

Outcome of Missed Monteggia Lesions in Children Managed by Ulnar Osteotomy & Open Reduction of Radial Head

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ABSTRACT

Introduction: Missed Monteggia lesions in children require prompt management to avoid complications. This study evaluated outcomes of children treated with ulnar osteotomy and radial head open reduction at a tertiary hospital in Bangladesh. **Methods & Materials:** This prospective observational study was carried out from July 2017 to June 2019 at the Department of Orthopedics, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh. This study evaluated outcomes in 16 pediatric patients (ages 4–15) with missed Monteggia lesions. Participants were selected via purposive sampling based on inclusion criteria. After pre-operative evaluation, surgical intervention was performed, and follow-ups assessed pain, range of motion, and Mayo Elbow Performance Score (MEPS). Data were analyzed using SPSS 25. **Result:** The mean age of participants was 9.81 years, with a male predominance (68.75%). Falls from height were the most common injury mechanism (75.00%), predominantly affecting the left side (56.25%). The mean duration from injury to operation was 8.06 months. Post-operatively, pain levels decreased significantly, with 31.25% reporting no pain and 68.75% reporting mild pain. Range of motion improved, with a decrease in the pronation-supination arc and an increase in the flexion-extension arc. MEPS scores showed substantial enhancement from a mean of 62.50 to 80.94. A significant association was observed between the duration from injury to operation and final treatment outcome. **Conclusion:** Ulnar osteotomy and radial head open reduction effectively relieved pain, restored elbow function, and improved outcomes in children with missed Monteggia lesions, highlighting the importance of timely intervention.

Keywords: Missed Monteggia Lesions, Ulnar Osteotomy, Open Reduction, Radial Head, Pediatric Orthopedics

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INTRODUCTION

The Monteggia lesion, which was initially documented by Giovanni Battista Monteggia in 1814 and involves a radial head dislocation along with a proximal ulna fracture, still poses diagnostic and treatment difficulties in contemporary orthopedics [1–3]. Despite increased awareness, these injuries often go unrecognized initially, leading to delayed diagnosis and subsequent difficulties in surgical reconstruction, which may result in suboptimal outcomes [4]. Missed Monteggia lesions, defined as unreduced radial head dislocations persisting four weeks after injury, are attributable to factors such as the rarity of the lesion and inadequacies in clinical and radiological examination [5–7]. Persistent radial head dislocation can lead to complications such as secondary degenerative arthritis, nerve abnormalities, reduced range of motion, and an increase in elbow valgus deformity [8]. The management of chronic Monteggia injuries is particularly challenging, with the difficulty of achieving satisfactory function escalating with the duration of the dislocation [9]. Surgical strategies vary widely and may include resection of the radial head, open reduction with or without transcapitellar pinning, annular ligament repair or reconstruction, and ulnar or radial osteotomy [10,11]. Among these options, open reduction of the radial head combined with ulnar osteotomy has gained prominence for its potential

to improve outcomes and prevent complications [12]. With dangers including re-dislocation, instability, nonunion of osteotomies, avascular necrosis of the radial head, nerve damage, and infection, the surgical treatment's prognosis is yet unknown [5,10]. To address these challenges and improve outcomes, ulnar osteotomy and open reduction of the radial head have been advocated for the treatment of missed Monteggia lesions [13]. This method seeks to treat the patho-anatomy of the lesion at its foundation, particularly the malunited deformity of the ulna, which may make it more difficult to realign the radial head during open reduction alone. This method lowers the likelihood of postoperative re-dislocation by maintaining the radial head in an anatomical position by treating ulnar deformity by osteotomy. Despite its widespread acceptance globally, there remains a dearth of literature evaluating the outcomes of this surgical option in Bangladesh. Therefore, this study was designed to assess the outcome of missed Monteggia lesions in children managed by ulnar osteotomy and open reduction of the radial head in a tertiary hospital setting. Through a comprehensive evaluation of surgical outcomes, this research aims to contribute valuable insights to the management of Monteggia lesions, particularly in settings where such data are limited.

