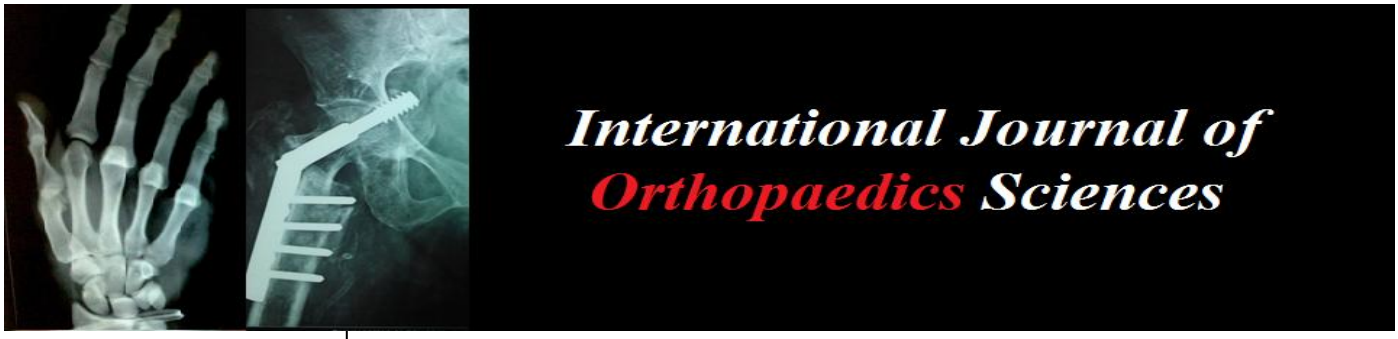

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A comparative study of functional outcomes of surgical versus conservative management of diaphyseal fractures of tibia in children

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Abstract
Introduction: Tibia Shaft Fractures in children are very common. Despite newer innovations in implants and techniques no standardize management stratergy is available.
Aims and Objectives: To compare and study time for union, weight bearing and functional outcomes with surgical versus conservative management of diaphyseal fractures of tibia.
Materials and methods: We studied 50 patients with tibia shaft fractures treated with Titanium elastic nails and closed reduction cast (CRC). Study was prospective. Radiographic union was defined as bridging of 3 cortices followed by which weight bearing was initiated. Final outcome evaluated at end of 6 months were classified as excellent, satisfactory, poor according to FLYNN criteria.
Results: Road traffic accident was common mode of trauma (74%) followed by domestic accident (26%). All patients achieved complete union at mean of 8 weeks (Range 8-12). Majority of patients had angulation less than $5^{0.}$ According to FLYNN criteria, 43 patients had excellent results, 7 had satisfactory results and none had poor result.
Conclusion: TENS nailing were superior in displaced fractures of tibia-fibula compared to conservative management in terms of early mobilization, union, weight bearing and residual angular deformity. Larger sample size with longer duration of follow up would give better outcomes.

Keywords: Tibia fractures, TENS, FLYNN criteria

Introduction
Tibia Shaft Fracture is one of the common Fractures in paediatric age group. It accounts about 10 to 15% of cases [1]. In majority of cases Close reduction and plaster application is the main stay of the treatment [2]. Surgical intervention is indicated only in limited cases like failed close reduction, open fracture, fracture with neurovascular injuries, polytrauma patients, fracture with compartment syndrome and in adolescent patients [3, 4]. Fractures of the Tibia in Paediatric age group are subject of ongoing controversy and discussion. Despite newer innovations in implants and external fixation devices, tibial fractures essentially remain unresolved; they are among the most challenging fractures to be treated by an orthopedic surgeon. Recently there has been a growing trend towards surgical treatment of Diaphyseal fractures in children reflecting a more interventionist attitude among Orthopedic Surgeons which is also due to technical development, notably that of Elastic Stable Intramedullary Nail(ESIN) [5]. The treatment for children between the ages of 6 and 10 years is the most controversial. Many such patients may be treated successfully with immediate closed reduction and casts. However, in older children and adolescents operative treatment should be considered to avoid complications such as delayed union, delayed weight bearing, malunion, rotational deformity, knee stiffness, limb length discrepancy and psychosocial problems. Operative treatment results in shorter hospitalization and early mobilization, which has psychological, social, educational and economic advantages over conservative treatment. Results from several studies have shown that Flexible Intramedullary Nail (FIN) or Titanium Elastic Nailing System (TENS) fixation meets these requirements because it allows rapid mobilization, low risk for physeal injury, closed insertion and fracture hematoma preservation.

