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Various treatment modalities in fractures of shaft of radius and ulna in children and associated complications at rural hospital

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Abstract

Fractures of both bones of the forearm are very common orthopaedics injuries in the paediatric age group. The majority of these fractures are usually treated by traction, reduction and above elbow casting. The present study is undertaken to study various treatment modalities and their postoperative complications and functional results.

Methods: It is a prospective study which was carried out from October 2019 to September 2021 in Pravara Rural Hospital, Loni, Ahmednagar. In this study 73 cases of fracture radius ulna of paediatric age group were treated by closed reduction and above elbow cast application and closed/open reduction with TENS nail fixation.

Results: A sample size of 73 patients were selected according to the inclusion and exclusion criteria coming to the hospital with fracture of shaft of radius and ulna. The patients in the study, ranged in age from 5 to 12 years old, with an average age of 8.315 years. The study discovered that males account for 54.8% of the incidence, while females account for 45.2% with male to female ratio being 1.2:1. The right hand was injured in 54% of cases, whereas the left hand was injured in 46%. A fall was the most common type of injury in our study (86%) followed by an assault (10%) and a traffic accident (4%). Conservative management had a higher union rate than other modalities. Postoperative swelling is more common in CRIF/ORIF with TENS nailing.

Conclusion: Conservative management with cast application remains the first choice for both-bone forearm fracture in children. In TENS nailing, complications are higher when compared to conservative management but still remains a good treatment modality for adolescent forearm fractures.

Keywords: Paediatrics fracture of radius and ulna, conservative management, closed/open reduction and internal fixation, tens nail

Introduction

The forearm consists of two parallel bones Radius and Ulna. Antebrachial Region, it is clinically known, spans the length of the region which extends roughly from elbow to wrist. They make radioulnar joint in wrist and elbow which play an important role in forearm rotation. Mechanism of injury causing fracture usually occurs from fall from height, sporting event or playground equipment injury.

Locations of Forearm Fractures in Children:

- 14% distal physis
- 60% distal metaphysis
- 20% midshaft
- 4% proximal third

Fractures of both bones of forearm are very common orthopaedic injuries in the paediatric age group [1, 2]. Forearm fractures comprises 40% or more of paediatric fractures [3, 4]. Injuries to the shafts of radius and ulna are the most common reasons for children to receive orthopaedic care [2]. Majority of these fractures are usually treated by traction, reduction and above elbow casting [5, 6]. Failures continue to occur with these methods of treatment. In some patients, the reduction achieved initially may be lost due to loosening of cast and movement at the fracture site which may lead to angulation, malrotation or over-riding of the fracture fragments,

necessitating operative intervention [6, 7]. Forearm fracture fixation with flexible nails has gained popularity in the past two decades, since it requires minimal surgical dissection and also tries to retain the biological factors at the fracture site [7, 8]. Even though flexible titanium and stainless-steel nails are available, Titanium nails are more likely to be used due to its inherent elastic property, thus allowing better insertional and rotational stability [6].

Even though the present study sheds some light on the operative management of pediatric forearm fractures, there are only a few limited and specific indications for surgery in these patients, and non-operative management with closed reduction and cast application appears to be the favoured treatment option. The results and complications of two different treatment modalities, conservative and operative management, are considered in this study.

Methods

This is a descriptive cross-sectional study carried out from October 2019 to September 2021 in the Department of Orthopaedics, Loni.

Inclusion criteria

1. Children Age group-5 years to 12 years
2. All Pediatrics patients of aged 5 years to 12 years who have radiological evidence of fracture and have undergone various method for fixation after being admitted in hospital.

Exclusion Criteria

1. Patients having fractures with neurovascular deficit
2. Multiple fractures with or without head injury
3. Crushing injury to the forearm
4. Both bone forearm fractures apparently showing sign of compartment syndrome needing fasciotomy.

This prospective study was hospital based and was conducted at a tertiary care private hospital. Patients were selected from those who attended the emergency and outpatient department. On admission to the institution, thorough history of mode of injury, associated injuries were documented for each patient. Clinical examination, neurovascular status and radiological assessment of the fractured limb were done. Patients were investigated further depending on the general condition and co-morbidity of the patient and routine pre-operative protocol was followed as per our hospital guidelines. All patients underwent various treatment modalities (closed reduction and cast application, close reduction or open reduction with intramedullary nailing with TENS nail) according to necessary indication. The cast was removed after 4-5 weeks and after that physiotherapy was provided step by step. A similar rehabilitation program consisting of assisted and active range of motion exercises was done for three months or more. Patients were followed at 2 weeks of surgery, at one month and then at monthly intervals till minimum of 6 months. Assessment and analysis of any complications were observed.