METHODS & MATERIALS

This prospective observational study was conducted at the Department of Orthopedics, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh, over a period spanning from July 2017 to June 2019. The study aimed to investigate the outcomes of missed Monteggia lesions in children managed by ulnar osteotomy and open reduction of radial head. Purposive sampling, a non-randomized technique, was utilized to select a sample size of 16 patients meeting specific inclusion criteria: patients aged between 4 to 15 years of both genders, without any neurological deficit, presenting with early and late cases (after four weeks to 4 years of initial injury), and fractures that could not be reduced by manipulation with or without percutaneous K-wires. Exclusion criteria included open fractures, pathological fractures, and fractures with non-union. The study procedures involved pre-operative evaluation using a structured data collection form, followed by surgical. Patients were discharged on the 2nd postoperative day (POD) after drain removal, with wound condition and stitch removal assessed on the 14th POD. Subsequent follow-ups were scheduled at 3, 6, 12, and 24 weeks post-operation, during which radiographic assessments and range of motion tests were conducted. Final assessments were performed according to the Mayo Elbow Performance Score (MEPS) [14,15]. Data analysis was carried out using the SPSS version 25.0 software, presenting quantitative data as mean ± SD and utilizing the student paired t-test for comparison, while qualitative data was expressed as frequency and percentage. A significance level of $p < 0.05$ at a 95% confidence interval was considered statistically significant. Institutional approval was obtained from the Institutional Review Board (IRB) of NITOR, and written informed consent was obtained from all participants after explaining the aims and procedures of the study. Confidentiality of patient information was strictly maintained throughout the research process.

RESULTS

Regarding age, the majority of participants were between 8 to 11 years old (43.75%), followed by those aged 12 to 15 years (31.25%), and 4 to 7 years (25.00%). The Mean±SD age was 9.81±2.88 years. In terms of gender, the study comprised predominantly male participants, accounting for 68.75% of the total, while females constituted 31.25%. Mechanisms of injury varied, with the most common being falls from height, observed in 75.00% of cases, followed by motor vehicle accidents (18.75%) and falls on the ground (6.25%). Regarding the affected side, 43.75% of participants sustained injuries on the right side, while 56.25% experienced injuries on the left side.

Table - I: Distribution of baseline characteristics among the participants (n=16)

Variables	Frequency	Percentage
Age		
4-7	4	25.00%
8-11	7	43.75%
12-15	5	31.25%
Mean±SD	9.81±2.88	
Gender		
Male	11	68.75%
Female	5	31.25%
Mechanism of Injury		

Fall From Height	12	75.00%
Motor Vehicle Accident	3	18.75%
Fall on Ground	1	6.25%
Affected side		
Right	7	43.75%
Left	9	56.25%

The most common delay interval observed was between 2 to 6 months, accounting for 50.00% of cases, followed by delays of 10 to 14 months and 14 to 18 months, each representing 25.00% of participants. Delay intervals of 6 to 10 months were reported in 12.50% of cases. The Mean±SD delay from injury to treatment was 8.06±5.47 months.

Table - II: Distribution of participants by delay from injury to treatment (in months) (n=16)

Delay (in months)	Frequency	Percentage
2-6	8	50.00%
6-10	2	12.50%
10-14	4	25.00%
14-18	2	12.50%
Mean±SD	8.06±5.47	

Each duration category, ranging from 11 to 26 days, accounted for 25.00% of participants, indicating an even distribution across the various hospital stay intervals. The Mean±SD hospital stay duration was 18.69±4.77 days

Table - III: Distribution of participants by hospital stay duration (n=16)

Hospital Stay	Frequency	Percentage
11-14	4	25.00%
15-18	4	25.00%
19-22	4	25.00%
23-26	4	25.00%
Mean±SD	18.69±4.77	

Prior to surgery, none of the participants reported being entirely pain-free, with all individuals experiencing some degree of pain. The majority of participants (81.25%) reported mild pain pre-operatively, while a minority (18.75%) reported moderate pain. Following surgical intervention, there was a notable improvement in pain scores, with 31.25% of participants reporting no pain post-operatively. Additionally, there was a decrease in the percentage of participants reporting mild pain post-operatively (68.75%). Notably, no participants reported experiencing moderate pain after surgery.

