

Assessment of Radiographic and Functional Outcomes of Flexible Intramedullary (IM) Nailing in Adolescent Patients with Forearm Fractures: A Clinical Study

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ABSTRACT

Introduction: There are various methods of management of fractures in both bones of forearm in children. Historically, closed reduction and plaster cast application has been the gold standard in management of these fractures, however there are increased chances of re-displacement, particularly in older children. Aim of the study was to assess clinical outcomes of flexible intramedullary nailing in adolescent patients with forearm fractures.

Material and methods: The study was performed in the Department of Orthopaedics of the Medical institute. A total of 18 patients with age ranging between 10-16 years of age with a both-bone forearm fracture that was planned to treat with IM nailing were selected for the study. The subjects were evaluated of their preoperative and follow-up anteroposterior (AP) and lateral radiographic views of forearm Radiographic measurements were obtained using a pencil and goniometer and it included angulation of the fracture site, percentage translation of the distal fragment, and location of the ulnar fracture in relation to the radius.

Results: There were 18 patients included in the study. The mean age of the patients was 12.34 years. The number of male patients was 11 and number of female patients was 7. We observed that the union of fractured bones at 3 months was seen in 50% patients; whereas, bony union at 6 months was seen in 72.3% patients. Loss of forearm rotation was seen in 22.22% patients. The complications seen were in 3 and 2 patients, that were both major and minor respectively.

Conclusion: We conclude that Intramedullary nailing of forearm fractures in adolescent patients is an equally very efficacious treatment as compared to plate and screw fixation.

Keywords: Forearm Fracture, Intramedullary Nailing Fixation, Upper Extremity Fracture

INTRODUCTION

Distal radius fracture is a common upper-extremity injury, accounting for 8–15% of all skeletal injuries observed in orthopedic practice.^{1,2} There are various methods of management of fractures in both bones of forearm in children. Historically, closed reduction and plaster cast application has been the gold standard in management of these fractures, however there are increased chances of re-displacement, particularly in older children.^{3,4} As a result, there is a rising trend to fix most of these fractures. Fracture fixation may be done by extra-medullary devices like plates which have various disadvantages such as large incisions, more soft tissue dissection, more chances of infection and a re-surgery of almost similar magnitude for removal of

implant. As suggested by Shoemaker et al., the ideal fixation mode should maintain alignment, be minimally invasive and should have least complications.⁵ This has led us to the use of intramedullary fixation devices. While the initial techniques of intramedullary nailing of the distal radius using percutaneous pins (rods) failed to provide support of the subchondral bone to prevent articular collapse, modified intramedullary devices, such as Micronail, allowed the provision of fixed-angle support of the subchondral bone and combination of stable fixation with minimal soft tissue dissection.⁶ Hence, we planned the study to assess clinical outcomes of flexible intramedullary nailing in adolescent patients with forearm fractures.

MATERIAL AND METHODS

The study was performed in the Department of Orthopaedics of the Medical institute. A total of 18 patients with age ranging between 10-16 years of age with a both-bone forearm fracture that was planned to treat with IM nailing were selected for the study.

Exclusion criteria were as follows:

1. Bilateral forearm injuries
2. History of forearm injuries
3. Concomitant wrist or humerus fracture
4. Underlying bone pathology

Preoperative and recent follow-up anteroposterior and lateral radiographs of the forearm were assessed (figure-1). Radiographic measurements were obtained using a pencil and goniometer and it included angulation of the fracture site, percentage translation of the distal fragment, and location of the ulnar fracture in relation to the radius.

STATISTICAL ANALYSIS

The statistical analysis of the data was done using SPSS version 20.0 for windows. The Student's t-test and Chi-

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square test were used to check the significance of the data. The p-value less than 0.05 was predetermined as statistically significant.

RESULTS

There were 18 patients in the study. The mean age of the patients was 12.34 years. The number of male patients was



Figure-1: A: Pre Operative X-Ray B: Post Operative X-Ray C: X-Ray At One Month-Showing

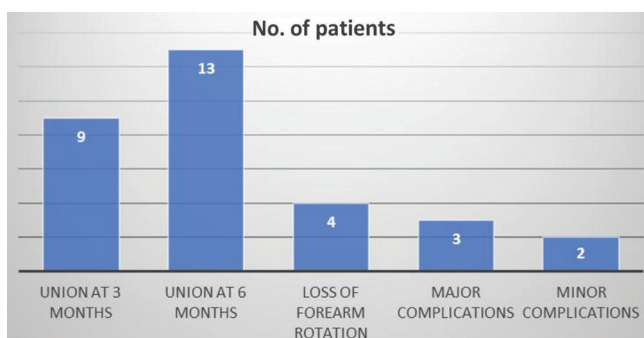


Figure-2: Frequency of patients with radiographic outcome, functional outcome and complications with intramedullary nailing