Results

This is a descriptive cross-sectional study of 73 cases, carried out from October 2019 to September 2021, in a tertiary health care hospital.

In our study, we discovered that boys account for 40 (54.8%) of the incidence, while girls account for 33 (45.2%) with male to female ratio being 1.2:1 (Graph No. 2). The youngest age at

the time of fracture was 5 years old and 12 years old was the oldest and the mean age was 8.315 years (Graph No. 1). Right side (53.43%, 39/73) involvement was more compared to left side (46.57%, 34/73) (Graph No. 3). The middle third of the radius and ulna (76.4%, 56/73) was the most prevalent site for fractures, followed by the distal third (19.6%, 14/73) and the proximal third (4%, 3/73). The most common manner of injury identified in our study was a fall (86%, 63/73), followed by an assault (10%, 7/73) and road traffic accident (4%, 3/73) (Graph No. 4). The most common fracture pattern was complete fracture (74%, 54/73) followed by greenstick pattern (16.4%, 12/73) and comminuted (9.6%, 7/73).

In our study, 38 cases were treated conservatively with an above elbow slab and a cast and 35 cases were treated with close reduction or open reduction with intramedullary nailing with TENS nail. Post-operative swelling was seen in 28 patients with 7 patients in conservative management and 21 patients in operative management. Post-operative pain score average in conservative management patients was 5 and operative management patient is 4.94 which was almost same (Graph No. 5).

Out of 38 patients who underwent conservative management, one patient developed elbow stiffness but no malunion or non-union. In all of the cases, the wrist movement was normal.

Out of 35 patients of TENS nailing, one patient (2%) had bursitis, two patients (4%) experienced delayed wound healing, one patient (2%) acquired superficial infection, and one patient (2%) experienced elbow stiffness. One patient had an elbow joint restriction in extension, and another had an elbow joint restriction in pronation. After three months, two patients (4%) showed evidence of non-union.

Discussion

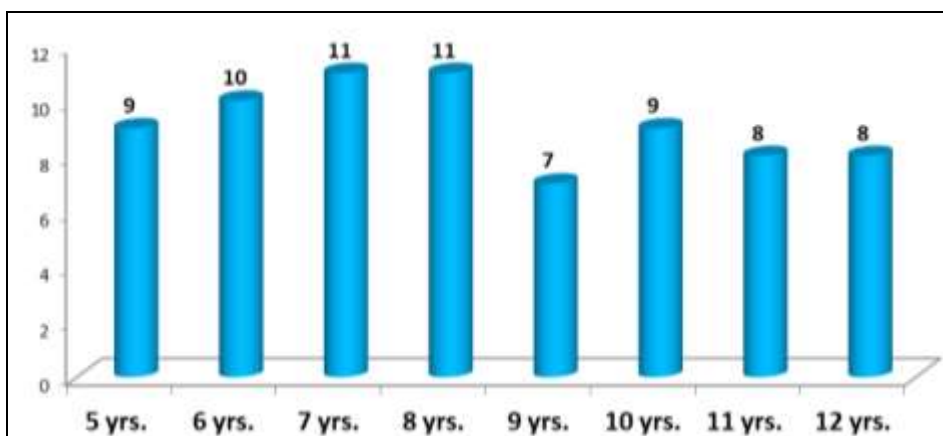
For age wise distribution studies done by Parajuli NP *et al.* (3-15 yrs., 10.3yrs.), Jeffrey E. Martus *et al.* (2-16 yrs., 9.7yrs.), Corinna C. Franklina *et al.* (1-16 yrs., 6.6yrs.), Emily A Eismann *et al.* (2-11 yrs., 6.3yrs.), Alison J. Dittmer *et al.* (4-16 yrs., 9.3yrs.) and Rohit R Patil *et al.* (3-12 yrs., 7.1yrs.) while our study included 73 patients ranging in age from 5 to 12 years, with a mean age of 8.315 years [9-14]. We found a male majority in incidence according to sex in our analysis, with males accounting for 54.8% and females for 45.2% with M:F ratio being 1.2:1 which is similar with Parajuli NP *et al.* (3.16:1), Corinna C. Franklina *et al.* (1.85:1), Emily A Eismann *et al.* (3.2:1), Alison J. Dittmer *et al.* (1.41:1) and Rohit R Patil *et al.* (2.57:1) study [9, 11-14]. The right hand was injured in 54% of cases, whereas the left hand was injured in 46%, similar incidence was seen in studies done by Parajuli NP *et al.* (56%, 44%), Rohit R Patil *et al.* (58%, 42%), Dr. Kundan Kushwah (63%, 37%) study and Waqar Alam *et al.* (63%, 37%) study [9, 14-16].

