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FUNCTIONAL OUTCOME OF DIAPHYSEAL FRACTURES OF LONG BONES IN CHILDREN WITH TENS SYSTEM

Orthopaedics

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ABSTRACT

Background: The diaphyseal fractures of pediatric long bones are very commonly encountered in orthopedic practice. Previously conservative treatment was considered ideal for these fractures and is treated by spica. Because of nonunion, unacceptable angular deformities, fracture instability, joint stiffness or the failure of conservative management, some diaphyseal fractures require osteosynthesis. Hence surgical procedure of choice for diaphyseal fractures in children is an intramedullary fixation with titanium elastic nails. **Objectives:** To examine the union rates, clinical results, and functional outcomes of TENS-treated pediatric diaphyseal fractures of long bones. **Methods:** This prospective study was carried out at Al-Ameen Medical College and Hospital, Vijayapura. Thirty patients aged between 6-16 years with diaphyseal fracture of long bones were included in our study. Patients were treated with closed reduction and internal fixation with TENS. They were followed up for 6 months both clinically and radiologically. The functional outcome evaluated using Flynn's scoring system. **Result:** The mean age of the patients was 10.3 years. There was male preponderance (66.66%). In our study, RTA was observed to be the main cause of fracture (50%) whereas (33%) fractures were due to self-fall and (16%) were due to fall from height. In our study, (33.33%) patients had fracture of femur, followed by fracture of tibia (30%), radius & ulna (26.67%), and humerus (10%). The mean time to union was 12.1 weeks. **Conclusion:** TENS in diaphyseal fractures of long bones provides early union early mobilization, deformity correction and minimal intervention.

KEYWORDS

Children and adolescents, TENs, diaphyseal fractures, long bones.

INTRODUCTION

Children are highly susceptible to injury, each year up to one in four children suffer an injury[1,2] The diaphyseal fractures of pediatric long bones are very commonly encountered in orthopedic practice. The constantly evolving methods of treatment in children with long bones fracture have shown a preference for the use of intramedullary elastic nails. Conservative treatment remains the mainstay for long bone fractures in children below the age group of six years as the remodeling ability of the immature bone in children is excellent.

The management of long bone fractures for age between 6-16 years is controversial. Plaster casting for the fracture of long bones in children less than six years and intramedullary nailing in adolescent above 16 years was suggested by Metazziau.

Elastic intramedullary nailing was preferred in older children due to poor tolerance of immobilization and an uncomfortable cast. In addition, there is less potential for the correction of mal-alignment in long bone fractures in older children nearing adolescence.

Whereas TENS provides minimal intervention, deformity correction and early mobility.

Various methods of fixation are available for the stabilization of long bone fractures in children. However, the introduction of flexible elastic nails has changed the management in children significantly.

METHODS

The current study is a prospective study carried out at Al-Ameen Medical College Hospital from July 2022 to May 2023. A total of 30 patients with displaced diaphyseal fractures of long bones were included in this study.

Inclusion Criteria

Children and adolescent patients from 6 to 16 year with closed displaced diaphyseal fracture of long bone, both the sexes, patient fit for surgery were included.

Exclusion criteria

Patients less than 6 years and more than 16 years of age, open fractures, metaphyseal fractures, pathological fractures, were exclude.

Pre-operative Care

The diameter of the individual nail is selected according to Flynn's formula

Diameter of nail = Width of the narrowest point of the medullary canal as seen on AP and lateral view X-ray × 0.4mm

Intraoperatively

Nail was chosen with diameter occupying at least 40% of the medullary cavity. In case of single nail usage, it's diameter should be more than 60% of the narrowest diameter of the medullary canal.

Post-Operative Care

- Analgesics were given according to the needs of the patient.
- IV antibiotics and injectables given.
- Sutures were removed on the 15th post-operative day and patients were discharged

Post-Operative Immobilization

In radiologically unstable fractures, post-operatively POP immobilization was given for 3 or more weeks. For stable fractures, only immobilization braces were given for 2 weeks. In all patients' static muscle strengthening exercises were started from the first Postoperative day.

