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## Study of management of distal 1/3rd tibial shaft fracture by intramedullary nailing

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### Abstract

**Background:** Tibia is not only the most common long bone of body to get fractured but also offers many challenges to Orthopaedic surgeons in managing its fractures. Since tibia lies directly below the skin in most of its course, it is not only prone to get open fractures very commonly but also prone to get wound problems after any fracture fixation surgery. There are various options available for the surgical management of distal 1/3<sup>rd</sup> tibial shaft fractures and each of these treatment options is associated with certain challenges.

**Method:** We studied the 60 patients of distal 1/3rd tibial shaft fractures operated with closed reduction and internal fixation with reamed intramedullary interlocking nailing. Radiological outcomes and clinical outcomes using Olerud-Molander score were assessed at 6 weeks, 3 months, 6 months and 1 year intervals.

**Result:** In our study, 28.44% patients were in 36-45 years age group, followed by 23.23% in 16-25 & 26-35. Males were 71.67% where females were 28.33%. Road Traffic Accident were maximum 70% in mode of injury, followed by fall from height 23.33%. Percentage of patients in which fibula was fixed was 16.66%. Mean for surgery duration in minutes was 85.08.

Percentage of Patients with Complication of Wound Infection was 05%. Mean of Olerud-Molander Score was 19.25 at 6 weeks, 32.33 at 3 months, 50.08 at 6 months and 85.58 at 1 year. Mean of Time of Union in weeks was found to be 19.83. We found out that 40% patients had Excellent & 60% patients had good results.

**Conclusion:** Intramedullary nailing for the management of distal 1/3rd tibial shaft fractures appears to be a good modality of treatment in terms of good union rate, less wound complications and good functional outcome. Use of appropriate surgical procedure, concurrent fibula fixation, distal locking with 3 screws and appropriate post operative rehabilitation gives satisfactory results.

**Keywords:** Intramedullary, nailing, tibial shaft & fractures

### Introduction

In the era of high speed vehicles, the road traffic accidents are increasing day by day. Majority of the victims of these accidents who are attended at hospital emergency have fractures<sup>[1]</sup>. An Orthopaedic surgeon routinely and very commonly attends a lot of patients of tibia fracture in OPD or in emergency. Management of any fracture is always challenging as there are many activities of a person which are going to get affected by the outcome of treatment. Tibia is not only the most common long bone of body to get fractured but also offers many challenges to Orthopaedic surgeons in managing its fractures. Because of its location between two hinges (knee and ankle), its fractures are not easy to get aligned during reduction<sup>[2]</sup>. Tibia is a large bone of the body and one of the principle load bearing bone in the lower extremity; Tibial fractures can cause a long morbidity and extensive disability even after treatment.

Since it is the main weight bearing bone of the leg, management of its fractures with conservative methods is usually non-promising. Since tibia lies directly below the skin in most of its course, it is not only prone to get open fractures very commonly but also prone to get wound problems after any fracture fixation surgery.<sup>3</sup> 39.0% of all tibia shaft fractures are open. Rate of associated ankle bones injury in shaft tibia fractures is 16.58%. Achieving the Wound healing, fracture union, weight bearing, normal movements at ankle and knee joints, smooth and non-tense skin without any impingement of underlying implants and subsequent

restoration of all daily routine and professional activities in patients of tibia fractures are the goals of any modality of its surgical management [4]. The management and prognosis of distal 1/3<sup>rd</sup> tibial shaft fractures are different from both pilon fractures and tibial mid shaft fractures. There are various methods available for the surgical management of distal 1/3<sup>rd</sup> tibial shaft fractures such as open reduction and plate Osteosynthesis, Osteosynthesis by minimal invasive technique, external fixation with rod fixators or ring fixators, intramedullary interlocking nailing [5]. The orthopedic surgeon must has to select the right choice of treatment for each particular patient. However, each of these treatment options is associated with certain challenges [6].