The most common manner of injury identified in our study was a fall (86%), followed by an assault (10%), and road traffic accident (4%). In our study, most common location of fractures was middle third of radius and ulna (76.4%) followed by distal third (19.6%) and proximal third (4%). Rohit R Patil *et al.*, Dr Kundan Kushwah's study, Syed Hahib Ullah *et al.* and Eric N. Bowman *et al.* study observed higher incidence of middle third fracture [14, 15, 18, 21].

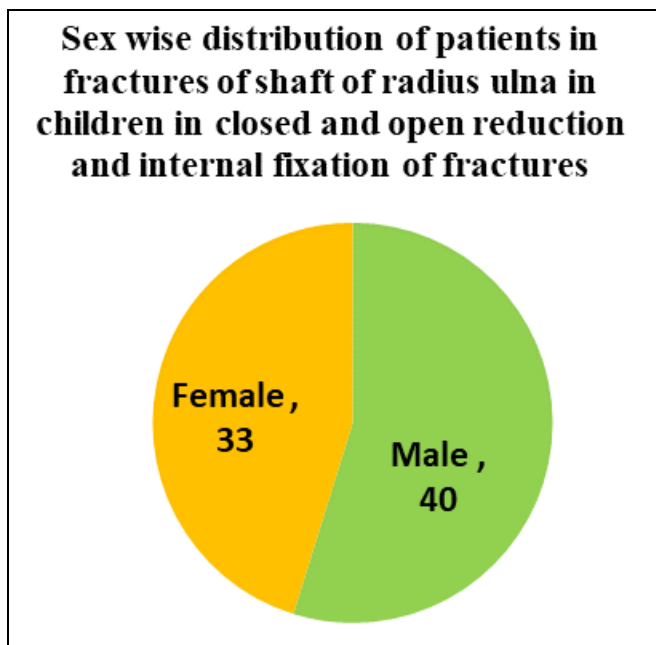
In our study, 38 cases underwent conservative management with above elbow slab followed by cast out of which, 1 case got elbow stiffness and there was no case of non-union or mal-union. Dr. Kundan Kushwah [15] study had 2 cases (13.3%) of mal-union and 2 cases (13.3%) of elbow stiffness among 15 patients who underwent conservative management

[15]. Manikandarajan and Dinesh Raj observed no case of malunion or non-union while 10% patient had a restriction of supination and pronation [17]. Bijaya Kumar Lamay study observed that out of 40 patients underwent conservative management, 4 cases (10%) have malunion and cosmesis is poor in 2 cases (5%), 3 cases (7.5%) have severe restriction of rotational movements of forearm and 8 cases (20%) have less than normal range of flexion movements around elbow [19]. Out of 35 patients of TENS nailing, 1 patient (2%) got bursitis, 2 patients (4%) had delayed wound healing, 1 patient (2%) developed superficial infection and 1 patient (2%) had elbow stiffness. 1 patient had restriction in extension at elbow joint and 1 patient had restriction in pronation at elbow joint.

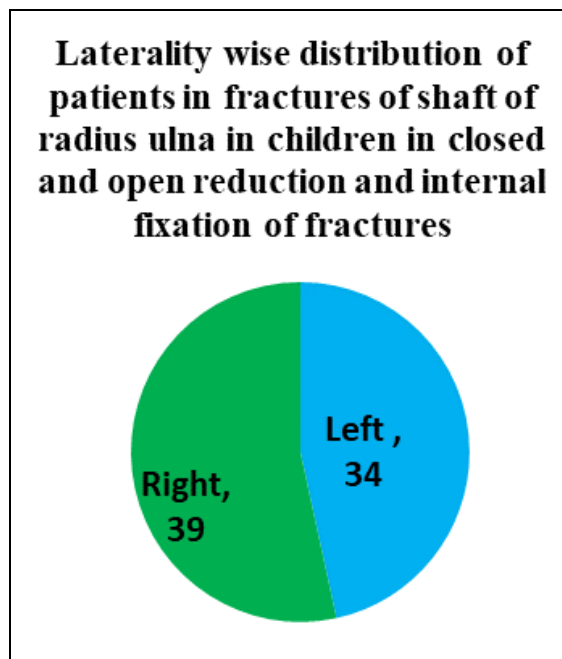
2 patients (4%) showed signs of non-union after 3 months follow up. Dr. Kundan Kushwah had done study in 15 patients of CRIF/ORIF with TENS nailing patient. 1 patient (6%) had infection and 1 patient (6%) had elbow joint stiffness [15]. In Bijaya Kumar Lamay *et al.* study, 10% cases have superficial infection and was treated with local antibiotics and healed, 5% cases of neuropraxia involving the superficial radial nerve were detected which resolved after several weeks with no long-term complication [19]. Biswajit Sahu *et al.* study observed 5% patients had superficial infection and 7.5% patients had pain due to nail prominence. 12.5% patients had restriction of supination and Pronation but no case of non-union [20].



