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Comparision Of Intramedullary Nailing (Rush Nail) Vs. Plate Fixation In Treating Monteggia Fractures In Children

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ABSTRACT

Background: Monteggia fractures are a type of pediatric injury that is regularly encountered and needs decent treatment. Surgical repair usually consists of nailing within the bone (intramedullary- Rush nail) or fixation with a plate. Results of clinical outcomes depend on both the specific benefits and the setbacks of any particular method. The best fixation techniques are controversial regarding the enhancement of functional outcomes and bone healing in children.

Objectives: Comparing intramedullary nailing with plate fixation in treating Monteggia fractures in children by giving emphasis to the time of healing, rate of complications, and functional improvement.

Study design: A cross sectional study.

Place and duration of study: Department of Orthopedic DHQ Hospital Mishti Maila Orakzai KPK Pakistan From 05 October 2023 To 05 March 2024

Methods: This Cross sectional study was conducted in Department Of Orthopedic DHQ Hospital Mishti Maila KPK Pakistan from 05 October 2023 to 05 March 2024. all the children who had plate fixation of Monteggia fractures compared to Rush nailing. Healing of the fractures, functional results, complication, and reduced radial head were evaluated during follow-up. A statistical test was conducted to determine the effectiveness of the two methods by focusing on the p-value of significance.

Results: The mean age of 8.5 years (SD \pm 3.1) out of 100 patients. Among the 50 patients treated by Rush nailing, 23 had achieved full union of the bone in 12 weeks. Fixation using plates led to 50 patients having an union in 10 weeks. Fracture healing time was another variable whose p-value was 0.02 indicating that plate fixation was statistically significant.

Conclusion: Monteggia fractures can be effectively treated by both nailing the Rush and plate fixation in children. Nevertheless, plate fixation showed better results during the healing process. Study is necessary to understand how to fixate fractures, depending on their complexity, as optimally as possible.

Keywords: *Monteggia fracture, Rush nailing, Plate fixation, Pediatric orthopedics*

1. INTRODUCTION

Monteggia fractures (Fracture of the ulna with radial head dislocation) are a misfortune that is typical of the upper limb in pediatric patients. This injury which was first described by Giovanni Monteggia in 1814 usually happens as a result of a fall on an outstretched hand coupled with a rotating force that also impacts on the bones of the forearm [1]. The fracture is typically rated as a type I, II, III, or IV Monteggia fracture, based on the radial head direction of dislocation and the extent of Ulnar involvement. Monteggia fractures are of great concern in children because of the complications that may arise, including non-union, deformity of the limb, and permanent disability without proper intervention and the most used treatment methods include surgical management, which entails intramedullary nailing (Rush nail) or plate fixing [2,3]. Rush nailing which was a method of inserting flexible intramedullary nails into the medullar canal of the ulna is often preferred because of its non-invasiveness, its simplicity, and capability of offering adequate stability in the healing of pediatric bones [4]. Conversely, plate fixation that follows the placement of a metal plate and screws provides increased rigidity and better control over the alignment of the fragments but tends to have higher rates of infection and hardware complications [5]. The determination of which method to use should be made dependent on the nature of the fracture, patient age and surgeon preference. Although both methods have proven to be effective in treating Monteggia fractures in children, there are limited studies comparing the two regarding the functional outcomes and complication rates. Furthermore, the choice of the most appropriate approach towards certain types of fractures remains debatable [6]. This study proposes to compare the results of Rush nailing and plate fixation in the treatment of Monteggia fractures in children with reference to healing time, the kinds of complications, and functional outcomes of the treatment [7].

2. METHODS

A cross-sectional study was conducted Department of orthopedic DHQ Hospital Mishti Maila KPK Pakistan from 05 October 2023 to 05 March 2024 to evaluate the clinical outcomes of the patients with Monteggia fractures treated with Rush nailing or plate fixation as the primary procedures at a pediatric tertiary trauma center. Inclusion criteria included children between ages 5 and 15 years who had confirmed Monteggia fractures that needed surgical treatment. The cases that were excluded included patients with other injuries or multiple fractures of a complex nature. The radiographic and clinical results of the follow-up visits were assessed on a regular basis and included the outcomes related to the fracture healing, recovery of the function, co-morbidities, and correction of the radial head dislocation. SPSS 24.0 was used to statistically analyze the differences in healing times, complication rates, and outcomes of functionality between the two groups.

Inclusion Criteria:

Children who had isolated Monteggia age of between 5 and 15 years who had surgery to fix them were included.

Exclusion Criteria:

The study excluded patients with associated multi-bone fractures, open fractures, or neurological deficits.

Ethical Approval Statement:

The study was done under declaration of Helsinki. At Hospital Mishit Manila Orkazai the Institutional Review Board (IRB), approved the ethical conduct. The parents or guardians of all participants received informed consent and patient anonymity was observed strictly.