Table - IV: Comparison of pre-operative and post-operative pain score among the participants (n=16)

Pain Status	Pre-operative (n=16)		Post-operative (n=16)	
	n	%	n	%
No pain	0	0.00%	5	31.25%
Mild Pain	13	81.25%	11	68.75%
Moderate Pain	3	18.75%	0	0.00%

At the pre-operative stage, the mean arc of motion for pronation-supination was 125.63±12.50 degrees, which decreased to 120.38±13.19 degrees at the final follow-up, indicating a statistically significant difference ($p < 0.001$). Similarly, the mean arc of motion for flexion-extension increased from 113.13±5.12 degrees pre-operatively to 120.63±6.02 degrees at the final follow-up, with a p-value of <0.001 , signifying significant improvement. Moreover, the MEPS functional ability score exhibited substantial enhancement from a mean of 62.50±7.30 pre-operatively to 80.94±7.35 at the final follow-up ($p < 0.001$), indicating a marked improvement in functional outcomes following surgical intervention.

Table - V: Comparison of Outcome variables between Pre-operative and final follow-up (n=16)

Variables	Pre-operative	Final follow-up	p-value
Arc of motion (pronation-supination)	125.63±12.50	120.38±13.19	<0.001
Arc of motion (Flexion -Extension)	113.13±5.12	120.63±6.02	<0.001
MEPS functional ability score	62.50±7.30	80.94±7.35	<0.001

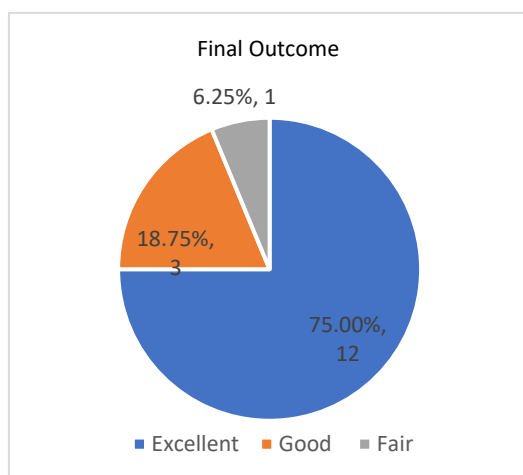


Figure - 1: Distribution of participants by MEPS score outcome at final follow-up (n=16)

The majority of participants achieved an excellent outcome, accounting for 75.00% of the cohort. Additionally, 18.75% of participants attained a good outcome, while 6.25% had a fair outcome.

DISCUSSION

The findings of this study highlight the pivotal role of ulnar osteotomy in addressing missed Monteggia fractures, effectively restoring anatomical alignment and promoting functional recovery. Ulnar osteotomy serves as a cornerstone procedure, aiming to rectify the primary ulnar deformity while preserving the integrity of the interosseous membrane. This preservation is crucial for maintaining stability in the radio-capitellar joint and facilitating the relocation of the radial head [16]. Upon reviewing the research participants' demographic details, it was found that the average age ranged

