bruce et al. study, it describes the incidence as type I (65 %), type II (18 %), type III (16 %), and type IV 1 %. In a plaster cast placed 90 degree, immediate post-operative, we used a slab, which is opened for wound inspection and suture removal. Once the sutures are removed, the full above elbow cast is applied.

Duration is as described as above and duration varies with the severity of injury, and the personal experience of the surgeon. The average range of immobilization in our study was 8 weeks. Complications observed in our study included shoulder stiffness in 2 (5.4 %) patients, which later improved with physiotherapy. 3 (8.1 %) patients had infection of which two were controlled by intravenous antibiotics. One patient went into an infected non-union, which was treated by antibiotics and later bone grafting. It is to be noted that in spite of minimal resources, none of the patients had permanent complications or debilitating morbidity. Delayed union was observed in 1 (2.7 %) patient. Bone grafting was not needed for union as the fracture healed with continued plaster immobilization.

Hard ware prominence was noticed by 1 (2.7 %) patient. But patient had no pain or functional impairment apart from the poor cosmetic appearance. Our overall complication rate was 21.6 %.

The following complications observed in literature were not observed

- Posterior interosseous nerve palsy
- Malunion & non-union of ulna fracture
- Radio humeral fibrous ankylosis
- Radioulnar synostosis
- Recurrence of radial head dislocation
- Myositis ossificans
- Volkmann's ischaemic contracture (VIC)

It has, therefore, to be concluded that most of these complications are rare theoretical possibilities, or rarities in clinical practice. In our study, 28 patients (75.6 %) got functional range of motion, and 34 patients (91.8) got functional range of pronation and supination as compared with Ajay Pal Singh Ish Kumar Dhammi, Anil Kumar Jain, Rajeev Raman and Prashant Modi.<sup>7</sup> Please note that this outcome is with minimal resources and our patients do not have regular access to a physiotherapist. The Broberg Morrey score<sup>8</sup> in our study was - 18 patients (48.6 %) had excellent functional outcome, 10 patients (27.0 %) had good outcome, 6 (16.2 %) had fair outcome and 3 (8.2 %) patients had poor functional outcome. The results in Mittal et al. series were excellent in 40 %, good in 40 %, satisfactory in 10 % and poor in 10 %. Overall results in our study with patient's satisfaction was about 76 % as compared to Mittal et al. in which it is 80 %.

## CONCLUSIONS

Even though the study was conducted with limited number of patients, and the follow up time was short, we may arrive at certain conclusions after the study that are supported by literature. They include-

- Most of the patients are in the productive/active age group (10 - 40 years)
- Right side is more frequently involved than left.
- Bado type I is most common type of Monteggia fracture dislocation.
- Males are more commonly affected than females.

- In young adults, the fracture usually results from high velocity trauma.
- Closed reduction of radial head is possible in most of the fresh cases.
- The fracture in adults invariably needs stable internal fixation of the ulna.
- The early diagnosis and treatment of Monteggia fracture dislocation is very important to achieve good results.
- The overall functional outcome of Monteggia fracture dislocation treated with open reduction and internal fixation is good.

To summarize, rigid internal fixation and early active mobilization is the key to achieve a good functional outcome. Open reduction and internal fixation of ulna leads to good elbow function and minimal loss of physical capacity. Early active mobilization after surgery was the most important deciding factor for good functional outcome. Prolonged immobilization of more than one month consistently produces poor results.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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