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## Tibial Diaphysis Fracture in Paediatric Age Group: Outcome with Elastic Nailing Fixation in Tertiary Care Center in Lumbini Province of Nepal

Sagar Panthi<sup>1</sup>, Rishiswor Shrestha<sup>1</sup>, Sabal Krishna Gaihre<sup>2</sup>, Angelica Karki<sup>1</sup>, Suyachha Chettri<sup>3</sup>, Ishory Bhusal<sup>1</sup>

<sup>1</sup> Department of Orthopaedics and Traumatology, Rapti Academy of Health Science, Ghorahi, Dang, Nepal

<sup>2</sup> Department of Orthopaedics and Traumatology, Rapti Provincial Hospital, Tulsipur, Dang, Nepal

<sup>3</sup> Department of Cardiothoracic and Vascular Surgery, Shahid Gangalal National Heart Care Center, Bansbari, Kathmandu, Nepal

### Abstract

**Introduction-** Tibial diaphysis fracture in paediatric age group accounts for 10 to 15% of all fractures. Fixation of tibial diaphysis fracture in paediatric age group by elastic nailing system provides relative stability. The purpose of this study is to evaluate the functional outcome of tibial diaphysis fracture in paediatric age group treated elastic nailing system. **Methods-** A prospective interventional study was conducted at Rapti Academy of Health Sciences, Ghorahi, Dang from November 2018 to November 2020. Ethical clearance was obtained from Institutional review board. All the children who were operated for tibial diaphysis fracture were followed up for six months. Final outcome was analyzed at final follow up. **Results-** Out of thirty children, there were sixteen male and fourteen female. Mean time of fracture union was 10.03 weeks. Two children develop limb lengthening of 1.5 cm and 1.2 cm respectively. One child had 1 cm shortening and three children develop bursitis on entry site. At final follow up 83.33% of child had an excellent outcome according to Flynn grading. **Conclusion-** Tibial diaphysis fracture can be treated with elastic nailing system with excellent to good functional outcomes.

**Keywords:** Elastic nail, Fracture union, Tibial diaphysis, Titanium elastic nailing system.

### INTRODUCTION

Paediatric long bone fractures can be managed conservatively with excellent union rate and good functional outcome [1]. Tibial diaphysis fracture in paediatric age group can be managed by closed reduction and above knee cast application in majority of cases. In some condition there is severe shortening, rotational malalignment and angular deformity. These sorts of fractures requires surgical intervention to achieve good functional outcome [2].

Tibial diaphysis fracture in paediatric age group comprises third common long bone fractures following forearm fracture and femur fracture. It account for 10 to 15% of all paediatric injuries [3].

There are various method of treatment of tibial diaphysis fracture in paediatric age group that includes closed reduction and long leg cast application, External fixator and plate and screw fixation that are reserved for unstable fractures [1,4-6].

Reamed antegrade intramedullary interlocking nail are reserved for adults because these nails damages the proximal tibia physeal plate in children. External fixators may cause pin tract infection and usage of plate and screw may requires extensive soft tissue damage as well as overgrowth and refracture [4-6]. Several authors report excellent to good results with elastic nailing system in management of long bone fractures in paediatric age group [7].

Traction forces are converted to compressive forces on fracture site by elastic nail. When two bent nail crosses each other at fracture site within the canal it provides three point fixation. The elasticity present on the nail has limited stress shielding effect on fracture site. There are various advantages of elastic nail which includes early fracture stabilization, early rehabilitation, less invasive, less chance of infection and less hospital stay [8,9].

\*Corresponding author:

**Dr. Sagar Panthi**

Department of Orthopaedics and  
Traumatology, Rapti Academy  
of Health Science, Ghorahi,  
Dang, Nepal

Email:  
drsagarmsortho@gmail.com

**MATERIALS AND METHODS**

A prospective interventional study was conducted in Department of Orthopaedics and Traumatology at Rapti Academy of Health Science Ghorahi, Dang, Nepal between the period of November 2018 to November 2020. Thirty children with the age group between 5 to 15 years with tibial diaphysis fracture were included. Fracture with acceptable alignment, Fracture with infected wound, Gustilo –Anderson Type III B and C open fractures, Pathological fractures were excluded from our study. Ethical clearance was obtained from Institutional review board. All included children were treated with elastic nailing system.

All surgical intervention was carried on general or regional anaesthesia. All children were placed supine in operating table. Painting and drapping were done. Appropriate size elastic nail was taken and the tip of nail was bent to prevent from cortical perforation. Two small longitudinal incision were given on lateral and medial side of proximal tibia 2 cm distal to proximal tibial physis under C-arm guidance. One nail was driven laterally to distal tibia and other towards medially to distal tibia. Toe touch weight bearing with the help of crutch was started at first post-operative day. Suture removal was carried out on 14 days after surgery. At 6 months final evaluation was done. Time of fracture union, pattern of fracture, length of hospital stay and for functional outcome Flynn Criteria was used.<sup>8</sup> The data was entered and analyzed using Statistical package of the Social Sciences version 21.