Flexible intramedullary nails achieved biomechanical stability from its Double C construct, which produces three point fixation and acts as an internal splint [6]. Flexible intramedullary nails allows controlled micro motion at the fracture site, which enhance callus formation [7]. TENS meets the requirements of this ideal device [8]. The choice of treatment may be influenced by the age of the child, the level and pattern of the fracture and to a great extent, by regional, institutional or surgeons preferences.

Materials and Methods

Methodology

This study was done to evaluate and compare the functional outcomes of surgical vs conservative management of diaphyseal fractures of tibia in children in our hospital setup. This is a prospective study (from June 2015 to June 2017) of 50 diaphyseal fractures of tibia in 50 patients treated at Krishna hospital and Medical research centre, Karad. Follow up period was till 6 months. Routine investigations were done as necessary. The diagnosis was confirmed by antero-posterior and lateral radiographs involving knee joint and ankle joint. Stabilization was done with an above knee slab, conservative procedure was done once the skin condition was good and swelling had subsided and surgical procedure was done as soon as possible.

Inclusion Criteria

1. Age group: 5-16 years
2. Patients of both sexes
3. Patients with diaphyseal fractures of Tibia
4. Patients with diaphyseal fractures of Tibia and Fibula
5. Compound Fractures (Type 1 and Type 2 Gustilo-Anderson classification)
6. Patients who are willing to participate in the study
7. Patients fit for surgery.

Exclusion Criteria

1. Skeletally mature patients
2. Pathological fractures
3. Compound Fractures (Type 3 Gustilo-Anderson classification)
4. Unwillingness to participate in the study
5. Patients unfit for surgery and or anaesthesia.

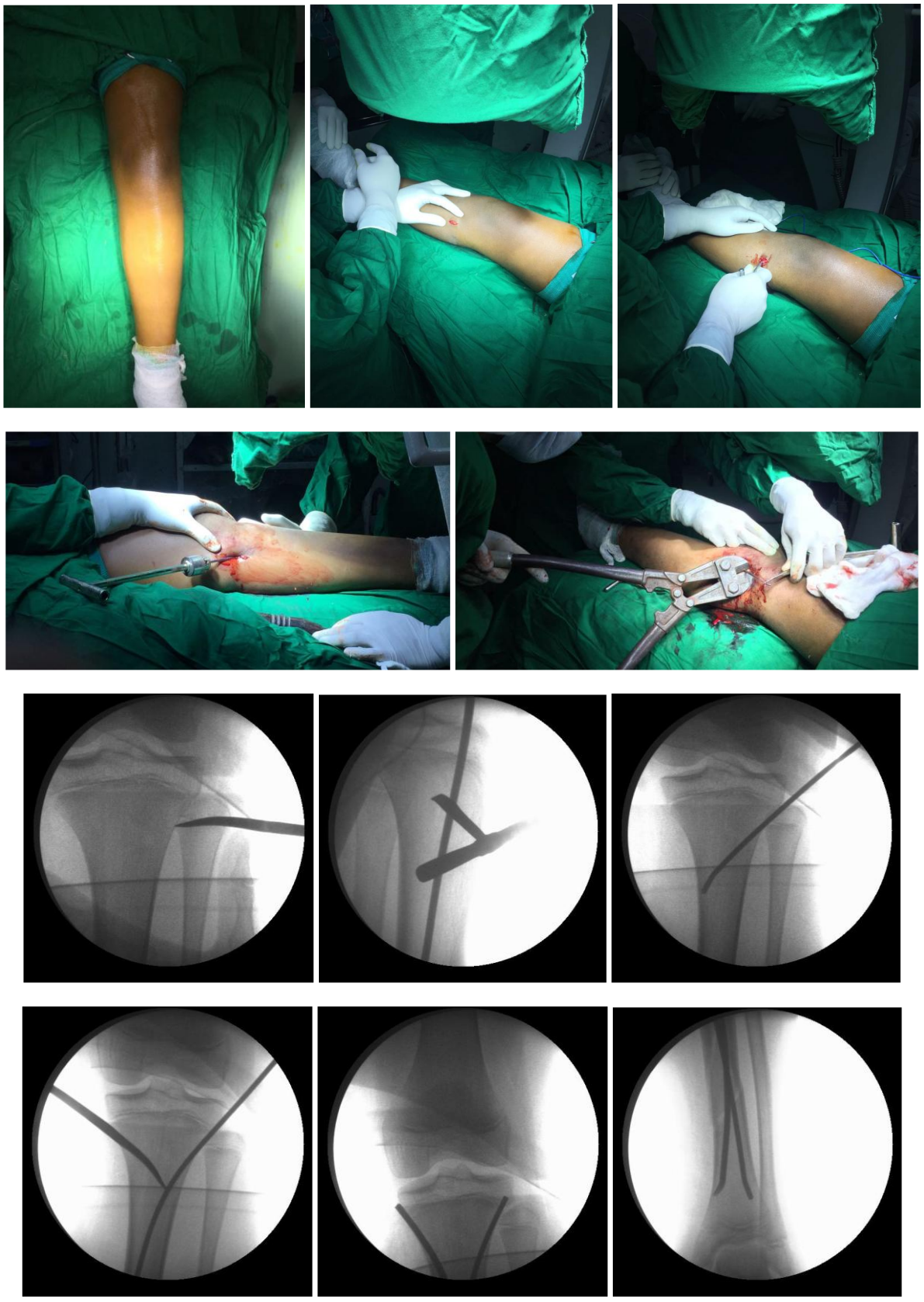
The form of treatment (Operative or conseravative) was decided randomly. Out of 50 patients, 25 patients were treated operatively (Titanium Elastic Nails) and 25 patients were treated conservatively with cast (Above Knee). The basic idea was to achieve near anatomical reduction. Post operatively limb was immobilized in plaster cast for six weeks and Patients were put on I.V antibiotics and analgesics and limbs were kept elevated. Patients were advised to keep the limb at elevation and strict non weight bearing with walker once patient is free from pain. Patients were assessed for fracture union radiologically. Once the fracture showed signs of radiological union, above knee cast was removed, partial weight bearing was encouraged which was then gradually increased to full weight bearing.