Parameters	No. of patients (n=18)	p-value
Union at 3 months	9 (50%)	0.11
Union at 6 months	13 (72.22%)	0.21
Loss of forearm rotation	4 (22.22%)	0.35
Major complications	3 (16.66%)	0.4
Minor complications	2 (11.11%)	0.8

Table-1: Assessment of radiographic outcome, functional outcome and complications with intramedullary nailing

11 and number of female patients was 7. Table 1 shows the assessment of radiographic outcome, functional outcome and complications with intramedullary nailing (figure-2). We observed that the union of fractured bones at 3 months was seen in 50% patients; whereas, bony union at 6 months was seen in 72.3% patients. Loss of forearm rotation was seen in 22.22% patients. The complications seen were in 3 and 2 patients, that were both major and minor respectively.

DISCUSSION

In the present study we assessed clinical outcomes of flexible intramedullary nailing in adolescent patients with forearm fractures. We observed that the union of fractured bones at 3 months was seen in 50% patients; whereas, bony union at 6 months was seen in 72.3% patients. Loss of forearm rotation was seen in 22.22% patients. The complications seen were in 3 and 2 patients, that were both major and minor respectively. But the results were statistically non-significant. The results of the study were correlated with previous studies and results were consistent with previous studies. Anastasopoulos J et al compared the efficacy of flexible intramedullary nails as a mode of fixation amongst paediatric femoral shaft fractures. The patients were aged between 7.2 to 13.5 years and the mean follow-up duration was 25.5 months. All subjects had open growth plates of femur at the time of surgery. There were no patients requiring re-operation. Complications of the study were pain/irritation at the site of insertion, wound breakdown and delayed union. No major complications were seen in the study. All children had full range of motion after nail removal. There were 44% of the children who had malalignment at the fracture site, there were no cases of clinical malalignment of the fractured limb. There were 50% of the children who had leg-length inequality but there was no functional problem. Flexible nail fixation of diaphyseal femoral fractures is a reliable method with a small learning curve and allows quick mobilization. Most of minor complications were technique related and could be avoided. Patel A et al evaluated functional, radiographic outcomes and complications of nailing and plating for diaphyseal forearm fractures amongst children under 18 years of age. There were statistically no significant differences in functional outcome or fracture union time between plating and nailing. No significant difference was observed in complication rate, angulation, shortening or rotation. Better cosmetic results and shorter duration of surgery was seen amongst the IM nailing group. The radial bow postoperatively was significantly abnormal amongst

the IM nailing groups. Nailing appeared to be a safe and effective alternative when compared to plating for paediatric fractures of forearm. However, critical results of the studies have found some methodological discrepancies.^{7,8}

Reinhardt KR et al evaluated the radiographic and functional outcomes of nailing and plating of fractures of forearm amongst children between ages of 10 and 16 years. 31 patients were divided into two groups and were compared retrospectively as per the perioperative data and patient outcome. The nailing group included 19 patients with a mean age of 12.5 years and the plating group included 12 patients, with a mean age of 14.5 years. It was observed that the surgery duration and use of tourniquet were significantly short in the nailing group. There was no difference in fracture union at 3 or 6 months. The radial bow magnitude was similar in the 2 groups at latest follow up. Radial bow location differed significantly from the normal values in both the groups. The rate of complication were similar between groups. Based on similar functional and radiographic outcomes, nailing of length-stable forearm fractures remains an equally effective method of fixation in skeletally immature patients 10 to 16 years of age when compared with plating and is our treatment of choice. Parajuli NP et al reviewed union time and functional outcome of pediatric diaphyseal forearm bone fracture managed with intramedullary rush pin by closed or open reduction. 50 subjects with both forearm fracture were treated with intramedullary rush pin using closed or open reduction and were followed up for six month duration for radiological and functional outcome. There were 31 patients who underwent closed reduction and 19 who underwent open reduction. All fractures had good alignment post operatively. 47 subjects had excellent results with normal range of motion of elbow and normal rotation of and three patients showed good results. Radiological union was observed at 3 months. Eight patients had minor complications that included skin irritation at prominent hardware, backing of ulnar pin, skin break down with hardware exposure. The study concluded that fixation with intramedullary nail is an effective, cheap, and convenient method for treating pediatric fractures.⁹⁻¹¹

CONCLUSION

Within the limitations of the study we conclude that Intramedullary nailing of forearm fractures in adolescent patients is an equally very efficacious treatment as compared to plate and screw fixation.

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