from 6 to 15 years, with a mean of 9.81 years. It's interesting to note that 43.75% of instances were in the 8–11 age range, 31.25% in the 12–15 age range, and 25% in the 4–7 age range. Additionally, a male predominance was evident, with males comprising 68.75% of the cohort compared to 31.25% females. While gender did not influence treatment outcomes, the higher prevalence of males is consistent with their increased participation in outdoor activities. The leading cause of missed Monteggia fractures in this study was falls from height, accounting for 75% of cases, followed by motor vehicle accidents (18.75%) and falls on the ground (6.25%). This distribution aligns with the principal mechanism of Monteggia fractures, typically resulting from falls onto an outstretched hand [17,18]. Furthermore, the majority of cases (56.25%) involved injuries to the left side, underscoring the importance of considering the side of injury in treatment planning. Analysis of the time interval from injury to operation revealed a varied distribution, with 50% of cases undergoing surgery within 2 to 6 months post-injury. Of the remaining cases, 12.5% underwent surgery within 6 to 10 months, 25% within 10 to 14 months, and the remaining 12.5% within 14 to 18 months. The mean duration from injury to operation was 8.06 months, ranging from 2 to 17 months. This distribution aligns with findings from the studies of Megahed et al, which reported a mean duration since injury of 11.2 months [16]. Significantly, a notable association was found between the duration from injury to operation and the final treatment outcome, echoing observations from He et al, where the duration of injury to operation impacted the final functional outcome significantly [19]. Pain assessment post-operatively demonstrated a reduction in pain levels, with 31.25% of cases reporting no pain and 68.75% reporting mild pain at the last follow-up. These findings are consistent with those reported by Mohamed & Hasan, who found that 33.33% of cases experienced mild intermittent pain at their last follow-up [20]. However, it is essential to acknowledge that our study's shorter follow-up period of 6 months may have underestimated the pain improvements compared to studies with longer follow-up periods, as noted by Park et al. [13]. Evaluation of elbow range of motion post-operatively revealed significant improvements, with a decrease in the pronation-supination arc from a mean of 125.63 degrees pre-operatively to 120.38 degrees post-operatively. Similarly, the flexion-extension arc increased from a mean of 113.13 degrees pre-operatively to 120.63 degrees post-operatively. These findings corroborate those reported by Delpont et al., where the mean pre-operative and post-operative arc of motion of the elbow (flexion-extension) was 115° and 127°, respectively [21]. Furthermore, Suzuki et al. suggested that reduction of the dislocated radial head leads to an increase in flexion of the elbow, supporting our observations [22]. Analysis of the Mayo Elbow Performance Score (MEPS) post-operatively revealed a significant improvement, with the mean MEPS score increasing from 62.5 pre-operatively to 80.93 post-operatively. Remarkably, 75% of cases achieved a good outcome, while 19% achieved an excellent outcome at the final follow-up. These outcomes closely resemble those reported by Megahed et al., where 50% of cases were rated as excellent, 31.25% as good, and 18.75% as fair [16]. The association between the duration from injury to operation and the final outcome underscores the critical role of timely intervention in optimizing treatment outcomes, as also highlighted in studies by He et al. and Park et al. [13,19].

Limitations of The Study

A modest sample size and a single hospital were used for the investigation. Thus, the outcomes might not be indicative of the entire community.

CONCLUSION

In conclusion, this study demonstrates that ulnar osteotomy and open reduction of radial head are effective surgical interventions for managing missed Monteggia fractures in children. By addressing the primary deformity of the ulna and restoring the normal relationship between the radius and ulna, these procedures facilitate the relocation of the radial head and promote functional recovery. The findings underscore the importance of timely intervention, with early surgical treatment associated with better outcomes. Significant improvements were observed in pain levels, elbow range of motion, and functional ability post-operatively, highlighting the efficacy of the surgical approach. Moreover, the majority of cases achieved good to excellent outcomes at the final follow-up, emphasizing the favorable prognosis associated with this treatment modality. Overall, this study contributes valuable insights into the management of missed Monteggia fractures and underscores the importance of ulnar osteotomy and open reduction of radial head as preferred surgical techniques in achieving optimal outcomes for affected children. Further research with larger sample sizes and longer follow-up periods is warranted to corroborate these findings and refine treatment protocols for this challenging orthopedic condition.

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