Follow up

Regular follow up was done at 3 weeks, 6 weeks, 3 months and 6 months after treatment till the fracture united. Follow up X-rays were taken to assess fracture union, the condition of implant. Weight bearing was restricted till fracture site showed callus formation. At 6 weeks X-ray of Tibia was taken in Ap and Lateral view, if signs of union were seen then above knee cast was removed and partial weight bearing was started which was gradually increased to full weight bearing. At 6 months Limb length was measured which was compared to opposite normal limb to evaluate limb length discrepancy.

Table 1: Flynn's scoring criteria

Variable	Excellent	Satisfactory	Poor
Limb-length inequality	<1.0 cm	<2.0 cm	>2.0 cm
Mal alignment	5 degrees	10 degrees	>10 degrees
Unresolved pain	Absent	Absent	Present
Other complications	None	Minor and resolved	Major and lasting morbidity



Observations and Results

A prospective, comparative, clinical study was conducted with 50 patients to compare and evaluate Outcomes of Surgical vs. Conservative Management in Diaphyseal Fractures of Tibia in children. The patients were selected randomly and were divided in the following two groups of 25 patients each:

Distribution of patients	N	%
Group 1: Surgical treatment	25	50%
Group 2: Conservative treatment	25	50%
Total	50	100%

The mean age in Group 1 was 10.4± 2.65 years and the mean age in Group 2 was 9.0 ± 2.97 years. As per Student t test, there was no significant association between the groups (p>0.05). There was dominance of right side (72% and 60%) as compared to left side (28% and 40%) in both groups. Road Traffic Accident was observed to be the main cause of fracture in both the groups (80% and 68% respectively) followed by fall (20% and 32% respectively).There was no significant association between the groups as per Chi-Square test (p>0.05). In Group 1, the duration of hospital stay for 64% patients was <5 days and for 24% patients was 5-7 days and it was 7-11 days for 12% patients. In Group 2, the duration of hospital stay for 80% patients was <5 days and for 20% patients was 5-7 days. The mean duration of hospital stay in Group 1 was longer as compared to Group 2 (4.8 vs. 3.2 days), however this difference was statistically not significant as per Chi-Square test (p>0.05).

Distribution of patients according to Radiological Union

In Group 1, the duration of radiological union in 48% patients was ≤6 weeks and 36% patients was between 6-9 weeks and was 9-12 weeks in 16% patients. In Group 2, the duration of radiological union in 32% patients was ≤6 weeks and 40% patients was between 6-9 weeks and was 9-12 weeks in 28% patients. The mean duration for radiological union was comparable in both the groups (7.7 vs. 8.2 weeks) and the difference was statistically not significant as per Chi-Square test (p>0.05).

