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Research Article

**ASSESSMENT OF FUNCTIONAL OUTCOME OF FOREARM
REFRACTURE TREATMENT IN CHILDREN**¹ Dr. Kashif Raza Khan, ²Dr. Syed Hahib Ullah, ³Dr. Mohammad Abid¹Assistant Professor, Department of Orthopedic Surgery, DHQ Teaching Hospital/Sahiwal Medical College, Sahiwal²Associate Professor, Department of Orthopedic Surgery, DG Khan Teaching Hospital, DG Khan³Assistant Professor, Department of Orthopedic Surgery, Shahida Islam Medical College Lodhran**Article Received:** December 2019 **Accepted:** January 2020 **Published:** February 2020**Abstract:**

Objective: To assess the functional outcome of forearm refracture treatment in children at DHQ teaching Hospital, Sahiwal.

Material and methods: This cross sectional study was conducted at Department of Orthopedic Surgery, Sahiwal Medical College Sahiwal from January 2109 to December 2019 over the period of 12 months. Total 25 patients with forearm refracture within 18 months of primary fracture (open/close) having age 6-14 years either male or female were selected. Functional outcome was assessed serially according to price et-al criteria.

Results: Total 25 patients with forearm refracture within 18 months of primary fracture were selected and outcome scoring as per Price et al was assessed. Out of 25 children, males were 17 (68%) and females were 8 (32%). Total 22 were closed fractures and 3 were type 1 open fractures. At 1 year follow up 25% had a good score and 75% had excellent score.

Conclusions: Refracture of forearm fractures in children can be treated both conservatively and surgically successfully like a primary fracture depending on the indications. It needs 2 to 3 more weeks of immobilization than primary fracture. Majority of cases have a good functional outcome. We suggest using splints till quadricortical union is achieved to prevent chances of refracture.

Keywords: Refracture, Forearm fracture, Paediatric, Outcome

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INTRODUCTION:

Forearm fractures are one of the commonest fractures accounting for 40% of paediatric fractures. Refracture is one of the complications of treated paediatric fractures. Refracture is defined as second fracture occurring in an otherwise normal bone within 18 months.¹ Refracture can be classified into early and late forms. The forearm refracture rate is around 5% in recent studies. Early refracture occur through the immature callus and occur due to short period of immobilization. Late refractures occur in the remodelled bone and are related to patient's activity.² Forearm fractures are increasing probably due to poor bone mineralization, due to decreased physical activity, Vitamin D deficiency as opined by Ryan et al.³ These fractures are treated by conservative measures with closed reduction and casting or by surgical fixation with flexible nails or plates. The implants are removed by six months to one year as compared to elderly patients which are delayed by 18 months to two years. The reasons for refractures are various and include incomplete immobilization, inadequate healing.⁴⁻⁵ Treatment of refracture is a debated topic with various authors advocating different methods. There are no definitive guidelines for management of forearm refracture and implant removal in paediatric cases. We collected all the cases of forearm refracture who presented to our institution. Our study is primarily aimed at studying the epidemiology, methods and difficulties of management and results of forearm refracture treatment. We assumed that there is no difference in management of these cases as compared to primary fracture. We managed these cases in the same line as if we are treating primary fractures except that we delayed immobilization by two more weeks.

MATERIAL AND METHODS:

This cross sectional study was conducted at Department of Orthopedic Surgery, Sahiwal Medical College Sahiwal from January 2109 to December 2019 over the period of 12 months. Total 25 patients with forearm refracture within 18 months of primary fracture (open/close) having age 6-14

years either male or female were selected. Refractures at proximal, middle and distal forearm shaft treated either by closed reduction and cast or intramedullary nailing were included.

Children with congenital or metabolic bone diseases, muscular dystrophies, and neurologic disorders were excluded from the study.

Study is approved by the ethical committee and written informed consent was taken from parents of every children. Demographic data of the selected patients was noted.

