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EVALUATION OF CLINICAL OUTCOME OF DIAPHYSEAL FRACTURE BOTH BONE FOREARM IN CHILDREN MANAGED WITH INTRAMEDULLARY FIXATION (TENS)-A PROSPECTIVE STUDY

Orthopaedics

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ABSTRACT

Introduction - Forearm fractures involving both bones are frequent orthopaedic injuries in the paediatric age group. Typically, these fractures are managed using traction, reduction, and application of an above-elbow cast. In cases of unstable fractures, fixation with flexible nails is performed, minimizing surgical dissection while preserving biological factors at the fracture site. **Objective -** To evaluate the functional outcome with respect to price et al criteria. **Methods-**Hospital based prospective study was done in orthopaedic department which includes 30 patients of age between 5 to 16 years having both bone forearm diaphyseal fracture selected according to inclusion criteria and managed with intramedullary nail. **Result** - Using Price et al.'s criteria, excellent outcomes were observed in 80% of patients who underwent elastic nailing for forearm fractures with less than a 15-degree reduction in forearm rotation.**Conclusion:** Surgical intervention with elastic nails are recommended for all potentially unstable and significantly displaced fractures of the forearm shaft in children. This approach has been associated with favourable functional outcomes.

KEYWORDS

TENS, BOTH BONE FRACTURE FOREARM, RTA, K-WIRE, ESIN, FUNCTIONAL OUTCOME

INTRODUCTION

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 radius and ulna shaft are the most common reasons for children to receive orthopaedic care. [2] Majority of these fractures are usually treated by closed reduction and above elbow cast application. [5,6] In some patients, reduction achieved initially may be lost later 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 decade, since it requires minimal surgical dissection and it 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] The purpose of this study is to evaluate the clinical result and side effects of titanium elastic nailing for paediatric patients with diaphyseal forearm fractures.

MATERIALS AND METHODS

This study was conducted in Department of Orthopaedics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar on 30 Patients (paediatric 5-16 years of age) presenting with diaphyseal fracture both bone forearm.

STUDY DESIGN: Hospital based prospective study.

SAMPLING TECHNIQUE: SRS (simple random sampling)
This study was conducted in Department of Orthopaedics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar on 30 Patients (paediatric 5-16 years of age) presenting with diaphyseal fracture both bone forearm.

INCLUSION CRITERIA:
1. Children aged between 5 to 16 years
2. Simple and compound fractures
3. Type 1 according to Gustilo Anderson classification for open fractures of both bone forearm shaft
4. Patient medically fit for surgery
5. Patient who has given written consent for surgery

EXCLUSION CRITERIA:
1. Children aged less than 5 years and more than 16 years
2. Undisplaced fractures
3. Compound fracture type 2 & 3 according to Gustilo Anderson Classification
4. Patient medically unfit for surgery
5. Patient who has not given written consent for surgery
6. Patients with pathological fractures
7. Patients managed conservatively for other medical reasons.

DATA COLLECTION PROCEDURE
Patients were followed up 4, 8, 12, and 24 weeks in the outpatient department, then every three months to assess for signs of inflammation or infection at operative site and range of movement of elbow and wrist. The ambulatory status of the patient was noticed and X rays of the involved limb were done and finding were recorded. The data of the patients were collected in Case Record Form and the collected data was entered into Microsoft Excel sheet.

SURGICAL TECHNIQUE
TENS NAIL INSERTION TECHNIQUE
PATIENT POSITIONING:
Patient laid supine on OT (operation theatre) table and brought to the edge of table and the affected part (arm) placed on a radiolucent side table. The image intensifier(C-arm) needs to be placed carefully to avoid getting in the way of the surgical field.

NAILING APPROACHES:
1. Approaches For Radius:
The two methods below can be used for intramedullary nailing (IMN) of the radius, they are both retrograde and tend to avoid injury to physeal growth plate.

A) THE STYLOID APPROACH:
Done via first extensor compartment which lies proximal to the distal radial physis.

B) LISTERS TUBERCLE APPROACH:
In this approach, entry to radial shaft is made between second and third extensor compartments just proximal to Lister tubercle.

In both methods, the intramedullary space of the radius bone is accessed using a bone awl. If fracture reduction proves to be challenging, the Volar Henry technique can be used to make a small open approach to the radius, achieve fracture reduction, and insert a nail .

2. APPROACH FOR ULNA:
Olecranon approach: Entry point is made over the tip of olecranon with an awl and entry point is confirmed under c-arm guidance (antegrade approach).

Distal medial entry point: This lies on medial side of distal ulna ,1cm proximal to growth plate.

Proximal lateral entry: An antegrade nailing technique is used. A bone awl that is inserted 4 mm laterally to the posterior crest and 3 cm distal to the tip of the olecranon to allow access the ulna bone's intramedullary cavity.