In stable fractures patients were allowed to walk with crutches after 2 weeks and gradually full weight bearing was allowed at 4 to 6 weeks after surgery. For humerus fractures patients were allowed for shoulder and elbow mobilization exercises after 2 weeks.

In unstable fractures patients were allowed non-weight bearing crutch walking for 4 to 6 weeks and then gradually full functional loading was allowed depending upon the patient and tolerance. Postoperative assessment was done using following parameters at 6, 12, 24 weeks.

RESULTS

A total of thirty cases with fractures of shaft of long bones in children aged 6-16 treated with TENs nailing between June 2022 to May 2023 were studied. The following observations were made.

Table 1: Age Distribution

Age in years	No. of patients	%
6-9	12	40.00
10-12	10	33.33
13-16	8	26.67
Total	30	100

Table 2: Gender Distribution

Gender	No of Patients	%
Male	20	66.66
Female	10	33.33
TOTAL	30	100.00

Table 3: Pattern Of Fracture.

Pattern of fracture	No of Patients	%

Transverse	14	46.70
Oblique	13	43.33
Spiral	3	10.00
Total	30	100

Table 4: Time For Fracture Union.

Time of fracture union (in weeks)	No of Patients	%
<12	21	70.00
12-18	6	20.00
18-24	3	10.00
Total	30	100

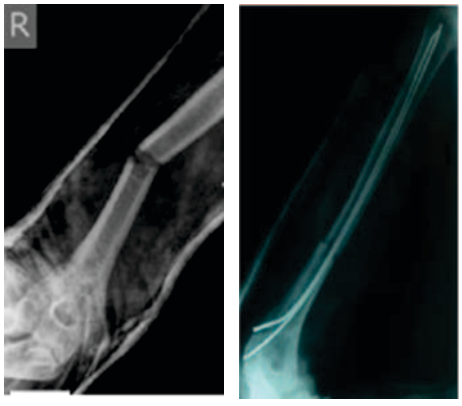
Table 5: Complications

Complications	No of Patients	%
Pain at the site of nail insertion	3	10.00
Infections	2	6.66
Limitation of joint movements	2	6.66
Migration of nails	1	3.33

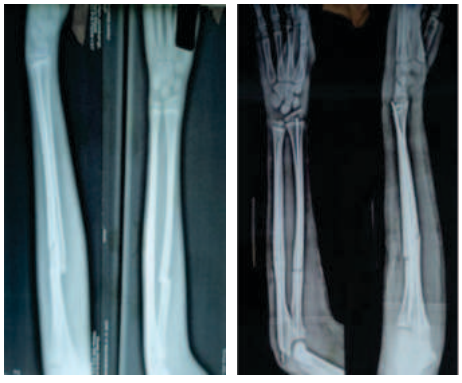
Table 6: Results (As Per Flynn's Scoring Criteria)

Results	No of Patients	%
Excellent	22	73.33
Satisfactory	8	26.66
Poor	0	0
Total	30	100

Preop X-Ray **Postop X-Ray**



Preop X-Ray **Postop X-Ray**



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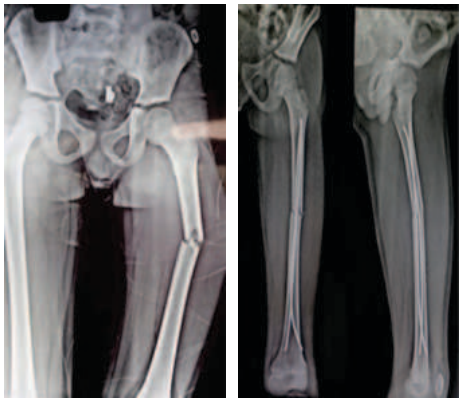
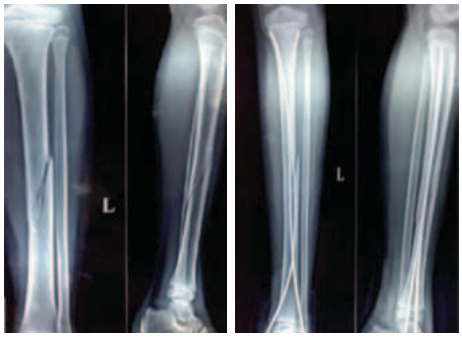


Preop X-Ray **Postop X-Ray**



DISCUSSION

It is controversial how to handle long bone shaft fractures in adolescents, especially those who are aged between 6 and 16 years. However, there is a growing acceptance of surgical treatment.

