

OUTCOME OF CLOSED TITANIUM ELASTIC NAILING IN PAEDIATRIC TIBIAL DIAPHYSEAL FRACTURES

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ABSTRACT

Background: Tibia fractures in skeletally immature patients are usually treated conservatively but sometimes operative treatment becomes essential. **Objective:** To determine the outcome of closed titanium elastic nailing in pediatric tibia diaphyseal fractures in terms of union and range of motion at knee and ankle joints. **Methodology:** A cross sectional study was conducted at Orthopedics Department of Lahore General Hospital, Lahore. A total of 35 patients ageing between 6-12 years with unilateral, isolated, closed displaced diaphyseal fractures of tibia were included in this study. Patients were followed in outpatient department after 15 days for operative wound examination and then were followed after every 2 months to determine the progress in union and range of motion. The collected information was entered in PASW Statistics 18 and analyzed. **Results:** The minimum age was 6 and maximum was 12 years. There were 19(54.3%) males and 16(45.7%) females. According to Hammer classification of fracture healing, at 2nd week post operative all patients has Grade-V. At 2nd Month follow up 12(34.28%) patients has Grade-II and 23 (65.72%) patient has Grade-III fracture healing. At 4th month follow up 30(85.71%) patients has Grade-I and 5(14.2%) patients has Grade-II union. At 6th month follow up all 35(100%) patients has Grade-I fracture healing. **Conclusion:** Treatment of diaphyseal fractures of tibia in children with closed elastic intramedullary nailing is a rapid and effective method in terms of bone union and range of motion of the ankle and knee joints.

Key Words: Pediatric, Tibia Diaphyseal, Titanium Elastic nailing, Fracture

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INTRODUCTION

Fractures of tibia in children are the third most common fractures.¹ The tibia fractures can occur by direct or indirect injuries in children.² Most of the fractures of the tibia are treated by manipulation and casting but sometimes surgical intervention becomes essential due to displacement and angulations of these fractures.³ These fractures can be treated by plaster cast, external fixation, open reduction and internal fixation, splints/orthosis and intramedullary stabilization with nail.⁴ In most of the patients, close reduction and casting produces excellent results but in some of these injuries the acceptable reduction is not achieved. This scenario creates social and psychological impact on the family and treating physician.^{5,6} As multiple methods of treatment show dissatisfaction in the modalities, hence a variety of intramedullary nails has been used to fulfill the deficiencies. The elastic intramedullary nailing is being commonly used for long bone fractures in children to avoid the complications in difficult and complicated tibia shaft fractures.^{7,8}

The experience about elastic nailing of tibia in

children is at its infancy and still long term studies are required to prove it a standard treatment option.^{9,10}

This study was planned to determine the outcome of closed titanium elastic nailing in pediatric diaphyseal fractures, in terms of union and range of movement at knee and ankle joint.

METHODOLOGY

A cross sectional study was carried out in Orthopedics Department of Lahore General Hospital, Lahore on 35 patients using purposive sampling technique from 1st January to 31st December 2014. Each patient was followed up to six months. All the patients with unilateral, isolated, closed tibia shaft fracture aging between 6-12 years were included in the study. All the patients with polytrauma, pathological fracture, previous surgery of the limb, history of long term steroids intake and history of severe systemic ailment were excluded from study. The demographic information was recorded. All patients were examined and investigated to confirm diagnosis. Routine investigations CBC, Blood Sugar, LFT, RFT, Anti HCV and HBs-Ag were done. Patients were explained about the risks and informed consent was

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taken. Follow up was done for six months. Data was collected as per Performa. All the patients were operated under general anesthesia within three days. The patients were placed supine on a radiolucent table. A tourniquet was applied to the upper thigh, but usually not inflated. The operative extremity was prepared and draped. The titanium elastic nails were used in all patients. Under fluoroscopy, the fracture site and proximal tibia physis was marked. A longitudinal 2 cm incision was made on both the lateral and medial side of the tibia metaphysis just proximal to the desired bony entry point.

Using a hemostat, the soft tissues were bluntly dissected down to bone. Based on preoperative measurements, an appropriately sized implant was selected so that the nail diameter is 40% of the diameter of the narrowest portion of the intramedullary canal. A drill bit roughly 0.5 mm larger than the selected nail was then used to open the single cortex at the nail entry site; angling the drill distally down the shaft facilitates nail entry. Prior to insertion, the nails was pre bent by hand into a gentle "C" shape which helps achieve three-point fixation. Both nails are then inserted antegrade through the entry holes and advanced to the level of the fracture site.

Under fluoroscopic guidance, the fracture was reduced in both the coronal and sagittal planes, and the first nail was advanced past the fracture site. If proper intramedullary position of the nail distal to the fracture site was confirmed on antero-posterior and lateral views, then the second nail was tapped across the fracture site. Both nails were advanced until the tips lie just proximal to the distal tibia physis. Fluoroscopy is again used to confirm proper fracture reduction as well as nail position.

