

## Management of Unstable Tibial Shaft Fracture with Titanium Elastic Nails in Children

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**Objectives:** to evaluate radiological and functional outcomes of Titanium elastic nails (TEN) in pediatric patients with tibial shaft fractures **Methods:** Study was prospective design. A total number of forty patients were treated who were presented with tibial shaft fracture. Patients were treated with TEN. In every patient antegrade nailing was performed by inserting a TEN in the medial side of metaphysis and another TEN in the lateral side of the proximal metaphysis. Main outcomes were leg length inequality, union, malunion and complications. SPSS version 23 was used for data analysis **Result:** Functional result (Flynn Criteria) was excellent in 38.5% patients and satisfactory was in 61.5% patients. Complication was occurred in 38.5% patients. Residual deficiency and pin tract infection was noted as 46.2% and 30.8%, respectively. Numerical variables were presented as mean and SD and categorical variables were presented as frequency percentages. P value  $\leq 0.05$  was taken as significant. **Conclusion:** Unstable pediatric tibial shaft fractures can be treated ideally through intramedullary fixation technique with titanium elastic nailing even untreated cases of conservative management and those cannot be reduces due to presence of open wound or edema.

**Keywords:** Elastic intramedullary nail, Fracture, Pediatric, Tibia.

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### INTRODUCTION

Third most common long bone fracture is tibial shaft fracture in children, its incidence is 15% in pediatrics<sup>1</sup>. After femoral fractures tibial fracture is the second most cause of hospitalization. Closed reduction is the treatment of choice and surgery is not required in such cases<sup>2,3</sup>. But in open tibial fracture due to play trauma, neurovascular injury and unacceptable angulation surgery is required<sup>4</sup>. Some procedures like intermedullary nailing, external fixation and krischner wire are completed with surgical procedures<sup>5</sup>.

In cases of soft tissues less external fixation are the best options<sup>6</sup>. But this fixation method also associated with number of complications like pin tract infections, malunion, leg length inequality and delayed union<sup>7</sup>. In adult management with rigid intermedullary nail is ideal but in tibial epiphysial injuries this treatment is not suitable<sup>8</sup>. In epiphysial case injuries alternate method is titanium Elastic nails(Ten). Due to this insertion

in metaphysis titanium Elastic Nails are preferred in children.

TEN have some advantages over intermedullary nails like less shaft tissue injury, flexible and stable mobility, minimum epiphysial injury, reduced treatment cost, easily application without penetrating fracture line and short operative time<sup>9</sup>. Disadvantages of TEN are inability to achieve stability in complex fractures, in advanced age delayed union and risk of compartment syndrome<sup>10</sup>. In this study we compare functional and radiological actions of children who were treated conservative and surgical.

### Methodology

Study was started after ethical approval from ethics. Informed written consent was obtained from patients after detailed information and purpose of study. Study was completed in one year duration from 5th January 2019 to 5th January 2020. Study was completed in orthopedic

surgery department of Nishter Hospital Multan. Non probability consecutive sampling technique was used. Sample size was calculated by using online software openepi.com.

Patients who lost thick follow up, head trauma, multiple fractures were excluded from study. Gustillo Enderson classification method was used for classification of open fractures. All outcome variables age, gender, post operative complications, mechanism of injury, posterial weight bearing union, surgical angulation, final coronal angulation, leg length, rang of motion and all radiological outcomes were assessed for all patients. Flynn et al was for evaluation of clinical outcomes.

Surgical procedures were performed under standard general anesthesia. Patients were kept on NPO (nothing per oral) for 6-8 hours. Two large bore brannulas were inserted bilaterally on dorsal side of hands. Prophylactic antibiotic (ceftriaxine 1g intravenous) was given. Closed reduction was done under Ligier and Mutaizem protocols. C-arm flouroscopy was used for visualization of procedure and for supervision. After lying patient in spine position Medial and Lateral incisions were given about 2cm distal to epiphysis of proximal tibia. An intramedullary TEN of about 2 to 4mm was inserted after marking the entry point. TEN was slided towards distal to fracture point and reduction was done under C-arm flouroscopy. Second intramedullary nail was inserted from proximal medial of tibia. TEN was bent from the tip after confirmation of proper reduction. Long leg splint was applied.

Data was entered on SPSS version 23, mean and standard deviation was calculated for numerical variables. Frequency and percentages were calculated for categorical data.

**Results**

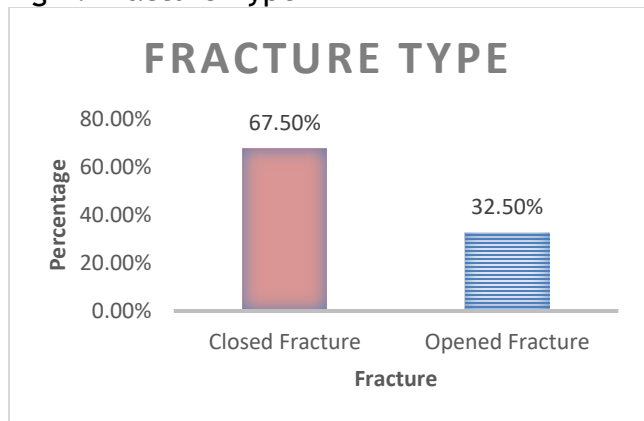
Forty patients were included in this study, both genders. The main outcome variable of our study was fracture type. Closed fracture was found in n=27 (67.5%) patients and opened fracture was found in n=13 (32.5%) patients. (Figure. 1). the mean weight-bearing time and heal time of the closed fracture patients was 1.88±0.52 weeks and 9.81±2.11 weeks, respectively. There were n=16 (59.3%) males and n=11 (40.7%) females in closed fracture patients. Right side was in n=4 (14.8%) patients and left side in n=23 (85.2%) patients. Complication was

