



PEDIATRIC FOREARM FRACTURES; FUNCTIONAL OUTCOME MANAGED WITH INTRAMEDULLARY RUSH NAILS - EXPERIENCE IN A TERTIARY CARE HOSPITAL

Muhammad Jamil¹, Ghulam Mustafa Kaimkhani², Dr. Naveed Ahmed Solangi³, Muhammad Bakhsh Chacher⁴

3. Department of Orthopedic Surgery
Dow University of Health Sciences
and Civil Hospital, Karachi

Correspondence Address:
Dr. Naveed Ahmed Solangi
Department of Orthopedic Surgery
Dow University of Health Sciences
and Civil Hospital, Karachi

Article received on:
09/08/2014

Accepted for publication:
09/09/2014

Received after proof reading:
21/02/2015

ABSTRACT... Unstable forearm both bones fracture in children more than 10 years of age are difficult to manage with cast and surgical intervention is required. **Objectives:** To determine the functional outcome of patients with unstable forearm fractures managed with intramedullary rush nail. **Methods:** This study was conducted at Department of Orthopedics, Civil Hospital Karachi from July 2011 to August 2013. All the patients with age in between 10 to 15 years, with close radius ulna unstable fracture presenting within 7 days of trauma or fall were included in the study. All the fractures were stabilized with intramedullary rush nails. Functional outcome was assessed at 12 weeks. **Results:** There were 79 patients included in the study. Mean age was 13.17 ± 2 years. There were 52 male patients (65.8%) and 27 females (34.2%). There were 24 patients with history of road traffic accident, 29 patients with fall and 26 patients with blunt injury. Acceptable outcome was found in 64 (81%) patients and observed more in male children ($p=0.001$) and children above 13 years of age ($p=0.027$). Union was achieved in all the patients. Six patients had pin site irritation and 2 had superficial infection. **Conclusions:** Intramedullary fixation with rush nail in unstable forearm fractures in the children appeared to be an effective method of fixation and provided acceptable outcome in 64 (81%) patients.

Key words: Pediatric forearm fractures; intramedullary rush nail; functional outcome

Article Citation: Jamil M, Kaimkhani GM, Solangi NA, Chacher MB. Pediatric forearm fractures; functional outcome managed with intramedullary rush nails - experience in a tertiary care hospital. Professional Med J 2015;22(2):195-199.

INTRODUCTION

Forearm fractures are common in children >10 years of age¹. Forearm diaphyseal fractures comprise 6-10% of all pediatric fractures and both fractures usually occur as a result of fall on to out stretched hand². Stable fractures can be managed with application of cast. Displaced fractures can be reduced and can still be managed with cast. Unstable fractures in which reduction cannot be maintained in cast need surgical intervention³. These fractures can be stabilized after open reduction and internal fixation with dynamic compression plate or intramedullary nails can be utilized after closed reduction⁴. Open reduction and internal fixation is a good technique to achieve accurate reduction. However it may be associated with extensive soft tissue stripping which may devascularize the bone segments, increases the risk of infection and poor scar which may not be cosmetically acceptable⁵. With the introduction of variety of intramedullary nails there is increasing trend in the fixation of these fractures with intramedullary implants. Kirschner wires,

steinmann pins and elastic stable intramedullary nails have been reported in literature with successful results^{6,7,8,9}. Intramedullary fixation is minimally invasive, simple to apply and maintains good alignment. At our institution we have utilized rush nail which is the forerunner of modern elastic intramedullary fixation in which the objective is to achieve three point fixation on the inner aspect of the cortex. The objective of this study was to determine the functional outcome of patients with unstable forearm fractures managed with intramedullary rush nail.

METHODS

This study was conducted at Department of Orthopedics, Civil Hospital Karachi from July 2011 to August 2013. All the patients with age in between 10 to 15 years, with close radius ulna unstable fracture presenting within 7 days of trauma or fall were included in the study. Patients with open fracture or associated with polytrauma were excluded from the study. The patients were admitted either through emergency or outpatient

department. The diagnosis was made on x-ray with unstable fracture involving both radius and ulna. Fractures were temporarily stabilized with back slab in the emergency or outpatient department, patients were admitted in ward and started on regular analgesia. The patients family was counseled for the surgical procedure and informed consent was taken. The patients were planned on the next available trauma list. All the surgeries were performed by senior consultants with at least five year postgraduate experience.