Distribution of patients according to weight bearing

In Group 1, 40% patients started weight bearing at 6 weeks while 44% patients started weight bearing at an average of 8 weeks while 16% patients started weight bearing at an average of 11 weeks. In Group 2, 20% patients started weight bearing at an average of 6 weeks, 52% patients started weight bearing at 8 weeks and 28% patients started weight bearing at an average of 11 weeks. The mean duration for weight bearing was comparable in both the groups (8.1 vs. 8.8 weeks) and the difference was statistically not significant as per Chi-Square test (p>0.05)

Comparison of Limb length inequality between groups

Majority of the cases in both the groups (88% and 92% respectively) had limb length inequality <1 cm. In Group 1 8% patients had limb length inequality of <2 cm and 4% patients had > 2 cm, whereas 4% patient each in Group 2 had limb length inequality of <2 cm and > 2 cm respectively. There was no statistically significant difference between the groups as per Chi Square test (p>0.05).

Comparison of Malalignment between groups

Majority of the cases in both the groups (84% and 80% respectively) had malalignment <5º. In Group 1, 16% patients had malalignment of 5-10º whereas 20% patients in Group 2 had malalignment of 5-10º. There was no statistically significant difference between the groups as per Chi-Square test (p>0.05).

Comparison of Infection between groups

There were 2 patients with superficial infection in group 1 and no patients in group 2, however this difference is statistically not significant as per Chi-Square test, (p>0.05).

Comparison of Functional Recovery between groups

The functional recovery was assessed as per Flynn's criteria. The final outcome was excellent in 88% and 84% cases of Group 1 and Group 2 respectively. Satisfactory in 12% and 16% cases of Group 1 and Group 2 respectively. There was no statistically significant difference in functional recovery between groups (p>0.05).

Discussion

In this study, the mean age in group 1 was 10.48 ± 2.65 years and in Group 2 was 9.0 ± 2.97 years. There was no significant difference in age among both the groups (p>0.05), which was comparable to study conducted by Onta PR *et al.* [9] where average age of the patient was 8.2 years ranging from 6 years to 12 years. Ahmed EKF *et al.* [10] similar study found mean age of the patients in the study was 11.3 years (range 5–15 years). In this study, in Group 1 the mean duration of hospital stay was 4.88 ± 2.21 days. In Group 2, the mean duration of hospital stay was 3.2 ± 1.69 days which was comparable to study conducted by Onta PR *et al.* [9] where average hospital stay of the patient was 5.7 days (range from 3 to 16 days). The mean duration for radiological union in group1 was 7.76 ± 1.90 weeks and in group 2 was 8.24 ± 2.19 weeks and this difference was statistically not significant (p>0.05) The mean duration for weight bearing in Group 1 was 8.16 ± 2.11 and in Group 2 was 8.84 ± 2.01 (Range 6 -12 weeks) which was comparable to study conducted by Onta PR *et al.* [9] All the children achieved complete healing (three cortex with bridging callus in radiograph) at a mean of 13.38 weeks (range 12–18 weeks). Full weight bearing was allowed to all the children as tolerated. The mean time for full weight bearing was 8.8 weeks (range 6 to 12 weeks). In the present study, majority of the cases in both the groups (88% and 92% respectively) had limb length inequality less than 1 cm. There was no statistically significant difference between the two groups in this study, Majority of the cases in both the groups (84% and 88% respectively) had malalignment less than 5º which were comparible to study conducted by Onta PR *et al.* [9] in which 16 children had angulation of less than 5 degrees whereas 2 children had angulation of 5 to 10 degrees and none of the children had angulation more than 10 degrees. In study conducted by Kapil Mani KC *et al.* [11] out of forty five patients treated with TENS, two cases developed malunion, one with 9 degree of anterior angulation and other with 10 degree of varus angulation. In the similar study done by O‟Brien *et al.* [12] in 16 tibial fractures, fixed with flexible intramedullary nails achieved a good functional outcome. They had 1 superficial infection, 6 coronal and 7 sagittal angulations without any functional compromise. One child had a leg shortening of more than 1.5 cm. Goodwin *et al.* [13] reported 2 cases with angular deformities of ten degrees each. In the present study, the functional recovery was assessed as per Flynn's criteria. The final outcome was excellent in 88% and 84% cases of Group 1 and Group 2 respectively and satisfactory in 12% and 16% cases of Group 1 and Group 2 respectively. There was no statistically significant difference in functional recovery between two groups (p>0.05). Ahmed EKF *et al.* [10] similar study reported 15 (75%) cases had excellent result and 5 (25%) cases had satisfactory result. There was no poor result according to Flynn scoring criteria for ESINs.

Conclusion

The results of TENS nailing were superior in displaced diaphyseal fractures of Tibia-Fibula as compared to conservative management in terms of early mobilization, union, weight bearing and residual angular deformities.

Conservative management showed good results in undisplaced fractures, but showed angular deformity when fibula was intact which got partially corrected during the course of our study. Larger sample size with longer duration of follow up would give better outcomes.

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