### Material and Method

The study was conducted in Sri Aurobindo Medical College and Post Graduate Institute, Indore from May 2018 to August 2019. In this study we included 60 patients of distal 1/3<sup>rd</sup> tibial shaft fractures operated with closed reduction internal fixation with reamed intramedullary interlocking nailing. Inclusion and exclusion criteria were following:

**Inclusion criteria:** 1- Extra-articular distal 1/3<sup>rd</sup> tibial shaft fractures closed or open fractures GA-1, GA-2, GA-3A with or without ipsilateral fibula fracture  
2- Fresh trauma  
3- Age 16 and above

### Exclusion criteria

1. Fractures with neuro-vascular injury or requiring skin or muscle graft closure
2. Any other associated fracture in ipsilateral lower limb other than fibula fractures
3. Age less than 16 years
4. Pathological fractures

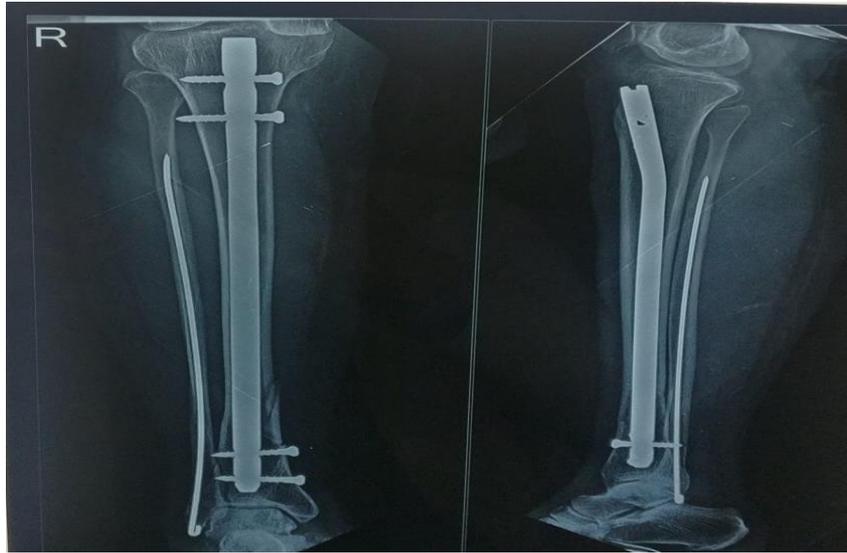
Patients were attended in emergency unit. After Patient's initial assessment and radiography, fracture was temporarily splinted with above knee slab and limb elevation was done. IV analgesics, oral proteolytic enzymes along with ice fomentation were started. Those with gross swelling were additionally given MgSO<sub>4</sub> dressing. All investigations requiring for pre anesthetic check-up were sent. Open fractures were washed thoroughly and closure was done in minor operation theatre and IV antibiotics

were started.

Patients were operated under spinal or general anesthesia. Standard operative procedure of intramedullary nailing was used. Patient was taken in supine position on a radiolucent table with tibial post under knee. Under all aseptic conditions, scrubbing painting and draping was done. If any associated ipsilateral fibula fracture was present within 5 cm from syndesmosis, it was first fixed with either rush nail or open plating. Then Tibial fracture was reduced with traction and manipulation. Fractures with spiral patterns were hold with clamp Percutaneous during procedure. Incision was started from tibial tubercle and extended proximally over medial border of patellar tendon. Patellar tendon was split to get access to proximal tibia. Entry point was determined in IITV at 3 mm medial to tibial crest in frontal plane and just distal to the angle between tibial plateau and anterior tibial metaphysis. Entry was made with curved AWL. A beaded guide wire was passed from entry site under IITV guidance which was kept central both in AP and lateral views. Guide wire was passed through fracture area while maintaining the reduction and descended up to just proximal to ankle joint. Serial reaming of medullary canal was done. Using a Teflon tube, beaded guide wire was exchanged with non-beaded guide wire. Tibia nail of appropriate length and 1.5 mm thinner than last used reamer diameter was inserted with using ZIG. Proximal locking with 4.9 mm locking bolts was done with sleeve guidance. Distal locking was done with three 4.9 mm locking bolts under IITV guidance free handily. Zig was removed and wash was given. Patellar tendon was sutured and wounds were closed in layers. Dressing was done and Elastocrepe bandage was applied. Patients were shifted to post operative ward. Post operative x-rays were done. Postoperatively limb was elevated over pillow and ice fomentation was given. Active toe movement exercises, ankle foot pump and knee range of motion exercises were started post operatively. Non weight bearing mobilization was started on post op day 1. Weight bearing was started according to fracture pattern and after patient was able to tolerate the pain. IV 3<sup>rd</sup> generation cephalosporins for 5 days, aminoglycosides for 3 days and oral cephalosporins for 5 days were given. Dressing was done on post operative day 2 and post operative day 5. Suture removal was done at post operative day 13. Patients were followed up at 6 weeks, 3 months 6 months and 1 year. At each follow up, x-rays were done and patient's Olerud-Molander score was assessed.