Procedure: Patient was placed supine on the operation table under general anesthesia. A rush nail size 2.0 to 3.0 mm was used for either bone. The nail in the radius was inserted just proximal to the physis on the radial border. Care was taken to avoid injury to the superficial radial nerve. An alternate point of entry was made dorsally adjacent to Lister's tubercle. The nail in the ulna was inserted just distal to the physis on the radial border. The point of entry was easily palpable and proximal to the annular ligament and head of the radius. The wound was closed and back slab was applied. Postoperative antibiotic (2nd generation cephalosporin) was continued for 3 days.

Active and passive range of motion exercises for fingers were started on 1st post operative day. Patients were discharged when clinically stable and pain free. Stitches were removed on 10th post operative day in outpatient department and followed every 4th week. Forearm remained immobilized for 8 weeks in plaster of Paris after which plaster was removed and active movements of elbow and forearm were started. Final outcome was measured on 12th week on the basis of grading system by Price et al (Table-i)¹⁰. Good to excellent outcome were taken as acceptable outcome. Data was analyzed through SPSS-16. The results were shown in frequencies and percentages. Functional outcome was compared among age groups, gender and timing of presentation. Chi square test was used and p value of < 0.05 was taken significant.

RESULTS

There were 79 patients included in the study.

Mean age was 13.17 ± 2 years (range 11 to 15 years). Patients were divided into two subgroups; 43 (54.4%) in one group with age < 13 and remaining 36 (45.6%) in other group with age >13. There were 52 male patients (65.8%) and 27 females (34.2%). Mean duration of injury was 3.39 ± 1.38 days with range from 2 to 6 days. Most of the patients presented within 3 days of injury (i.e 58.2%). There were 24 patients with history of road traffic accident, 29 patients with fall and 26 patients with blunt injury. Excellent functional outcome was found in most of the patients (n=42; 53.2%) followed by good in 22 (27.8%), fair in 11 (13.9%) and poor in 4 (5.1%). Acceptable outcome was found in 64 (81%) patients. In patients younger than 13 years of age acceptable outcome was observed in 31 (72.1%) patients while in the other group (>13 years) acceptable outcome was observed in 33 (91.7%) patients (p=0.027)[Table-II]. Acceptable outcome was observed more in male patients (n=49; 94.2%) as compared to female patients (p=0.001)[Table-III]. In patients presenting within 3 days of injury, acceptable outcome was found in 34 (73.9%) while in patients presenting more than 3 days on injury acceptable outcome was found in 30 (90.0%) [Table-IV]. Union was achieved in all the patients. Six patients had pin site irritation and 2 had superficial infection managed with antibiotics.

Outcome	Symptoms	Loss of forearm rotation
Excellent	No complaints with strenuous activity	<15
Good	Mild complaint with strenuous activity	15-30
Fair	Mild complaints with daily activities	31-90
Poor	All other results	>90

Table-I. Grading system for functional outcome

DISCUSSION

In our study Intramedullary fixation for pediatric forearm fracture showed excellent outcome in 53.2% and good in 27.8%. Acceptable outcome was observed more in male patients and patients with age between 13 to 15 years.

Hand and forearm fractures account for 1.5% of

		Acceptable Outcome			p-Value
		Yes	No	Total	
Age Group (years)	≤13	31 (72.1%)	12 (27.9%)	43 (100%)	0.027*
	>13	33 (91.7%)	3 (8.3%)	36(100%)	
	Total	64 (81%)	15 (19%)	79 (100%)	

Table-II. Acceptable outcome in age groups
*Chi square test

		Acceptable Outcome			p-Value
		Yes	No	Total	
Gender	Male	49 (94.2%)	3 (5.8%)	52 (100%)	0.001*
	Female	15 (55.6%)	12 (44.4%)	27 (100%)	
	Total	64 (81%)	15 (19%)	79 (100%)	