Detailed history of mechanism of injury during the primary and second fracture was noted. Fracture site, pattern and whether closed or open was recorded. Method of treatment of the first fracture and time till refracture was analyzed. Radiographs of forearm, AP and lateral views were taken. Closed reduction under brachial block or general anaesthesia was tried under fluoroscopic guidance in all cases. Undisplaced fractures, reducible stable fractures were treated with above elbow cast. Surgical fixation with intramedullary square nail was done for unstable fractures. Regular follow up was done at 1 week, 2 weeks, 6 weeks, 6 months and 1 year. Radiographs were taken at 6 weeks and bony union analyzed. The limb was immobilised till tricortical union was obtained. Cast was removed at 6 weeks in most of the cases but had to till 8 weeks in few cases which were sequentially followed up with weekly radiographs. Implant removal was done at 6 months in surgically fixed cases. The patients were followed up at 6 months and 1 year and bony union and residual angulation was noted. Functional outcome was assessed using Price et al criteria (Table 1).⁶ Complications like infection, restriction of movements, neurologic deficits were recorded during follow up visits.

All the collected was entered in SPSS version 18 and analyzed. Mean and SD was calculated for numerical data and frequencies were calculated for categorical data.

Table 1: Outcome scoring as per Price et al.

Outcome	Symptoms	Loss of forearm rotations
Excellent	No complaints with sternous exercises	15
Good	Mild complaint with sternous activity	15- 30
Fair	Mild complaint with daily activity	30-90
Poor	All other results	≥90

RESULTS:

Total 25 patients with forearm refracture within 18 months of primary fracture were selected and outcome scoring as per Price et al was assessed.

Out of 25 children, males were 17 (68%) and females were 8 (32%). (Fig. 1) Age range in this study was 6-14 years. Total 4 (16%) children were 6 years old followed by 5 (20%) were 7 years old, 2 (8%) children were 8 years old, 3 (12%) were 9 years, 2 (8%) were 10 years, 2 (8%) 11 years, 2 (8%) 12 years, 3 (12%) 13 years and 2 (8%) children were 14 old. (Table 2)

As shown in Table 3, 22 were closed fractures and 3 were type 1 open fractures. All our cases had radial fractures at the time of primary fracture and 80% had associated ulna fracture. Radius was found to be involved in all refractures with associated ulna fracture in 92% cases. Most of the cases were middle third fractures.

Initial method of treatment was surgical in 30% of patients while it rose to 42% in refracture cases. Surgical fixation was done in 11 patients and 4 required open reduction and fixation due to closed medullary canal. Tricortical union was seen by 6 weeks in 56% cases and by 7 weeks in 68% cases. By 8 weeks all the patients had tricortical union on radiographs (mean-6.56 SD-1.23) (Table 4).

Assessment of functional score using price et al scoring showed a good score in 33% of patients and excellent in 67% at 6 months in patients treated with closed reduction and cast. At 1 year 25% had a good score and 75% had excellent score. In patients treated with square nail 46% had a good score and 54% had excellent score at 6 months and by 1 year 69% had an excellent score and 31% had good score. None of the patients developed post op infections and no patients had any neurologic deficits.

Fig. 1: Gender distribution

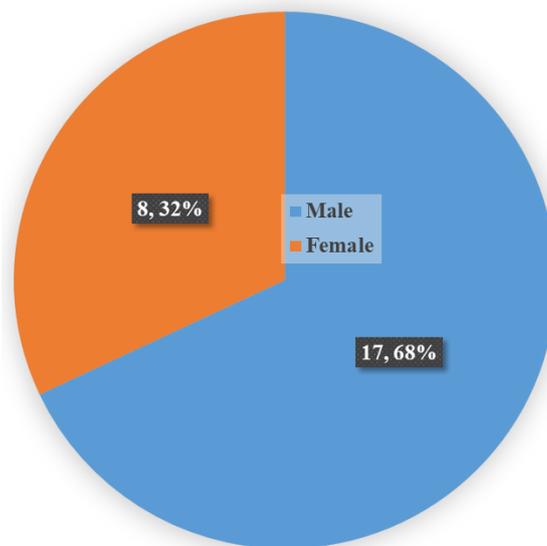


Table 2: Age distribution.

Age (in years)	Frequency (N)	Percentage (%)
6	4	16
7	5	20
8	2	8
9	3	12
10	2	8
11	2	8
12	2	8
13	3	12
14	2	8

Table 3: Site of fracture.

Site	Frequency (N)	Percentage (%)
Proximal 1/3	5	20
Middle1/3	15	60
Distal 1/3	5	20

Table 4: Radiological union.