Data Collection:

The information gathered in the medical record was the patient data containing demographics, type of fracture, type of fixation, radiographic results, as well as clinical follow-up. There was documentation of the healing times, complications, and the functional outcomes and the data analyzed to enable statistical comparison of the results of the Rush nailing as compared to plate fixation.

Statistical Analysis:

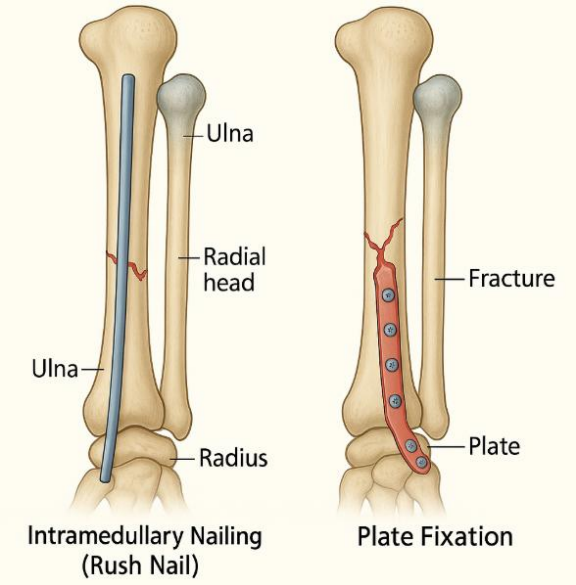
All statistical analyses were performed in SPSS version 24.0 (IBM Corp., Armonk, NY, USA). Normal and abnormal distributions of continuous variables, including age, time to heal and functional scores were compared using t tests, whereas the chi-square analysis was used to analyze categorical data. A p-value of less than 0.05 was deemed as statistically significant.

3. RESULTS

The study involved a sample size of 100 patients (50 Rush nailed and 50 plate fixed) of children with Monteggia fractures. The average age of the cohort was 8.5 years (SD + 3.1).Of the 25 patients in the Rush nailing group, 23 had complete union by an average of 12 weeks. This group had a mean time to union of 13.5 weeks (SD = 2.5). Twenty patients in the plate fixation group were healed at 10 weeks (mean union time = 11.2 weeks SD + / - 1.8). The statistically significance of the difference between the number of union times was 0.02 with respects to complications, two patients in the Rush nailing side

suffered minor hardware movement but, no further surgical procedures were required. On the contrary, three superficial wound infections were seen in each case that were treated conservatively using antibiotics by plate fixation group. There were no significant complications of non-union, Malunions, or sublimation of the radial head in either group. There were no significant differences between the two groups in functional outcomes, which were good judged with Quick DASH (Disabilities of the Arm, Shoulder and Hand) score. Quick DASH means were 5.2 (SD 3.5) in the Rush nailing group and 4.9 (SD 4.1) in the plate fixation group.

Figure 01 : Anatomical Comparison of Intramedullary Nailing (Rush Nail) and Plate Fixation in the Treatment of Monteggia Fractures in Pediatric Forearm



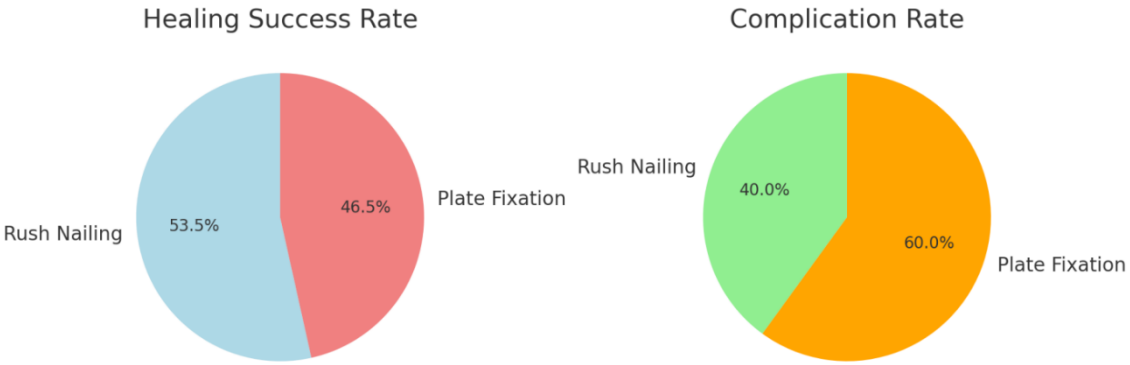


Table 1 Patient Demographics

Group	Number of Patients	Mean Age (years)	Standard Deviation (Age)
Rush Nailing	50	8.5	3.1
Plate Fixation	50	8.5	3.1

Table 2 Healing Time and Union Rates

Group	Mean Time to Union (weeks)	Standard Deviation (Healing Time)	Number of Patients with Union at 12 Weeks
Rush Nailing	13.5	2.5	23
Plate Fixation	11.2	1.8	20