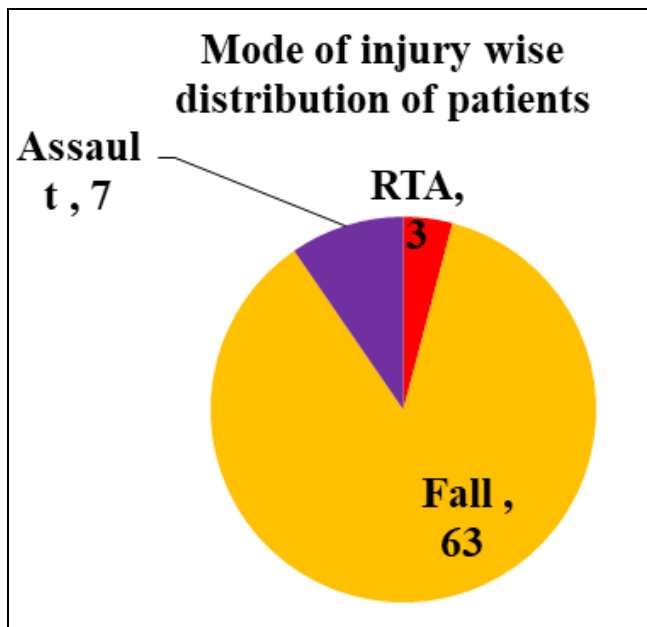
Graph 1: Age wise distribution of patients in fractures of shaft of radius ulna in children in closed and open reduction and internal fixation of fracture



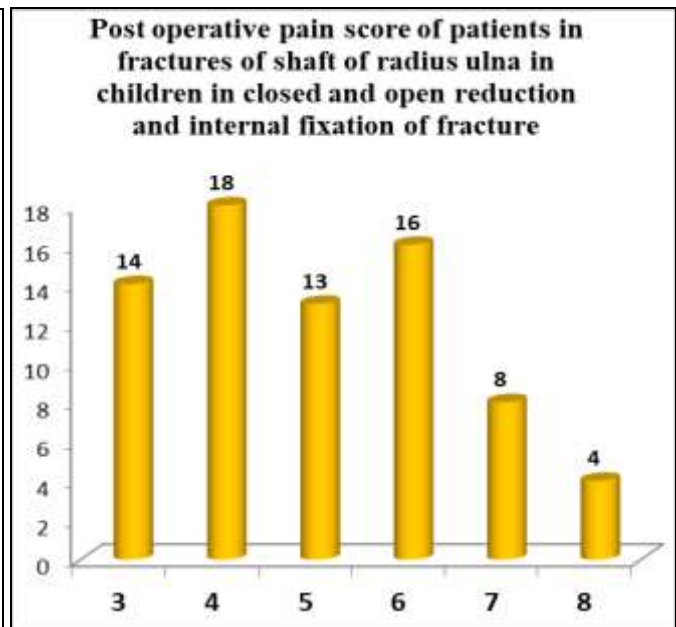
Graph 2: Pie diagram of Sex wise Laterality wise distribution of patients



Graph 3: Pie diagram of distribution of patients



Graph 4: Pie diagram of Mode operative pain of injury wise distribution of patients



Graph 5: Bar Diagram of Post- score of patients in fractures

Table 1: Postoperative complications of patients in fractures of shaft of radius ulna in children in closed and open reduction and internal fixation of fractures

Postoperative complications	Number of patients	Percentage (%)
No Complications	67	91.78
Bursitis	1	1.36
Delayed wound healing	2	2.73
Elbow stiffness	2	2.73
Superficial infection	1	1.36
Total	73	100.00

Table 2: Postoperative complications of patients in fractures of shaft of radius ulna in children underwent conservative management and operative management

Conservative Management (38 patients)	Operative Management (35 patients)
Elbow Stiffness - 1 patient	Delayed wound healing – 2 patients
Non-union/Mal-union – 0 patient	Elbow stiffness – 1 patient
	Bursitis – 1 patient
	Superficial infection – 1 patient

Conclusion

Conservative management with cast application remains the first choice for both-bone forearm fracture in children. Children have excellent remodeling potential and even fracture with displacement and greater angulation heal without any deformity. Fracture treated conservatively had a greater potential of healing along with a faster healing rate. Closed/open reduction and internal fixation are indicated when conservative management fails. In TENS nailing, complications are higher when compared to conservative management but still remains a good treatment modality for adolescent forearm fractures.

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