Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(5A):1443-1446 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2016.v04i05.002

Original Research Article

Closed Primary Intramedullary Nailing for Elderly Paediatric Diaphyseal Forearm Bone Fracture

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Abstract: The current study was undertaken to assess the results of primary closed nailing in fracture shaft radius and ulna in elderly paediatric age group. Though in Paediatric age group the bones have a capacity to remodel when treated conservatively, controversy exists as to what amount of angulation, displacement and rotation is acceptable. Thirty patients with both forearm bone fractures were treated primarily with Intramedullary closed nailing by L wires or Titanium elastic nails and followed up for a period of 3 months for radiological and functional outcome. All 30 patients maintained good alignment post operatively.26 patients had excellent results with full range of movements while 4 had good results. In all patients good radiological union was seen in 6-8 weeks. The study proved that the closed primary intramedullary fixation is a simple, economic and easy way to treat both bone diaphyseal fracture in forearm in elderly paediatric age group.
Keywords: Intramedullary Nailing, Elderly Paediatric forearm fracture

INTRODUCTION

The number of forearm fractures is increasing faster than the predicted rate due to rapid industrialization, road traffic accidents and various sports activities, increasing the incidence of fall and direct blow. Function may be most obviously affected with loss of pronation/ supination [1], and as many as half of patients with both bone forearm fractures will have obvious loss of forearm pronation, which is significant in displaced fractures. Loss of forearm rotation is most likely when fractures occur in the middle third of the forearm. To obtain and hold an accurate reduction usually necessitates closed reduction and internal fixation in elderly paediatric age group. The present study was undertaken to provide satisfactory functional outcome by preventing complications of conservative and open surgical method, by choosing closed Intramedullary Nailing in elderly paediatric age group.

AIM

To assess the results of primary closed nailing in fracture shaft radius and ulna in elderly paediatric age group.

METHODOLOGY

30 children with closed displaced fractures of shaft radius and ulna in paediatric age group of 10 to 18 years were attended in Dr. D. Y. Patil Hospital and Research centre, Kolhapur, from a period of May 2014 to November 2015 and treated with closed intramedullary nailing, Lwires or Titanium Flexible nails, in patients who were affording. Patients with isolated bone fracture, metaphyseal bone fracture, compound fractures and pathological fractures were excluded. Fracture union and final range of motion were assessed radiologically and clinically in subsequent follow ups. Radiological union was proved by signs of bridging callus at the fracture site on Anteroposterior(AP) and Lateral views on X-rays.

Clinical union was assessed by the criteria described by Price *et al* [2].

Table 1: Criteria described by Price *et al* [2]

Perfect	No complaints/pain with strenuous physical activity and/or loss of < 10º forearm rotation
Good	Mild complaints/pain with strenuous physical activity and/or loss of 11º–30º forearm rotation
Fair	Mild subjective complaints/pain during daily activities and/or loss of 31º–90º forearm rotation
Poor	All other results

OPERATIVE TECHNIQUE

Following Close reduction under anaesthesia with the help of C-Arm, radial fracture was fixed retrogradely with the nail advanced through the hole just proximal to the distal radial epiphysis, taking care not to injure extensor tendons and superficial radial cutaneous nerve. Ulnar fracture was fixed anterogradely distal to epiphysis of olecranon. The tip of radial nail was bent to about 15 to 30 degrees for easy passage through the medullary cavity and manipulation through the fracture site. Length of the nail was measured from the proximal to distal epiphysis and diameter of the size of medullary cavity at the level of isthmus. Adequate length was kept buried under the skin for easy removal after the union. Patients fixed by intramedullary nail were immobilized in the above elbow pop slab for 4 weeks post-operatively. The patients were followed up at regular interval at four weeks, six weeks and if required after 8 weeks at our hospital till union occurred and evaluation was done based on Price *et al* scoring system [2]. Elbow movements and wrist movements were noted and the union was assessed radiologically and clinically.