**Fig 1:** Pre-Operative X-Ray



**Fig 2:** Immediate Post-Operative X-Ray



**Fig 3:** X-Ray at 6 Weeks Follow-Up

**Fig 4:** X-Ray at 3 Months Follow-Up



**Fig 5:** X-Ray at 6 Months Follow-Up

**Fig 6:** X-Ray at 01 Year Follow-Up



**Fig 07:** Clinical images showing ankle and knee movements at 1 year follow up

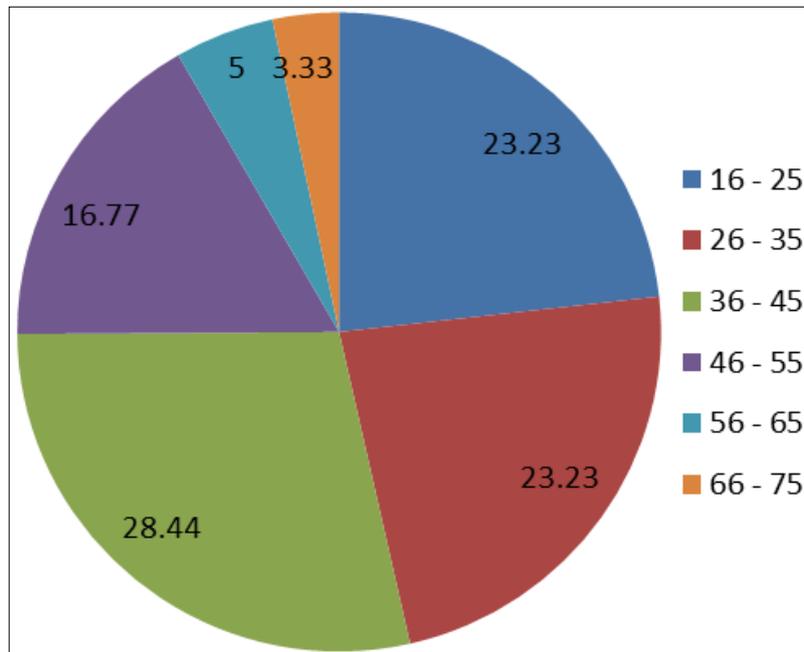
**Results**

In our study, maximum percentage of patients (28.44%) were in 36-45 years age group, followed by 23.23% in both 16-25 & 26-35 years age group. Mean age of patients was 36.88 years. In our study, males were 71.67% and females were 28.33%. Road Traffic Accident 70% was the most common mode of injury, followed by fall from height which was 23.33% of all. Percentage of patients in which fibula fixed was 16.66%. Mean duration of surgery in minutes was 85.08. In 5% patients, we observed complication of Wound Infection which were managed with dressing and appropriate antibiotics and were healed subsequently; fracture union was present in these patients. Mean Olerud-Molander Score at 6 Weeks was 19.25, at 3 weeks was 32.33, at 6 months was 50.08 and at 1 year was 85.58. Union

was achieved in all patients. Mean Time of Union was found to be 19.83 weeks. In overall results, we found 40% patients had Excellent & 60% had good results.

**Table 1:** Age Distribution

Age Group (Years)	Frequency	Percent
16- 25	14	23.23
26 - 35	14	23.23
36 - 45	17	28.44
46 - 55	10	16.77
56 - 65	03	05.00
66 - 75	02	03.33
Total	60	100.0



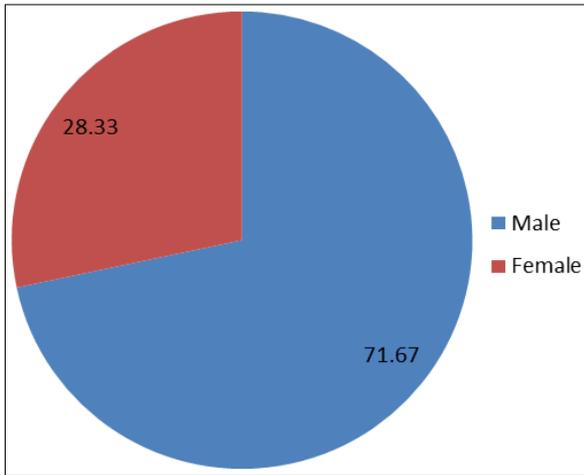
**Graph 1:** Age Distribution

**Table 1A:** Age Distribution

Statistics	N	Mean	Std. Error of Mean	Std. Deviation	Range	Minimum	Maximum
	60	36.88	1.731	13.409	51	17	68