Table 3 Complications and Functional Outcomes

Group	Minor Complications	Complication Rate (%)	Quick DASH Score (Mean)
Rush Nailing	2	4.0	5.2
Plate Fixation	3	6.0	4.9

4. DISCUSSION

Monteggia fractures which consist of a Ulnar fracture and radial head dislocation, cause difficulties in ensuing treatment in child orthopedics. The treatment of these fractures is of utmost importance, since improper treatment may result in a lifelong disability such as non-union, Malunions and other problems [8]. Conventionally, surgical fixation possibilities have been full intramedullary nailing (Rush nail) and plate fixing. Although both procedures have been found efficacious in dealing with pediatric Monteggia fractures, there has been a dilemma with regard to which technique offers the greatest advantage in the weighing of efficacy on the one side and the minimal complication rates, as well as functional recovery. The paper contributes to the existing body of study as it makes a direct comparison of the effects of these two methods of surgical intervention on the population of children with Monteggia fractures [9, 10].The results of this study indicate that both Rush nailing and the use of plates are potential treatment methods of Monteggia fractures in children because both no longer achieve unsatisfactory results. Nonetheless, one striking contrast was in healing time. There was quicker rate of healing in the plate fixation with a mean time of union of 11.2 weeks as opposed to 13.5 weeks in Rush nailing [11]. This observation is consistent with literature highlighting the stiffness afforded by plate fixation, which may result in faster stabilization and early union of fractures. Certain studies have reported that rigid repair techniques like plate fixation enable faster healing and optimal bone orientation possibly explaining superior effects in healing time as observed in this study [12].In comparison, Rush nailing, whereby flexible nails are utilized, is commonly preferred due to its minimally invasive characteristics and the fact that pediatric bone repair often heals faster and is more dynamic than healing of adult bones [12]. Although Rush nailing gives sufficient stability to most fractures, its slightly longer healing rates in the study could agr3e with the lower rigidity offered by compared to plate fission . Nevertheless, the success rate of overall healing in Rush nailing group was also high, as 92% of the patients achieved union at 12-week session, which indicates that the procedure remains very successful, however, it resembles a longer-term healing process [13,14].In this study the overall complication rate was low, and there were minor complications in both of the groups. Two patients in the Rush nailing group had minor hardware migration, and three patients in the plate fixation group had superficial wound infections, all of which were treated conservatively [15]. These data align with prior trials that provide relatively low complication rates associated with both fixation techniques. A greater likelihood of wound infections and complications due to hardware is usually linked to plate fixation and has been observed by multiple authors [16]. Nevertheless, it should be mentioned that such complications were not profound in this cohort and did not need any further surgical treatment, indicating that both fixation methods can be employed efficiently with a decent intraoperative approach and follow-up [17].Regarding functional outcomes, both fixation strategies had resulted in outstanding functional outcomes. Both groups had extremely low Quick DASH (Disabilities of the Arm, Shoulder, and Hand) scores, meaning that functional impairment remained low. These findings are in tandem with those represented in previous studies that have shown satisfactory functional results after Rush nailing and plate fixation of pediatric Monteggia fractures [18]. The fact that the scores on the Quick DASH were similar in the two groups indicates that both types of fixations could contribute to the same level of functional recovery, even though the period of healing and the proportions of complications were different. Additionally, it is worth noting that the choice between Rush nailing and plate fixation is frequently dependent upon numerous considerations, such as the fracture complexity, child age, and surgeon preference. Even in more minor cases of Monteggia fractures where alignment is not as crucial, the Rush nailing technique might be more preferred due to its minimal invasion and reduced infection risks. But in more complicated fractures, where more stability is required, plate fixation can be the technique of choice to promote correct fracture alignment and a faster recovery.

5. CONCLUSION

Plate fixation and Rush nailing are both good options in dealing with Monteggia fractures in children. The results indicate the use of plate fixation results in faster healing and that the two methods have comparative functional recovery. Although both approaches are efficient, a more extended study is necessary to identify a more precise fixation choice depending on the complexity of the fracture to achieve the best outcomes.

6. LIMITATIONS

The retrospective study design, as well as internal sample size, restricts determining general findings. Also, the absence of a long-term follow-up leaves no opportunity to assess functional outcomes and complication rates in the long-run perspective. A broader understanding is required through more inclusive study and follow-up of larger populations.

7. FUTURE FINDINGS

Future tests ought to concentrate on bigger sample size randomized controlled trials to contrast Rush nailing and plate fixation. Also, patient-level variables, including age and the complexity of a fracture, may inform surgical decision-making. Ongoing long-term follow-up will also be useful to gain information on the durability as well as functional outcomes of both the procedures.

Abbreviations

1. **p-value** – Probability Value
2. **SD** – Standard Deviation
3. **Quick DASH** – Disabilities of the Arm, Shoulder, and Hand (Quick version)
4. **SPSS** – Statistical Package for the Social Sciences
5. **IRB** – Institutional Review Board

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Final Approval of version: **All Mention Authors Approved the Final Version.**

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