Table-III. Acceptable outcome among gender subgroups
*Chi square test

		Acceptable Outcome			p-Value
		Yes	No	Total	
Duration of injury (Days)	≤3	34 (73.9%)	12 (26.1%)	46 (100%)	0.057*
	>3	30 (90.9%)	3 (9.1%)	33 (100%)	
	Total	64 (81%)	15 (19%)	79 (100%)	

Table-IV. Acceptable outcome in respect to duration of injury
*Chi square test

all emergency department cases, with radius or ulnar fractures, or both, comprising the largest proportion of fractures (44%) in this group¹. Of 6,493 pediatric fractures that were seen over a 10-year period in one center, forearm shaft fractures were one-third of the total in frequency (14.9%), just lower in incidence than distal radius fractures (20.2%) and supracondylar fracture of the humerus (17.9%)². In another study, however, diaphyseal fractures accounted for only 3.4% of children’s fractures³. Boys typically outnumber girls by a 2:1 ratio, with the majority seen in children who are 6 to 8 years of age⁴. In this study however the ages of children were in between 10-15 years but male dominance was also seen in this study (65.8%). These fractures are usually caused by a fall on an outstretched extremity. As a child matures, the weaker bone shifts distally; thus, shaft fractures may tend to occur more commonly in younger children⁵. Other authors, however, believe that forearm fractures occur in older children, presumably as a result of activities that result in these high-energy injuries. Mid-shaft fractures are most commonly the greenstick

type (82.5%)¹⁴. This study shows that most of the patients were present with <13 years of age, i.e. 43 (54.4%).

Forearm fractures can be easily managed with close reduction and cast application. But with the children more than 10 years of age there is increased risk of displacement⁶. Unstable fractures require internal fixation. Intramedullary fixation has certain advantages including less periosteal stripping, small scar mark which is more cosmetically acceptable, absence of diaphyseal stress riser and less risk of infection⁷. Intramedullary nails have been utilized in open fractures, failed plating and burns patients. The problem with unlocked intramedullary nail is loss of rotational control. We have utilized pre bent intramedullary nail to achieve 3 point fixation in unstable close fractures and additionally immobilized in plaster cast for 8 weeks to overcome this problem.

Ahmad et al⁸ reported the results of 22 patients with an average age of 9.5 years having unstable

radius ulna forearm fractures. They observed excellent outcome in 18 (82%) patients, good in 2 (9%) and fair in 2 (9%) patients. In our study average age was 13.17 years and excellent outcome was observed in 53.2%.

Baldwin K et al⁹ performed a systematic review and meta-analysis to compare intramedullary versus plate and screw fixation in both bone forearm fractures in children and adolescents. They concluded that both are acceptable fixation methods and 9 of 10 patients had excellent outcome regardless of fixation methods. Intramedullary fixation had better cosmesis.

Parajuli NP¹⁰ et al reported their results of using intramedullary rush pins as a fixation method for both forearm bone fractures in 50 patients. Excellent result was reported in 47 (94%) patients while good in 3 (6%) patients. Eight patients were reported to have minor complications including skin irritation, back out of ulnar implant and skin breakdown with exposed implant. In our study 6 patients had pin site irritation and 2 patients had superficial infection.

Absence of comparison group was a limitation of our study.

CONCLUSIONS

Intramedullary fixation with rush nail in unstable forearm fractures in the children appeared to be an effective method of fixation. It provided acceptable outcome in 64 (81%) patients with minor complication which were managed conservatively.

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Robert James Graves, FRCS (27 March 1796 – 20 March 1853)



He was an eminent Irish surgeon after whom Graves' disease takes its name. He received a degree in medicine in 1818. He was President of the Royal College of Physicians of Ireland, Fellow of the Royal Society of London and the co-founder of the Dublin Journal of Medical Science. He is also the uncredited inventor of the second-hand on watches.



AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. N.	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Muhammad Jamil	Topic selection Introduction writing	
2	Ghulam Mustafa Kaimkhani	Statcal analysis	
3	Dr. Naveed Ahmed Solangi	Data collection References collection	
4	Muhammad Bakhsh Chacher	References collection	