Weeks	Frequency (N)	Cumulative percentage (%)
4	8	8
5	4	12
6	44	56
7	12	68
8	32	100

DISCUSSION:

Paediatric forearm refracture is commonly seen in regular orthopaedic practice but we have limited articles regarding management and treatment protocols of these cases.⁵ It needs to be studied in detail to find out the causes, incidences and difficulties of treatment and functional outcome of refracture. We focused on the method of treatment with special emphasis on difficulties faced during management and causes of refracture.⁸ We studied refracture cases treated both conservatively and surgically. Bould in his study reported 4.9% refractures among 768 children with displaced fractures.⁷ We treated 610 forearm fractures in 5 years and our refracture rate is 4.7%. It is comparable to various other studies.

Fernandez et al studied complications of paediatric forearm fractures treated by intramedullary nail and reported refracture in 13 children following intramedullary nail removal and in all, implant removal was done between 6 and 8 months.⁹ Remaining 14 had refracture sustained with elastic nail in situ and all of them suffered significant injury adequate to cause a fracture. The incidence of refracture was 5 % in their study. We studied refractures irrespective of initial mode of treatment (conservative/surgical) and the rate was 4.7%.

The mechanism of injury was slip and fall while playing in majority of cases. The sex ratio showed that refracture is more common in boys. Left sided fracture was common than right side. We had 60 % refractures in middle 3rd area while 20% each in distal and proximal 3rd area. Triskoy et al in their study revealed 72% refractures in middle while 24% in the proximal and 4% in the distal third radius forearm bones.¹⁰

Baitner et al in their study compared refracture with a control group and found that a thin fracture line was visible in 48% of patients as compared to 21% in controls.¹³ Triskoy et al in their study of 37 patients revealed refracture rate of 1.4%. The

immobilization duration was 72.2 days for initial fractures and 98.2 days for refracture. They waited till quadricortical fracture union with no trace of fracture line visible.¹⁰ In our study immobilization time is lower. We generally immobilize for 4 to 6 weeks in primary fracture and 8 weeks in case of refractures. The plaster was removed once there is no pain and tricortical union was achieved. We always warned parents and children about chances of refracture and to avoid playing outdoor for 3 months. We measured the interval of refracture after discontinuing plaster or implant removal. Our result showed that 76% of refractures happened by 16 weeks. Tricortical union was seen by 6 weeks in 56% and by 8 weeks in all patients. It is a very important observation which points out that majority of refractures happened before quadricortical union or complete fracture line disappearance.

We went through implant removal at duration which averaging 7 months. Makki et al in their study reported 16.7% refractures and the risk was high when nails were removed within 6 months of insertion.¹¹ The reason for premature removal was nail irritating skin mainly over ulnar side. We had one patient who presented with fracture following three months of initial surgery with bent nails inside. He was treated conservatively with manipulation and above elbow cast application under c arm guidance. X-ray showed well healed fracture with nails inside.

Method of treatment is a debated issue. Many articles have advocated conservative management. Makki et al in their study documented that open reduction was required in 33% patients with fracture of fore arm bones. Tisosky et al operated only 7 % of refracture cases in their series of patients. We could not go for conservative management in many cases and had to resort to operative method in 42% cases which were quite unstable and proper reduction could not be maintained. There were around 50% patients above 10 years which prompted us to do surgical fixation as remodelling

is less in this age group.¹⁰ Open reduction was necessary in four cases as negotiating nail through medullary canal was not possible due to blockage of canal by callus. We observed that it is necessary to be ready for open reduction in case closed reduction becomes difficult due to medullary canal block.

Weinberg et al studied refractures treated by intramedullary nail. They could nail 85% patients without opening.¹⁴ In 42% patients they found closed medullary canal. In our study 4 patients required open reduction. We did not find complications like osteomyelitis or tendon injury. Two patients had numbness over superficial radial nerve area which gradually disappeared.

CONCLUSION:

Refracture of forearm fractures in children can be treated both conservatively and surgically successfully like a primary fracture depending on the indications. It needs 2 to 3 more weeks of immobilization than primary fracture. Majority of cases have a good functional outcome. We suggest using splints till quadricortical union is achieved to prevent chances of refracture.

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