**RESULTS**

Patient demographic characteristics are shown in Table 1.

The mean age of children was 8.73 years (5-14 years). Mean length of hospital stay was 6.1 days (3-14 days). Average time of fracture union was 10.03 weeks (6-15 weeks). Two patients had Gustilo and Anderson Type II open fractures managed with debridement and intravenous antibiotics thus, their hospital stay was longer 11 and 14 days respectively. In one child, open reduction was required via anterolateral approach to reduce the fracture due to failed closed reduction. Two children had 1.5 cm and 1.2 cm lengthening and one patient had 1 cm shortening at final follow-up. Three children develop bursitis over entry site. We could achieve full knee range of motion in all children. None of the child had nail breakage, nonunion, delayed union and infection.

Twenty five children (83.33%) had excellent outcome and five children (16.67%) had good outcome according to Flynn grading at final follow up. (Table 2)

**Table 1:** Patients Characteristics

Parameters	No. of cases
<b>Gender</b>	
Male	16 (53.33%)
Female	14 (46.67%)
<b>Involved Side</b>	
Left	16 (53.33%)
Right	14 (46.67%)
<b>Fracture Pattern</b>	
Communited	13 (43.33%)
Oblique	8 (26.67%)
Transverse	6 (20%)
Spiral	3 (10%)
<b>Mechanism of Injury</b>	
Sports related	13 (43.33%)
Fall from height	12 (40%)
Motor Vehicle Accident	5 (16.67%)

**Table 2:** Flynn grading at final follow-up

Flynn Grading	Number (n=30)	Percentage (%)
Excellent	25	83.33
Satisfactory	5	16.67
Poor	0	0



**Figure 1:** (A) Pre-op radiographic picture (B) Immediate post-op radiographic picture (C) Final follow up radiographic picture (D) Child sitting in cross leg position at final follow-up

**DISCUSSION**

Tibial diaphysis fracture in paediatric age group is third common fracture following forearm fracture and femur fracture<sup>[3]</sup>. Most of the tibial fractures in paediatric age group can be managed conservatively but unstable variant warrants surgery<sup>[2]</sup>. Elastic nail is one of the good option for management of tibial diaphysis fracture in school children<sup>[10]</sup>.

Elastic nail doesn't require reaming during insertion hence the endosteal blood supply is preserved which promotes early fracture healing<sup>[11]</sup>.

The indication of surgical treatment of paediatric tibial diaphysis fracture are open fracture, floating knee, associated compartment syndrome, polytrauma and unstable fracture<sup>[12-15]</sup>.

We evaluated thirty children, out of them 53.33% were male and 46.67% were female. Sankar et al reported 73.68% male and 26.32% female in their study [15]. KC et al reported 62.2% male and 37.8% female [7]. Male are more involved in outdoor activities compared to female [16].

Kubiak et al compared elastic nail and external fixators for management of tibial diaphysis fracture in paediatric age group. Those children who were managed with external fixator group had two delayed union, three nonunion and two children had malalignment. They concluded that elastic nail is superior to external fixator [14].

Vallamshetla et al reported the mean time of fracture union was 10 weeks and two children had limb length discrepancies which was comparable to our study [17].

In our study, the average hospital was 6.1 days which was comparable to the study done by Onta et al [18].

Kubiak et al started early postoperative partial weight bearing with the help of crutches in those patient who have more than 50% bony contact. Early weight bearing is most important predictor for fracture healing as it allows micromotion at the fracture site [14].

We achieved 83.33% excellent results and 16.67% satisfactory results with no patients had poor results. Ahmed et al reported 75% excellent results and 25% satisfactory results [19]. This is because of early fracture healing and early return to daily activities.

Two children had 1.5 cm and 1.2 cm lengthening. Limb lengthening is one of the commonest complications seen in paediatric long bone fractures this occurs due to increase in vascularity in growth plate at the time of fracture union.

Three children had bursitis over nail entry site. These are the fewer complications and occur due to friction of nail and soft tissue. None of the child develops nonunion, delayed union, breakage of nail and infection.

Elastic nail provides three point fixation as well as micro motion on fracture site thus, stimulates external callus formation and provides bony strength [20].

## CONCLUSION

Management of tibial diaphysis fracture with elastic nail in paediatric age group is safe and stable means of treatment with excellent to good functional outcome and early return to daily activities.

## Conflicts of interest

Author declared no conflict of interest.

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