The goal of the current study was to evaluate the effectiveness of flexible nailing with TENS for treating long bones shaft fractures in pediatric patients. The surgical treatment of pediatric fractures with subsequent early mobilization and hospital discharge has grown in popularity as a result of rising healthcare expenses.

All the 30 patients having diaphyseal long bones fracture were fixed with intramedullary TEN's nail and followed up on a periodic interval until fracture union occurred. The follow-up period ranged from 4 weeks to 6 months and results were analyzed both clinically and radiologically. The results were evaluated according to Flynn's scoring system.

J. N. Ligier et al studied children ranged from 5-16 years with a mean of 10.2years.[4] Atul Bhaskar studied children ranged from 6-12 years with a mean of 10 years.[5] Fluran D et al had studied patients from the age group between 4-17 with a mean age of 11.7 years.[6] In the present study 16(53.3%) of the patients were 6-10 years, 14 (46.66%) were 11-15 years age group with the average age being 10.3 yrs.

The most common mode of injury in J. M. Flynn et. al (234 cases), 136(58.1%) were RTAs, 46(19.6%) were self-fall and remaining 43(28.8%) where as a result of fall from height.[7] In our study RTA was the most common mode of injury accounting for 15 (50%) cases followed by self-fall - 10(33%)

Our study comprised of 14 cases (46.70%) with transverse fractures, 13 cases (43.33%) with oblique fractures. There were 20 male (66.66%) and 10 patients (33.33%) were female. The injured limb in most of the cases (70%) was right sided in our study.

Union was achieved in <3 months in 24 (80%) of the patients with average time to union being 12.1 weeks. Atul Bhaskar reported average time for union as 10.5 weeks.[5]

Wudbhav N. Sankar et al. in their study allowed full weight bearing between 5.7 –11.6 weeks; an average of 8.65 weeks.[8] In our study, unsupported full weight bearing walking for lower limb and functional loading for upper limb was started in <12 weeks for 21 (70.00%) of the patients

In our study complications like Pain at site of nail insertion was seen in 3 cases (10%), infection in 2 cases (6.66%), limitation of joint movements in 2 cases (6.66%) and migration of nail in 1 case (3.33%).

The functional outcome evaluated using Flynn's scoring system[3] was excellent in 22 cases (73.33%), satisfactory in 8 cases (26.67%)

Studies	Excellent	Satisfactory	Poor
Present Study	73.33	26.67	-
Gamal El Adl et al[9]	75.8%	24.2%	-
J.M. Flynn et al[10]	65%	25%	10%
Wudbhav N. Sankar[8]	63.15%	31.57%	5.26%
K C Saikia et al[11]	59%	27.2%	13.6%

CONCLUSION

The conservative treatment of pediatric long bone fractures is considered gold standard because of great ability of remodeling, but this treatment carries problems of loss of reduction, angulatory/

rotational mal-alignment, longer hospital stay, prolonged immobilization keeping the child away from peer group and school. TENs appears logical and safe to obviate these problems, as it has following advantages

- Titanium elastic nail allows micromotion at fracture site, leads to enhanced callus formation and provides more stability, which is ideal for early mobilization and return to function.
- It is technically simple and reliable procedure.
- It has minimal complications, easier post-operative maintenance and excellent outcome when compared to other methods of treatment.
- Excellent results were achieved with it, in terms of union and full weight bearing.
- Based on our studies and results we conclude that titanium elastic nailing offers excellent results in displaced diaphyseal fractures of long bones in children between 5 and 15 years of age and may be considered as an ideal choice of treatment.

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