SELECTION OF TITANIUM NAIL:

The nails should be of appropriate size so that it does not cause incarceration of the titanium elastic nails in the bone. [9] Ideally, nails which fill around two-thirds of the medullary canal diameter (at the level of the isthmus) should be used. [9] The nail diameter commonly used was 2 mm for patients included in this study.

CLINICAL AND FUNCTIONAL OUTCOME EVALUATION

Price et al. criteria, which is based on the degree of forearm rotation loss, was used to assess the functional outcome.

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

EVALUATION OF RADIOLOGICAL OUTCOME:

Preoperative Xray of the forearm bone were obtained in two views (AP and lateral) to assess site and type of diaphyseal fractures and were classified using AO classification system. Postoperative radiographs were taken on the first postoperative day, then at 4 weeks, 8weeks, 4months and 9 months during the postoperative follow up visits.

RESULTS

In present study the mean age of the patients is 11.8 years which ranged from 5 to 16 years and 53% of patients are between 9 to 12 years.

In our study total number of males were 23 and females were 7. This shows that male predominated in our study population.

MODE OF INJURY

Various modes of injury can lead to diaphyseal fracture of bone forearm some of them include road traffic accident (RTA), fall on outstretched hand (FOOSH), fall from height. In our study 46 % of cases are due to fall on out stretched hand and least number of cases are due to sports injury.

Mode of injury	No of cases	Percentage
Road traffic accident	8	27%
Fall on out stretched hand	14	46%
Fall from height	5	17%
Sports injury	3	10%

FRACTURE DISTRIBUTION

Fracture can occur at any level in forearm in present study, majority of the fracture occurred at middle one third of forearm constituting around 63%.

Fracture Site	No of cases	Percentage (%)
Proximal one third	5	17%
Middle one third	19	63%
Distal one third	6	20%

TYPE OF FRACTURE

Based on the presence or absence of external injuries, the majority of cases that presented to us was closed fracture.

Fracture Type	No of cases	Percentage
Compound/Open	1	3%
Closed	29	97%

POST OPERATIVE COMPLICATIONS

Skin irritation seen in 2 patients, which was the most common complications with nailing; which contributed about 7% in present study. Protruding nail, superficial infection elbow stiffness were also observed. One patient had a superficial skin infection, which was treated with oral antibiotics and dressings. Two patients developed skin irritation and pain due to nail at ulnar entry site and one patient developed nail protrusion which required early nail removal. One patient developed elbow stiffness which required early ROM exercise.

Post-Op complications	No of Cases	Percentage (%)
Skin irritation	2	7%
Superficial infection	1	3%
Elbow stiffness	1	3%
Wound infection	0	0%
Refracture	0	0%
Nail protrusion	1	3%

FUNCTIONAL OUTCOME

Price et al criteria was used to assess the functional outcome of the patients. Excellent result were achieved in 80% of the cases after elastic nailing of forearm fractures with <15o of loss of forearm rotation.

Functional outcome (Price et al criteria)	No of patients	Percentage
Excellent	24	80%
Good	6	20%
Fair	0	0
Poor	0	0

RADIOLOGICAL OUTCOME

In this study, bony union of fracture was achieved in an average time of 8.8 wks. Radiological fracture union was observed in about 87 percentage (%) of patients before 11 weeks out of which 57% of patients achieved it before 8 wks.

No. of cases	Time taken for radiological union (in weeks)	Percentage
17	6-8	57%
9	9-11	30%
4	12-14	13%

DISCUSSION

Majority of diaphyseal forearm fractures in paediatric age group were treated conservatively with closed reduction and cast application. However certain fractures in older children required operative management especially unstable and irreducible fractures because of unpredictable remodelling potential.

Recent studies recommend the use of titanium elastic intramedullary nailing in paediatric forearm fractures because of excellent functional results.

The mean age of the patients in present study was 11.80 years with a range from 5 – 16 yrs. Most patients presented between 9 - 12 years (53 %). Similar observations were also made in 2019 by Amit Kumar et al.10 with a mean age of 10.5 years and in 2016 by Kapila et al.11 with 11.2 years.

We did close reduction and internal fixation under fluoroscopy in 27 patients (90 %). However, three patients (10 %) required open reduction and internal fixation in those who presented late to the hospital. In 2019, Biswajit Sahu et al.12 studied 40 children in which closed reduction was done in 37 patients (92.5 %), and three patients (7.25 %) required mini-open reduction.

In 2016, Daoud Makki et al.13 stated in their study that both-bone fractures have higher rates of closed reduction than single-bone fractures. They reported an 80 % chance of successful closed reduction of at least one bone. They stated that open reduction should be performed when a few attempts of closed reduction have failed and that open reduction of radius, if required should be performed through a volar approach.

