



## TREATMENT OF TIBIAL FRACTURES IN CHILDREN USING INTRA MEDULLARY NAILING

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### ABSTRACT

**Background:** Fractures of the tibia in children are very challenging in their management. They form about 15% of fractures. They were managed by closed reduction and above knee cast. Today there is an increasing trend towards surgical stabilization. Elastic stable intramedullary nailing (ESIN) is a minimally invasive technique that allows short hospital stay and early ambulation.

**Methods:** Between May 2022 and August 2022 a prospective study was done on fifteen patients (2 females and 13 males) with a mean age 9 years old (range 5-15 years).

Patients were followed up for 5 months after surgery. All patients undergone ESIN using two nails.

**Results:** At the time of the last follow-up, Flynn scoring system showed 12 excellent cases 2 satisfactory cases and only 1 poor case.

**Conclusion:** We recommend the use of this technique in most of tibial shaft fractures whether open or closed in different fracture patients. This is due to being simple, non-invasive, and rapid, with low rates of infection.

**KEYWORDS:** Elastic Stable Intramedullary Nailing, Leg Fractures.

### INTRODUCTION

Most of tibial fractures in children can be treated by above knee cast (1). But because of the non-anatomical reduction and the warning of the parents about their sons, there has been an increasing tendency towards surgical stabilization (2,3). The important indications for surgical management include fractures accompanied with compartment syndrome, infection, rigidity or bilateral fractures of tibia. Elastic stable intramedullary nailing has become a very acceptable options for treatment because of short hospital stay, early mobilization, anatomical reduction, minimal invasion, parent's satisfaction. (4,5)

#### Biomechanics of ESIN

Elastic stable intramedullary nailing is a minimally invasive procedure to manage fractures of the femur and tibia in children (6). They provide biomechanical and stable fixation for most types of fractures (7). They allow very small amount of mobility during weight bearing (8,9). They preserve soft tissues and fracture haematoma

that fasten bone healing. Bridging callus occurs at the fracture site (10).

#### Biomechanical Properties of ESIN

The biomechanical principles of ESIN depends on the application of two elastic nails into the metaphysis, each supporting the inner cortical contact. This produces the following four types of fixation:

1. Bending/Bowing stability
2. Axial stability.
3. Torsional stability
4. Rotational stability. (11)

#### PATIENTS AND METHODS

From May 2022 to August 2022 a prospective study was undertaken on fifteen patients to assess the results of elastic stable intramedullary nails in fixation of tibial shaft fractures in children in Mataria Teaching Hospital. (2 females and 13 males) patients were followed up 5 months post-operative.

### Mode of Trauma

All of the patients had a history of high energy fractures. 12 were due to an RTA, 2 were due to MCA 1 was due to trauma by heavy object.

- Five cases were simple transverse fractures ( $< 20^\circ$ ).
- Eight cases were simple oblique or spiral ( $> 20^\circ$ )
- One case was simple transverse fractures ( $< 20^\circ$ ).
- One case was simple oblique or spiral ( $>20^\circ$ )

### Surgical Data

In all patient's general anaesthesia was used. Supine position was used in all patients. An image intensifier is placed at the end of the table, which allows the surgeon and the assistant to stand on either side of the leg.

Two short straight incisions about 2 cm long are made in the medial and lateral sides of the leg.

Size of the nail was determined according to the formula: Nail diameter =  $0.4 \times$  diameter of medullary canal.

Pre-bending of the nail to 3 times the diameter of bone at fracture site.

Medially, blunt dissection is performed down to the cortex of the tibia, down to the midpoint of the medial proximal metaphysis, close to the medial border. The entry hole is made with an awl into the medial cortex of the proximal tibia. Then, the medial nail is applied to a T-handle and inserted through the entry point.

Lateral nail is applied in the same way as the medial one. Both nails are pushed down to the fracture site and fracture is reduced, then, each nail is carefully passed across the fracture site.