**Table 2:** Sex Incidence

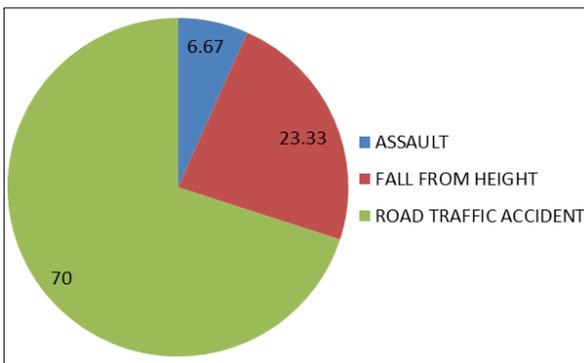
Sex	Frequency	Percent
Female	17	28.33
Male	43	71.67
Total	60	100.0



Graph 2: Sex Incidence

Table 3: Mode of Injury

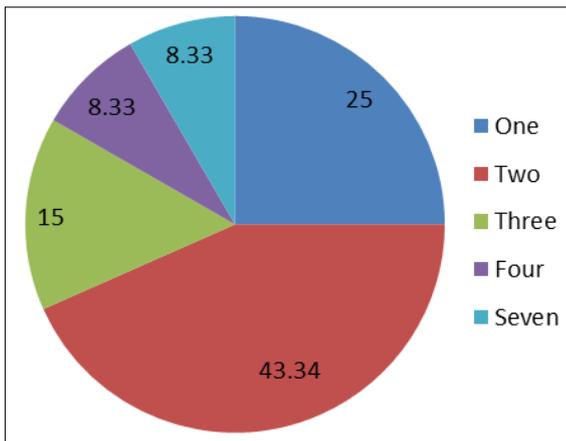
Mode of Injury	No. of patients	Percentage
Assault	04	6.67
Fall from height	14	23.33
Road traffic accident	42	70
Total	60	100.0



Graph 3: Mode of Injury

Table 4: Average Injury to Operation Interval

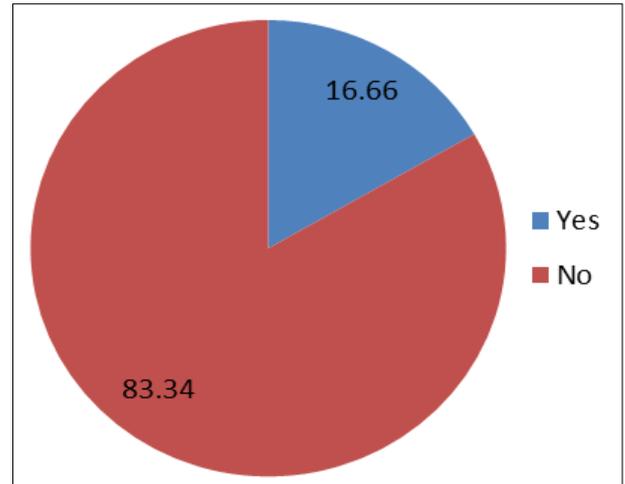
Days	No. of patients	Percent
01	15	25.0
02	26	43.34
03	09	15.0
04	05	8.33
07	05	8.33
Total	60	100.0



Graph 4: Mode of Injury

Table 5: Percentage of patients in which fibula was fixed

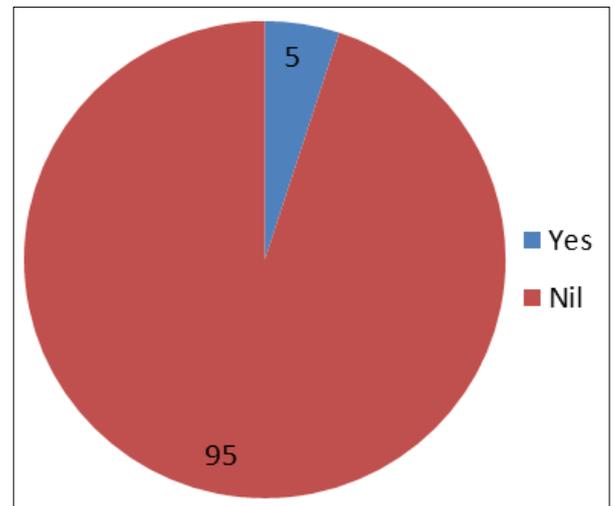
Fibula Fixation	No.	Percentage
Yes	10	16.66
No	50	83.34
Total	60	100.0