In our study, two patients (6 %) developed a implant related skin irritation with an overall complication rate of 17 %. There were no major complications. In 2010 Flynn JM et al.67 reported an overall complication rate of 14.6 % in 144 children.

Price et al criteria was used to assess the functional outcome of the patients. Excellent result were achieved in 80% of the cases after elastic nailing of forearm fractures with <15o of loss of forearm rotation.

FUNCTIONAL RESULTS IN VARIOUS STUDIES

Studies	Excellent	Good	Fair
Dinesh Kumar et al.[79]	86.6 %	13.3 %	-
Syed Ifthekar et al.[68]	90.62 %	9.37 %	-
Recep Dincer et al.[58]	82.7 %	15.9 %	1.4 %
Lamay et al. [75]	87.5 %	10 %	2.5%
Mahesh Goyal et al.[74]	89%	11 %	-
Present study	80%	20%	-

In this study, bony union of fracture was achieved in an average time of 8.8 wks. Radiological fracture union was observed in about 87 percentage (%) of patients before 11 weeks out of which 57% of patients achieved it before 8 wks.

CONCLUSION

Although forearm fractures in children can be treated conservatively, they often lead to complications like mal union and restriction of movements. Based on our results, we conclude that elastic stable intramedullary nailing is a safe and effective technique for managing diaphyseal fractures of both bone forearm in children. It gives elastic mobility promoting rapid union at fractures site and stability, ideal for early mobilisation. This technique provides excellent results in terms of both radiological union and functional outcome.

The limitations of our study were small series of cases, short period of follow up, and lack of a comparative group. A similar study in future with another operative technique as comparative group would make our results more reliable. Considering the good results obtained in our study we recommend this technique for management of unstable diaphyseal forearm fractures in older children.

REFERENCES:

1. Lu D, Lin Z, Zhang JD, Chen H, Sun LJ. Treatment of pediatric forearm midshaft fractures: Is there a difference between types of orthopedic surgeon? Orthop Traumatol Surg Res. 2017;103(1):119–22.
2. Mandlewala V, Rathod H, Patel S. A study of 50 cases of mangement of non-physeal forearm fracture in children upto the age of 12 years. Int J Orthop Sci. 2018;4(4):458–61.
3. Johnson CW, Carmichael KD, Morris RP, Gilmer B. Biomechanical Study of Flexible Intramedullary Nails. 2009;29(1):44–8.
4. Lyons RA, Delahunty AM, Kraus D, Heaven M, McCabe M, Allen H, et al. Children's fractures: A population based study. Inj Prev. 1999;5(2):129–32.
5. Hadizie D, Ortho M, Munajat I, Ortho M. Both-Bone Forearm Fractures in Children with Minimum Four Years of Growth Remaining : Can Cast Achieve a Good Outcome at Skeletal Maturity ? 2017;11(3):1–9.
6. Calder PR, Achan P, Barry M. Diaphyseal forearm fractures in children treated with intramedullary fixation: Outcome of K-wire versus elastic stable intramedullary nail. Injury. 2003;34(4):278–82.
7. Kang SN, Mangwani J, Ramachandran M, Paterson JMH, Barry M. Elastic intramedullary nailing of paediatric fractures of the forearm: A decade of experience in a teaching hospital in the United Kingdom. J Bone Jt Surg - Ser B. 2011;93 B(2):262–5.
8. Lascombes P, Prevot J, Ligier JN, Metaizeau JP PT. Elastic stable intramedullary nailing in forearm shaft fractures in children: 85 cases. J Pediatr Orthop. 1990;(10):161–71.
9. Lascombes P, Prevot J, Ligier JN, Metaizeau JP PT. Elastic stable intramedullary nailing in forearm shaft fractures in children: 85 cases. J Pediatr Orthop. 1990;(10):161–71.
10. Kumar A, Amit Ray A, Kaura NK. Tens (Titanium elastic nail system): a good option for managing both bone forearm fracture. National Journal of Clinical Orthopaedics 2019;3(1):15-18.
11. Kapila R, Sharma R, Chugh A, et al. Evaluation of clinical outcome of management of pediatric forearm fractures using titanium elastic nailing system: a prospective study of cases. J Clin Diagn Res 2016;10(11):RC12-RC15.
12. Biswajit S, Anshuman M, Barsha T. Management of pediatric both bone forearm fractures by titanium elastic nailing system. Journal of Orthopaedics, Traumatology and Rehabilitation 2018;10(2):103-106.
13. Daoud M, Matar HE, Webb M, et al. Elastic stable intramedullary nailing in pediatric forearm fractures: the rate of open reduction and complications. J Pediatr Orthop B 2017;26(5):412-416.