To minimize soft tissue irritation, the nails were backed out a few centimeters and cut along proximal tibia metaphysis. Care was taken not to bend the nails away from the bone to facilitate cutting as this increases nail prominence and subsequent skin irritation. The two incisions for nail entry were closed in a layered fashion, and the wounds are well padded with gauze. To protect our fixation and to minimize irritation at the nail entry site from knee motion, patients were immobilized postoperatively, with a long leg back slab and discharged on 1st post operative day.

Each patient was followed in outpatient

department weekly for wound management till 15 days. Stitches were removed at 15 days and movement started at knee and ankle joint. On 1 month, patient started weight bearing with back slab on operated limb. After 2 months, back slab was removed and patient continued walking with full weight bearing. Further, patient followed up every 2 months till 6th month for union and subsequently for range of motion. Nails were removed after complete union. The collected information was entered in PASW Statistics 18 and analyzed through it. Mean and standard deviation was calculated for numeric data i.e. age, and ankle/knee joint movement. Frequencies and percentages of Categorical data i.e. sex, union was measured. All the data was presented in tables and graphs, as appropriate.

RESULTS

There were total 35 patients included in the study among them the mean age was 8.21 ± 1.68 years, the minimum age was 6 years and maximum age was 12 years. There were 19 (54.3%) males and 16 (45.7%) females in our study.

Table I: Fracture healing at 6th Week.

6 th Week Followup	Frequency	Percentage
Grade-I	0	0
Grade-II	0	0
Grade-III	15	42.85%
Grade-IV	20	57.15%
Grade-V	0	0

Table II: Fracture healing at 2nd month follow-up.

2 nd Month Follow Up	Frequency	Percentage
Grade-I	0	0
Grade-II	12	34.28%
Grade-III	23	65.72%
Grade-IV	0	0
Grade-V	0	0

At 2nd week post operative all patients had Grade-V healing stage, according to Hammer et al classification of fracture healing. At 6th week follow up 15 (42.85%) patients showed Grade-III and 20 (57.15%) patients has Grade-IV fracture healing. (Table I). At 2nd Month follow up 12(34.28%) patients has Grade-II and 23 (65.72%) patients has Grade-III fracture healing. (Table II)

Table III: Fracture healing at 4th Month follow up.

4 th Month Followup	Frequency	Percentage
Grade-I	30	85.71%
Grade-II	5	14.2%
Grade-III	0	0%
Grade-IV	0	0%
Grade-V	0	0%

At 4th month follow up 30(85.71%) patients has Grade-I and 5(14.2%) patients has Grade-II fracture healing.

Average range of motion in degree (Flexion) for knee operated limb was 134 ± 1.91 , minimum Range of motion was 125 and maximum range of motion was 135. The mean range of motion in degree (Flexion) for ankle was 19.91 ± 0.51 minimum range of motion was 17 and maximum range of motion was 20.

DISCUSSION

Titanium elastic intramedullary nailing treatment has been used for long bone fractures in the children.¹¹ Pediatric orthopedic surgeons have strived their hard work to include this operative modality of treatment in the armamentarium of fractures in children.¹² There is a little disagreement concerning the treatment of long bone fractures in children less than 6 years (POP cast) and adolescents older than 16 years (locked intramedullary nailing).¹³ However controversy persists regarding the treatment of tibia fracture in children between the ages of 6 to 16 years.

Several options are available such as manipulation and casting, splints/orthosis, external fixation, flexible stable intramedullary nails and compression plating.¹⁴ In the present study, union was achieved in all of the patients with follow up of six months. Ali MI,¹⁵ achieved union after elastic nailing 48 open fractures of tibia with a follow up of fifteen weeks in all the patients and there was no growth arrest, re-fracture and infection just like the present study. The difference in the duration of union of tibia fractures in these studies is due to reason that in closed fractures hematoma is preserved.

Furlan et al,¹⁶ conducted a study on 175 long bone fractures (36 tibia fractures) treated with elastic stable intramedullary nailing, and 89% of the patients were very satisfied and 11% were satisfied with the treatment and outcome. None of

the patients were dissatisfied with the technique of treatment.¹⁶ In the present study 100% of the patient have achieved acceptable range of motion at knee and ankle joints and no complication regarding infection, re-fracture, pin site irritation and re-manipulation was observed.

Weight and age is very important while considering this treatment modality in children with tibia-shaft fractures. In the present study the upper age limit was 12 years and weight was not taken into account as most of the patients are less than 40 kg approximately. However most of the authors considered that in patient with weight of more than 50kg and age more than 12 years the elastic intramedullary nailing is not without complications.¹⁷

Multiple other factors such as nail size, material of the nail, manufacturing technology, race, weather, intramedullary canal diameter ratio and length of the tibia are also important in the treatment of tibia fractures in children.¹⁸ Clinical and investigational studies are required to evaluate each of these factors individually. External fixation and rigid intramedullary nailing are usually not suitable for pediatric fractures of tibia.¹⁹

CONCLUSION

Elastic intramedullary nailing is an excellent modality of treatment of pediatric tibia displaced diaphyseal fractures regarding union and range of motion at ankle and knee joints while abiding the rules and regulations of closed methods under image intensifier.

Conflict of interest:

The authors have declared no conflict of interest.

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