

Original Research Article

Evaluation of optimizing Monteggia fracture-dislocation care: surgical innovations, radiological insights, and functional rehabilitation in adult patients

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ABSTRACT

Background: Monteggia fractures, rare in adults, involve proximal ulna fracture and radial head dislocation. Managing these injuries poses challenges, fueling historical debates and driving advancements in internal fixation. Watson Jones' frustration highlights the ongoing pursuit of effective surgical approaches for optimal outcomes and functional limb restoration. This study aims to evaluate Monteggia fracture-dislocation treatment by analyzing radiological outcomes for structural insights and alignment post-surgery.

Methods: This prospective observational study, conducted at Swapno general hospital, Mirpur-2, Dhaka, Bangladesh from 1st January 2021 to 31 January 2024, enrolled 30 patients with radiologically confirmed Monteggia fracture-dislocation. Surgical procedures involved creating an interval, anatomical reduction, and fixation, with regular follow-ups assessing outcomes, including range of motion, X-rays, and VAS scores, while statistical analysis utilized SPSS version 23.

Results: The highest frequency percentage in the age distribution was observed among individuals aged 41-45, constituting 20% of the total sample, while the lowest frequencies were recorded in the 31-35 and >51 age groups, each representing 10% of the sample. Physical assault emerged as the leading cause of injury, accounting for 40% of cases, followed by road traffic accidents at 36.66% and falls at 23.33%. In terms of final outcomes, the majority of patients (43.33%) achieved a good outcome, while the lowest percentage (10%) resulted in poor outcomes.

Conclusions: In conclusion, addressing Monteggia fracture-dislocation in adults requires navigating inherent complexities. Modern internal fixation methods prove impactful, emphasizing the need for precise classification and stable anatomical reduction.

Keywords: Monteggia fracture, Internal fixation, Anatomical reduction

INTRODUCTION

Monteggia fracture stands as an uncommon injury, encompassing a proximal ulna fracture coupled with the dislocation of the radial head on the same side. This condition accounts for a mere 0.7% of all elbow fracture-dislocations observed in adult patients.¹ In the past, the management of Monteggia fracture-dislocation, particularly addressing the radial head dislocation, has been a topic of debate. Numerous surgeons were of the opinion that a nonoperative approach could be a viable treatment strategy for Monteggia fracture-dislocation.²

The introduction of modern methods of internal fixation, specifically the AO/ASIF system, has significantly impacted the outcomes of operative interventions for Monteggia injuries in adults. The use of internal fixation, employing a 3.5 mm DCP or LC-DCP plate, is deemed essential. In cases of comminuted fractures, achieving sufficient purchase with a minimum of three screws on each side of the fracture is advisable whenever possible. For comminuted fractures, common in most Monteggia injuries in adults, autogenous cancellous bone grafting, typically sourced from the iliac crest, is recommended, aligning with practices for other forearm fractures.³⁻⁶

Monteggia fracture, as coined by Watson Jones, reflects the frustration articulated in his seminal 1943 text. Jones expressed that "No fracture poses as many challenges; no injury is fraught with greater difficulty; and no treatment is marked by more widespread failures."⁷ Regarding the mechanism various theories were postulated. Direct force theory of speed and Boyd in 1940.⁸ Hyperpronation theory of Mervyn Evan in 1947 and Hyperextension theory of Tompkins in 1971.^{9,10} It constitute 0.7% of all elbow fractures and dislocations and 7% of fractures of the radius and ulna.⁷ Adequate classification and achieving a stable anatomical reduction can result in favorable outcomes for Monteggia fractures in adults, often leading to good or excellent results.

However, the reliability of surgical outcomes diminishes in cases of chronic injuries.¹¹ There are various methods of operative treatment for Monteggia fracture dislocation such as small DCP, LC-DCP, 3.5 mm reconstruction plate, K-wire, Rush nail and tubular plates. Additionally, the use of internal fixation methods such as K-wire, Rush nail, and tubular plates necessitates prolonged immobilization, leading to stiffness in the elbow joint. However, the primary treatment objective is to provide a functional limb at the earliest possible time, promoting robust bony union for quicker mobilization. Another alternative, the LC-DCP, is predominantly employed in cases involving osteoporotic bone.

Objectives

The specific objectives of this study encompass a comprehensive evaluation of the Monteggia fracture-dislocation treatment, to scrutinize and analyze the

radiological outcome, providing insights into the structural aspects and alignment post-surgery and to assess the functional outcome, focusing on the restoration of limb functionality and mobility.

METHODS

The study design involves a prospective observational approach conducted at Swapno general hospital, Mirpur-2, Dhaka, Bangladesh. The study spanned from 1st January 2021 to 31 January 2024. The study duration was 3 years. The study population was 30. The targeted study population comprises patients admitted to various orthopaedic units of Swapno general hospital, Mirpur-2, Dhaka, Bangladesh, diagnosed with radiologically confirmed closed Monteggia fracture-dislocation.