**FIGURE 1- Entry Point of The Nail**

During the last step, orientation of the nails is fine-bended so that the medial nail points medially and the lateral nail points laterally.

Patient remained in hospital for 48 hours post-operative. Antibiotics and parenteral antioedematous drugs were administered. Strong analgesics may be used. Above knee slab is done for obese patients.

Patient came to outpatient clinic after 2 weeks for removal of sutures. Plain x-rays were done and range of motion was checked for full range of motion.

At 8 weeks follow up

Plain x-rays were done, some patients showed signs of full union, and were allowed to weight bear. While older patients (12-15 years) were still not fully united.

12 weeks follow up

Plain x-rays were done, signs of full union for almost all patients appeared on x-rays and full weight bearing was allowed.



**FIGURE 2- AP And Lateral Views of Boy with Fracture Tibia**



**FIGURE 3- AP And Lateral Views 1 Month Postoperative**



**FIGURE 4- AP And Lateral Views 4 Months Postoperative**

**RESULTS**

The clinical results in our study were assessed at the end of the follow up for every case. All cases came at 12 weeks follow up with full weight bearing. Only one case of the fifteen suffered from pain, which was relieved after removal of nails.

Regarding range of motion, all cases had full range of motion in both knee and ankle joints.

Two cases showed valgus deformity with varying degrees, while only one case showed varus deformity.

No apparent LLD was noticed in most patients. Only two cases showed shortening of 0.5 cm in each (Table 1).

**Flynn Scoring System <sup>(5)</sup>**

**Limb Length Inequality**

Only two patients showed limb length inequality which was 0.5 cm in both cases.

**Pain**

In the Flynn scoring system, presence of pain would give a poor result and this occurred in only one case. Pain was relieved after removal of the nails.

**Malalignment (Table 1)**

**TABLE 1- Showing Type, Number and Degree of Deformities**

Deformity	Number of Cases	Degree
Varus	1	4
Valgus	2	2

**Complications**

There were no complications detected in 14 cases, only one case showed a minor complication which was irritation at entry site and was relieved immediately after removal.

**DISCUSSION**

Titanium elastic nails produce biomechanical stability from the divergent "C" configuration which creates six points of stability and allows the nail to act as an internal strut <sup>(12)</sup>.

ESIN have been used with great success in different countries for a number of decades, but it wasn't until the mid-1990s that elastic nailing gained acceptance in North Europe <sup>(4,5)</sup>.

The mean age of our study was 9 years old (range; 5-15) which is considered average compared to other studies, **Ligier et al.** <sup>(13)</sup>.

In this study the number of male patients was higher than that of the females and this was noticed in all other studies. In our study patients were followed up for an average of 5 months which is less than other studies, and the mean time of union was 10 weeks.

**Metaizeau** <sup>(4)</sup> followed the patients up for 15 months and the patients showed union after 11 weeks. In **Mckibbin B.** <sup>(14)</sup> the average time of union was less than other studies: 7 weeks which was in contrast to **Mizuno et al** <sup>(15)</sup> as patients showed union in an average of 20.4 weeks.

Regarding complications of ESIN we had only 1 case with irritation at entry site, no angular deformities  $>10^\circ$ , no limb length discrepancy no compartment syndrome or infections.

**Metaizeau** <sup>(4)</sup> reported 6 cases with irritation at entry site, 3 cases with angular deformities  $>9^\circ$ , no limb length discrepancy no compartment syndrome and no infections.

**Quain et al.** <sup>(7)</sup> reported 2 cases of angular deformities  $>10^\circ$ , no limb length discrepancy, 4 cases with compartment syndrome, no infections and irritation at entry site.

## CONCLUSION

Our study has demonstrated that elastic stable intramedullary nailing is successful low-morbidity alternative in treating tibial fractures in skeletally immature patients 5 to 15 years old that allows early ambulation with good functional results.

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