Graph 5: Percentage of patients in which fibula was fixed

Table 6: Percentage of Patients with complication of Wound Infection

Wound infection	No.	Percentage
Yes	03	05
Nil	57	95
Total	60	100.0



Graph 6: Percentage of Patients with Wound Infection

Table 7: Mean of Olerud-Molander Score

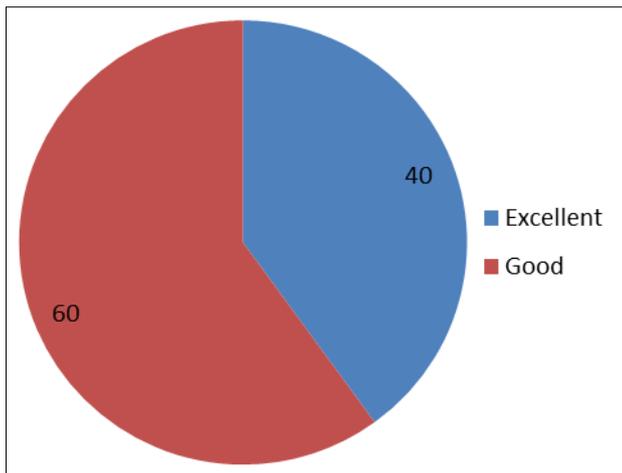
Statistics	N	Mean	Std. Error of Mean	Std. Deviation	Range	Minimum	Maximum
6 week	60	19.25	.426	3.297	10	15	25
3 month	60	35.33	1.062	8.227	25	25	50
6 month	60	50.08	.984	7.619	25	40	65
1 year	60	82.58	.836	6.476	25	70	95

Table 8: Mean of Time of Union in weeks

	N	Mean	Std. Error of Mean	Std. Deviation	Range	Minimum	Maximum
Average Time of Union	60	19.83	.190	1.475	4	18	22

**Table 9:** Results

Results	No. of patients	Percentage
Excellent	24	40
Good	36	60

**Graph 7:** Results**Table 10:** Surgery duration in minutes

Surgery Duration In Minutes	N	Mean	Std. Error of Mean	Std. Deviation	Range	Minimum	Maximum
	60	85.08	1.579	12.230	45	60	105

### Discussion

Management of Distal 1/3<sup>rd</sup> tibial shaft fractures is challenging because of the various complications coming out of different modalities of treatment. These fractures are mostly seen after high energy trauma creating axial and rotational forces on distal part of tibia [7]. If we look into the literature, various studies were done to compare the results of various treatment options for distal tibial shaft fractures. The various treatment methods from conservative treatment to surgical treatment with open reduction and plate Osteosynthesis, Osteosynthesis by minimally invasive technique, external fixations with rod fixators or ring fixators, intramedullary interlocking nailing have been tried [8]. Nonoperative treatment in patients who are not fit for surgery may result in complications like delayed union, malunion and joints stiffness even in stable fractures [9]. Managing distal tibial shaft fractures with associated distal fibular fractures 5 cm near syndesmosis offers additional challenges of maintaining ankle syndesmosis stability [10, 11]. These fibular fractures should be fixed before tibia fixation. In a study, fixing fibula first was more helpful in achieving the alignment of limb or reduction in comminuted tibia fractures than fixing tibia first [12]. In the study they reported that in 03 patients of the 15 had angle in varus or valgus > 5° without fibular fixation. This was significantly more than our study where no malalignment was reported [13].

Another clinical concern arises is the less availability of space for distal locking bolts in distal tibia nailing. [14] With use of distal tip locking nail, it is possible to lock the nail with three distal locking bolts. Another problem arises due to wide medullary canal of distal tibia which may result in varus angulation even after internal splinting by nailing. Polar screws may be used if such malalignment is encountered [15]. With regard to wound and skin infections; complications are very less compared to open plating or MIPPO. 5% of Wound complication rate was very less in our study which was similar to other studies who reported wound complication rate of 6.94%, and 4.84% in their studies of

nailing in distal tibia [16].

### Conclusion

Intramedullary nailing for the management of distal 1/3<sup>rd</sup> tibial shaft fractures appears to be a good modality for treatment in terms of good union rate, less wound complications and good functional outcome. Use of appropriate surgical procedure, concurrent fibula fixation, distal locking with 3 screws and appropriate post operative rehabilitation gives satisfactory results.

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