The methodology employed a thorough patient assessment, commencing with a detailed exploration of the injury's mechanism, timing, and the patient's age through a comprehensive patient history. Subsequent to this, extensive systemic and local examinations were carried out to ensure a comprehensive evaluation. Radiological assessments involved capturing antero-posterior and lateral view x-rays of the affected forearm and elbow, providing a reliable assessment of ulna fractures and radial head dislocations. Additional investigative measures included a range of blood tests (Total count, differential count, hemoglobin%, ESR, RBS), urea and serum creatinine analysis, routine and microscopic urine examinations, chest X-ray (P/A view), and, for patients aged over 35, ECG and echocardiography. In surgical process, an interval was created between the flexor carpi ulnaris and extensor carpi ulnaris, followed by an incision through the ulnar periosteum to expose the fracture site.

The periosteum was carefully stripped from each fracture end using a periosteal elevator, sparingly to ensure optimal preservation. Removal of the fracture hematoma and gentle curettage of the fracture site were performed. Precise anatomical reduction was achieved, and fixation was carried out using a 3.5 mm dynamic compression plate or a limited contact dynamic compression plate, along with a minimum of three cortical screws on either side of the fracture.

After achieving rigid fixation, the wound was closed layer by layer, and a sterile compression dressing was applied. The forearm was positioned in supination, and the elbow was flexed to 100 to 110 degrees to prevent the re-dislocation of the radial head. Regular follow-up sessions were conducted for the patient at intervals of 2 weeks, 6 weeks, 12 weeks, and 24 weeks to evaluate the ultimate outcome.

These follow-up assessments included testing the range of motion, performing X-rays, measuring VAS scores for pain, and evaluating the functional outcome based on Anderson criteria. Additionally, a thorough assessment of any potential late complications was conducted, with a

focus on observing improvements in the patient's condition. The statistical analysis was conducted using SPSS version 23 statistical software.

Inclusion and exclusion criteria

The inclusion criteria specify that the study involves patients aged 21 to 51+ years with closed fractures, of all sexes, and including fractures on both sides. In contrast, exclusion criteria encompass individuals beyond the age limit (below 21 and above 51), those with open fractures, active or latent infections, medically unfit cases (uncontrolled diabetes, chronic renal failure, COPD, ASA score), and individuals unwilling to undergo surgery.

RESULTS

Table 1 represents the distribution of patients by age, with a total sample size of 30 individuals. The ages range from 21 to above 51 years old. The highest frequency of patients falls within the age group of 41-45, comprising 20% of the total sample, while the lowest frequency is observed in the age groups of 31-35 and >51, each accounting for 10% of the sample. The mean age of the patients is 5.13 years with a standard deviation of 1.06. Also, the Table provides a breakdown of patients' occupations, showing that the majority are service holders (26.66%), followed by businessmen (20.00%), students (16.66%), housewives (13.33%), and others (23.33%).

Table 1: Distribution of patients by age and occupation, (n=30).

Variables	N	Percentage (%)
Age distribution (in years)		
21-25	4	13.33
26-30	5	16.67
31-35	3	10
36-40	5	16.67
41-45	6	20
46-50	4	13.33
>51	3	10
Mean ± SD	5.13±1.06	
Occupation		
Businessman	06	20.00
House wife	04	13.33
Service holder	08	26.66
Student	05	16.66
Others	07	23.33

Table 2: Distribution of patients by Bado classification (n=30).

Classification	N	Percentage (%)
Type I	18	60
Type II	12	40

Table 2 presents the distribution of patients by Bado classification, with a total sample size of 30 individuals.

The majority of patients fall into type I classification, constituting 60% of the sample, while type II classification comprises 40% of the sample.

Table 3: Distribution of patients by post-operative complication, (n=30).

Post-operative	N	Percentage (%)
Absent	22	73.33
Present	08	26.77

Table 3 presents the distribution of patients by post-operative complication status, within a total sample size of 30 individuals. The majority of patients, constituting 73.33% of the sample, did not experience any post-operative complications. Conversely, 26.67% of patients did encounter post-operative complications.

Table 4: Distribution of the patient's causes of injury (n=30).

Injury causes	N	Percentages (%)
RTA	11	36.66
Fall	07	23.33
Physical assault	12	40

Table 4 presents the distribution of patients according to the causes of their injuries, based on a sample size of 30 individuals. The leading cause of injury among the patients is physical assault, accounting for 40.00% of the cases. Road traffic accidents (RTA) follow, comprising 36.66% of the cases, while falls represent 23.33% of the injuries.