RESULTS

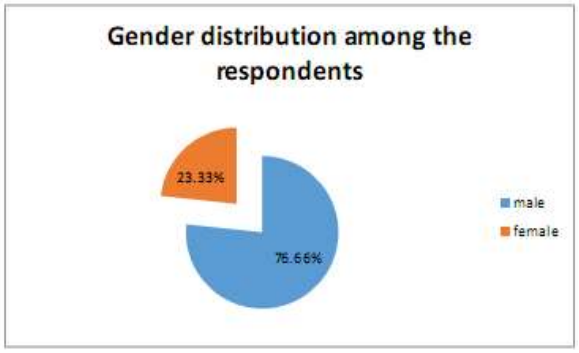

Fig-1: Gender distribution among the respondents

There were 30 patients (23 males and 7 females) of age 10 to 18 years with mean age being 11.76 years, treated for diaphyseal forearm fractures with intramedullary nailing by L wire or Titanium Flexible nails.

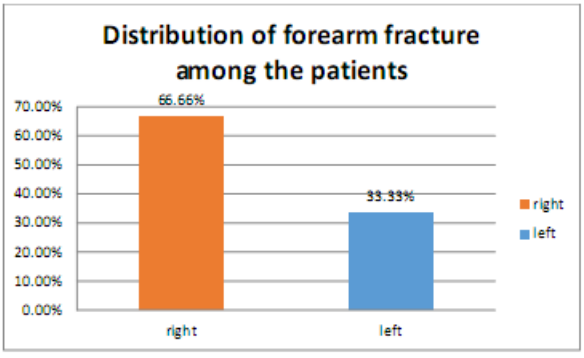

Fig-2:Distribution of forearm fracture among the patients

20 patients(66.66%) had right forearm fracture while 10(33.33%) had left forearm fracture. Patients were followed up for 6-8 months.

The Average time of fracture union which is defined as presence of bridging callus on AP and Lateral X-rays was 6-8 weeks.

Table 2: Results by Price's criteria

Results	Percentage
Excellent	86.66%
Good	13.33%
Total	100%

Results were evaluated with Price's criteria and we had 86.66% excellent results and 13.33% good results.

No cases of non-union, malunions, infection, nerve injury, compartment syndrome or epiphyseal injury were reported.

Two cases developed intrusion of nail in ulnar entry point and one in radius. One case presented with Olecranon bursitis. Complications such as limb length discrepancy affecting the extremity functions, epiphyseal damage, angular or rotational deformity, synostosis or restricted elbow movement were not encountered.

DISCUSSION

Diaphyseal forearm fractures comprise 3–6% of all paediatric fractures [3, 5] and are the second most common fracture type among adolescents. Some children can have loss of forearm rotation after conservative management. Residual angulation or rotational deformity can lead to a significant reduction in pronation-supination, particularly in older children in whom there is less potential for bone remodelling. Anatomical reduction may therefore be of greater importance in this age group as they can tolerate a lesser degree of mal-union. It is essential to maintain and restore the position and magnitude of the radial bow to preserve forearm range of motion [7].

In recent years the proportion of paediatric forearm fractures treated with internal fixation has increased, with a particular rise in the use of intramedullary nailing. This increase may be driven by improved understanding of the functional implications of malunion, technological advances, social acceptance or fear of litigation. In addition to regaining length, opposition and axial alignment, achieving rotational alignment is necessary, if a good range of pronation and supination is to be restored. Malunion and nonunion occur more frequently because of difficulty in reducing and maintaining reduction of two parallel bones in the presence of the pronating and supinating muscles that have angulatory as well as rotational influences. Currently, there has been a trend favouring closed IM nailing for the paediatric population. Benefits of IM nailing for children are better cosmesis and easy removal of the nail. In our series 30 patients were treated by Intramedullary surgical intervention, we had 23 males and 7 females, having male predominance in the other studies as well. The most common mode of injury in our study was fall on outstretched hand in domestic mode (80%) while rest were road traffic accidents, and fall from bicycle (20%).Transverse fracture was most common, accounting to more than half of fracture patterns, followed by oblique and then comminuted pattern. Fractures were more common in Right Forearm (66.66%) than in Left Forearm (33.33%).