occurred in n=1 (3.7%) patients. Residual deficiency and pin tract infection was noted as n=6 (22.2%) and n=5 (18.5%), respectively. Functional result (Flynn Criteria) was excellent in n=16 (59.3%) patients and satisfactory was in n=11 (40.7%) patients. The mean weight-bearing time and heal time of the opened fracture patients was 2.39±0.56 weeks and 11.83±1.89 weeks, respectively. There were n=7 (53.8%) males and n=6 (46.2%) females in opened fracture patients. Right side was in n=5 (38.5%) patients and left side in n=8 (61.5%) patients. Complication was occurred in n=5 (38.5%) patients. Residual deficiency and pin tract infection was noted as n=6 (46.2%) and n=4 (30.8%), respectively. Functional result (Flynn Criteria) was excellent in n=5 (38.5%) patients and satisfactory was in n=8 (61.5%) patients. P-value ≤0.005 considered as significant. (Table. I).

**Table. I: Comparison of patients with closed and open fractures**

Variable	Closed Fracture n=27 (67.5%)	Opened Fracture n=13(32.5%)	P-value
Weight-bearing time (weeks)	1.88±0.52	2.39±0.56	0.008
Heal time (Weeks)	9.81±2.11	11.83±1.89	0.005
<b>Gender</b>			
Male	n=16 (59.3%)	n=7 (53.8%)	0.746
Female	n=11 (40.7%)	n=6 (46.2%)	
<b>Side of fracture</b>			
Right	n=4 (14.8%)	n=5 (38.5%)	0.093
Left	n=23 (85.2%)	n=8 (61.5%)	
complication	n=1 (3.7%)	n=5 (38.5%)	0.004
Residual deficiency (coronal/sagittal angulation)degree	n=6 (22.2%)	n=6 (46.2%)	0.122
Pin tract infection/irritation Shortness	n=5 (18.5%)	n=4 (30.8%)	0.385
<b>Functional result(Flynn Criteria)</b>			
Excellent	n=16 (59.3%)	n=5 (38.5%)	0.217
Satisfactory	n=11 (40.7%)	n=8 (61.5%)	

Fig-1: Fracture Type



### Discussion

Tibial shaft fracture can be managed accurately with closed reduction method. Patel et al<sup>11</sup> conducted a study and concluded that tibial fracture which is open and associated with neurovascular injury, and multiple traumas can be treated with percutaneous fixing, external fixations and screw plating. But Berger et al<sup>12</sup> recommended titanium Elastic nailing is the treatment choice for open fractures with excellent outcomes and minimal score formation in pediatric cases. Easy applicability of such procedures also makes it ideal for children.

In a study Debnath et al<sup>13</sup> reported 50% excellent results, 36% acceptable and 14% poor outcomes with TEN in pediatrics that were operated for midshaft tibial fractures. Another study by Pennock et al<sup>14</sup> compared TEN with screw plating and reported similar recovery rate of 97% in both groups. In our study TEN obtained all excellent cases with no pain air minimal pain. Our study is comparable with studies discussed above.

O'Brien et al<sup>15</sup> conducted a study on 16 patients to evaluate outcome and complications associated with complete handling. In this study no report of nonunion and movement restriction observed. Sanker et al<sup>16</sup> conducted a study on unstable fracture of tibia and managed with TEN and reported 63% of excellent outcomes, 32% acceptable and 5% cases of poor outcomes. It is a higher ratio of good outcomes as compared to any other treatment method for tibial fractures in children.

Another study was conducted by Heo et al<sup>17</sup> on 81 patient with open fractures and reported 88% excellent results and satisfactory results is 12% of patients.. All these patients were treated

with TEN. Basaran et al<sup>18</sup> evaluated tibial shaft fracture treated with TEN occurred due to high energy trauma and reported excellent outcomes on 45% patients, 55% satisfactory results and poor outcomes were observed.

Mean age of patients in our study was also similar to studies conducted by Gordon et al<sup>19</sup> Mean age was 11.7 years in patients who were healed in normal time and outcomes are good. Mean time of union in these patients was 10.46 less than or equal to 4.09 weeks. Delayed union is also a fact of advance age group. Kc KM et al<sup>20</sup> reported that pin tract was found in 13.3% of patients. Even of TEN should be placed under the skin otherwise it can cause pin tract infection.

### Conclusion

Unstable pediatric tibial shaft fractures can be treated ideally through intramedullary fixation technique with titanium elastic nailing even untreated cases of conservative management and those cannot be reduces due to presence of open wound or edema.

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