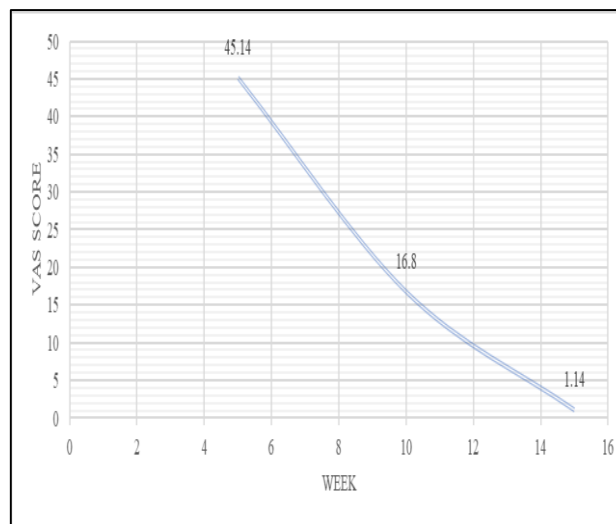


Figure 1: Distribution of patients according to pain status.

This Figure shows the patients according to their pain status measured on the visual analog scale (VAS) over three different weeks. The VAS scores vary significantly, with the highest pain intensity reported at week 5 (45.14), followed by a notable reduction at week 10 (16.8), and a further decrease to a minimal level at week 15 (1.14).

Table 5: Final outcome of the patients (n=30).

Conditions	N	Percentages (%)
Excellent	08	26.66
Good	13	43.33
Fair	06	20
Poor	03	10

Table 5 presents the final outcomes of patients within a sample size of 30 individuals. The majority of patients achieved a good outcome, accounting for 43.33% of the cases. Following this, 26.66% of patients were categorized as having an excellent outcome. Fair outcomes were observed in 20.00% of cases, while a smaller proportion, 10.00%, resulted in poor outcomes.

DISCUSSION

Monteggia fracture-dislocations are uncommon, constituting less than five percent of all forearm fractures. Successful outcomes in Monteggia fractures hinge on prompt and precise diagnosis, secure fixation of the ulna, precise realignment of the radial head, and post-operative immobilization to facilitate ligamentous healing around the dislocated radial head. In our study, the ages range from 21 to above 51 years old. The highest frequency of patients falls within the age group of 41-45, comprising 20% of the total sample, while the lowest frequency is observed in the age groups of 31-35 and >51, each accounting for 10% of the sample. The mean age of the patients is 5.13 years with a standard deviation of 1.06. Retrospective study conducted in India among adult patients showed similar result.¹² Monteggia fractures are within the spectrum of forearm injuries, frequently arising either due to a fall on the outstretched arm with forced pronation or from direct trauma.¹³ In our study, the majority of patients fall into type I classification, constituting 60% of the sample, while type II classification comprises 40% of the sample. In other study, the direction of the dislocation of the radial head and the type of proximal ulnar fracture in Bado type II lesions might influence the outcome.¹¹ Another study also found poor prognosis in Bado type II fracture.¹⁴

In our study, the majority of patients, constituting 73.33% of the sample, did not experience any post-operative complications. Conversely, 26.67% of patients did encounter post-operative complications. In other study, the retrospective study of Bruce and Wilson et al reported the incidence of nerve palsies 14% after treatment.⁷ In our study, The leading cause of injury among the patients is physical assault, accounting for 40.00% of the cases. Road traffic accidents (RTA) follow, comprising 36.66% of the cases, while falls represent 23.33% of the injuries. In other study, this fracture often occurs after a highway accident or aggression, which explains the male predominance of age. Monteggia fractures are part of a spectrum of forearm injuries and commonly result either from a fall on the outstretched arm with forced pronation or from a direct injury.¹⁵

Common surgical complications following Monteggia lesion treatment encompass issues like implant loosening, ulna misalignment, radio-ulnar dislocation, ulna nonunion, radial head necrosis, postoperative infections, heterotopic ossification, osteosynthesis loosening in the radial head and neck, delayed consolidation in the radius neck fracture, radio-ulnar synostosis, deficiency neuropathy, and posterolateral rotatory instability. Yet, the conventional treatment approach has been demonstrated to yield suboptimal functional outcomes in these admittedly complex fracture patterns. The introduction of low-profile locking buttress plates for distal radius fractures has remarkably enhanced functional scores, marking a significant innovation in treatment.¹⁶⁻¹⁸ The majority of patients achieved a good outcome, accounting for 43.33% of the cases. Following this, 26.66% of patients were categorized as having an excellent outcome. Fair outcomes were observed in 20% of cases, while a smaller proportion, 10%, resulted in poor outcomes. In other study we see, the study of found 80.5% patients had satisfactory outcome.¹²

Limitations

The study's limitations include the single-center design, potentially limiting the generalizability of findings, and the retrospective nature of data collection, which may introduce biases and incomplete information.

CONCLUSION

In conclusion, this study underscores the complexity and challenges associated with Monteggia fracture-dislocation in adults. The utilization of modern internal fixation methods has demonstrated significant impacts on surgical outcomes, emphasizing the importance of adequate classification and stable anatomical reduction. While operative interventions hold promise for favorable results, chronic injuries present a considerable challenge, warranting further exploration of optimal treatment approaches for improved patient outcomes.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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