We had a greater operating time in the beginning of the study which reduced greatly with experience. This signifies the short learning curve of Closed Intramedullary Nailing of Radius and ulna. The patients were discharged on the 2nd post operative day as we did not face any serious post op complications. The only intra-operative complication we faced was perforation of the far cortex of Ulna in 2 cases, for which the nail was withdrawn and passed again after slightly bending it, and was followed for rest all of the cases which prevented it from happening again. There were no cases of infection, neurovascular injury, compartment syndrome, malunion, nonunion or epiphyseal damage in our study. Olecranon Bursitis was seen in one case, following which the nail was removed and bursa excised after the union, the patient did not have any complain following it. Care was taken to cut the nails at proper length to avoid such complication. Intrusion of the nail at Ulna entry point was noticed in 2 cases, and a window at entry point was needed to remove the nail. Adequate length of nail was left for easy removal avoiding bone growth on it to avoid this complication at the time of removal. We advise removal of nails in most of the patients after 8-10 months, to avoid difficulties in removing nails, due to longitudinal growth of radius and ulna. Results were evaluated with Price's criteria and we had 86.66% excellent results and 13.33% good results.

Table 3: Comparison of literature of other similar studies

	Study Period (Years	Total Patients (n)	Sex	Mean age of fixation (years)	Type of Implant used	Average time to Radiology union	Functional outcome assessment Criteria	Functional Outcome	Complications
Yalcinkaya M *et al* [3]	8 yrs	45	M=35	10	Rush pins,	6 -10 weeks	Price criteria	Excellent= 82.2%	Major= 2 (4.44%)
			F= 10		Kirschner wire			Good = 17.8%	Minor=15 (33.3%)
Murat Atley [4]	4 yrs	48	M=30 F=18	10.3		7-8	Price criteria	Excellent= 83.3%	Major = 4 (3.8%)
					Kirschner wire	Weeks		Fair = 12.5%	Minor=11 (10.6%)
								Poor= 2.5% Bad=2.5%	
Niranjan Parajuli [5]	3 yrs	50	M=38	10.4	Rush pins	6-10 weeks	Price criteria	Excellent= 94%	Minor= 4 (13.3%)
			F= 12					Good= 6%	
Shoemaker SD *et al* [6]	8 yrs	32	M=22	8.8	Kirschner wire	12 weeks	Price criteria	Excellent= 96.8%	Major= 2 (6.2%)
			F= 10					Good= 3.2%	Minor= 7 (21.8%)
Our study	2 1/2 yrs	30	M=23	11.76	L wire, Titanium flexible nails	6-8 weeks	Price criteria	Excellent= 86.66%	Minor=5(16.66%)
			F=7					Good = 13.33%	

The Success of Intramedullary nailing depends on good surgical technique, proper instrumentation and good C-Arm visualization. When indicated, primary closed intramedullary nailing in paediatric forearm fractures usually is effective. Most series show good to excellent results using this method. Titanium elastic nails are a popular choice as they are more malleable.

CONCLUSION

The advantages of internal fixation by intramedullary nailing in paediatric age group are that it's a least invasive procedure, technically easy procedure with the help of C-Arm, short operating time, reduced risk of infection and other complications, decreased hospital stay and economic procedure. On the basis of the results of the present study, we recommend this surgical technique as a primary procedure for treatment of unstable diaphyseal forearm fractures in elderly paediatric age group.

ACKNOWLEDGEMENT

We are thankful to all our Colleagues and the Faculty members in the department of orthopaedicsin Dr. D.Y.Patil Hospital and Research Centre for their generous contribution in our study.

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