

ORIGINAL RESEARCH

REAMED INTRAMEDULLARY INTERLOCKING NAILS: A PREFERABLE OPTION FOR FIXING TIBIAL FRACTURES IN ADULTS

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ABSTRACT

Background: The frequently fractured long bone in the human anatomy is tibia and the mode of surgical procedure relays on evaluating the mode of injury, configuration of fracture and individual health and financial status. The use of non-operative treatment of tibial fractures is associated with a high prevalence of malunion, joint rigidity and deprived functional consequence. Tibial shaft fractures are recurrently treated by intramedullary interlocking nails. The necessity of opting reamed intramedullary nail is considered the gold standard implant for tibial fractures in closed and open (Gustilo) fractures.

Materials and Methods: The study consists of 52 patients with tibia shaft fracture treated with tibia interlocking nail. Clinical outcome and functional results were evaluated by Klemm and Borner criteria.

Results: In this study, we have operated a total 52 cases with tibia interlocking nail in tibial shaft fractures. The union rate in closed fracture was started earlier at 12.50 weeks in 80.76% (42) cases and it took 15.89 weeks in 13.46% in (7) cases and 19.50 weeks in 5.76% (3) cases for union in Type I and Type II fracture respectively. The study yielded about 92.30% (48 cases) of excellent result.

Conclusion: The present study shows that closed fractures of the tibia shaft treated with interlocking intramedullary tibia nailing involves minimal surgical trauma and negligible blood loss. It provides the advantages of early ambulation, lower rates of infection and non-union. A significant advantage of interlocking nail in addition to early joint mobilisation, is early weight bearing which allows earlier return to work. Hence the study concluded that closed interlocking intramedullary nail is the treatment of choice in closed tibia shaft fracture.

Keywords: Tibial fractures, Tibia, Interlocking Medullary, Klemm and Borner criteria.

INTRODUCTION

The incidence of tibial shaft fracture was 16.9/100,000/year. Males have the highest incidence of 21.5/100,000/year and present with the highest frequency between the age of 10 and 20, whereas women have a frequency of 12.3/100,000/year and have the highest frequency between the age of 30 and 40.^[1] The treatment option for tibial shaft fractures vary according to the type of fracture, bone density, age group, other co-morbid conditions, often bony and soft tissue injury and rate of complications.^[2] Several methods have been used for treatment of this fracture, including Closed reduction and cast immobilization which was previously been regarded as the typical treatment for skiing injuries. Early reports suggest that during the recent decades, the use of reamed intramedullary interlocking nails (IMLN) for correcting both open and closed fractures has become more popular due to decreased incidence of non-union, allowed shorter hospitalization time, and earlier weight bearing for the patient compared to other fixation methods.^[3-8]

MATERIALS & METHODS

The study was conducted at Narayana Medical College & Hospital, Nellore, AP, India. The cases which were selected had sustained fracture shaft of tibia. All the cases were included in study after getting an informed consent. This is a prospective analysis carried out from June 2020 to May 2022. The study consists of a total of 52 patients with shaft tibia fractures. Study was conducted after getting approval from the ethics committee. We followed Klemm Borner's criteria for evaluation of final results. Our present study was aimed to analyse the advantages, complications, period of union and range of knee and ankle joint movements after treating tibial shaft fractures with reamed interlocking intramedullary nailing in adults.

Inclusion criteria

1. Patient aged under 18 years and above.
2. All patients with shaft tibia fracture & treated with interlocking nail
3. Closed Fracture
4. Compound fractures type 1 and type 2, according to Gustilos - Andersons classification.

Exclusion criteria

1. Patients treated conservatively.
2. Intra articular fracture of tibia.
3. Patients under 16 years.
4. Compound fractures of Tibia, type 3A, Type 3B, Type 3C, according to Gustilos classification.
5. Pathological fracture.

RESULTS

A total of 52 patients with fracture shaft of tibia treated with closed intramedullary interlocking nailing in Narayana Medical College & Hospital and was studied from June 2020 to May 2022. The patients are followed up for at least 2-14 months. All these patients were available for follow up. Pre operatively following factors were observed and tabulated as follows.

Table No 1: Age and Gender Wise Frequency of Tibial Fractures

	Males		Females	
Mean weight	69.56±1.9		49.67±2.7	
Age group	No. of cases	Percentage	No. of cases	Percentage
20-30	24	44.23%	9	17.30%
30-40	7	13.46%	4	7.69%
41-50	6	11.53%	3	5.76%
51-60	4	7.69%	1	1.92%
>65	1	1.92%	1	1.92%
Total	42	80.76%	18	34.61%

In our study participants, the mean age was found to be 28.2±1.89 years in males and females. Males were predominant than females with 24 (44.23%), 9 (17.30%) cases respectively. The mean weight in male and female subjects was 69.56±1.9 and 49.67±2.7 respectively. [Table 1]

Table No 2: Distribution of fracture pattern

	Pattern of closed fracture	No. of cases	Percentage
Closed fracture	Transverse	12	23.07%
	Oblique	21	40.38%
	Comminuted	5	9.61%
	Spiral	3	5.76%
	Segmental	1	1.92%
Type 1		7	13.46%
Type 2		3	5.76%
Total		52	100%

In our study group 80.76% (42) cases were presented close fractures, 13.46% (7) cases and 5.76% (3) cases were shown type 1 and type 2 fractures respectively. Of the total 80.76% (42) cases of closed type of fractures predominantly 40.38% (21 cases) were oblique type followed by 23.07% (12 cases) of transverse, 9.61% (5 cases) with comminuted, 5.76% (3 cases) of spiral and 1.92% (1 case) of segmental type of fracture. [Table 2] Majority 68.33% (41 cases) were with static type of nail locking of which mostly 41.66% (25 cases) were inserted with 9mm, 18.33% (11 cases) were implanted with nails of 10mm diameter and the percentage of cases inserted with 8mm nail is 6.66% (4 cases). [Table 3]

Table No. 3: Nail size and locking type

	Nail locking			
Nail size	No. of Cases with static nail locking	Percentage	No. of Cases with dynamic nail locking	Percentage
8mm	4	6.66%	3	5.01%

9mm	25	41.66%	7	11.66%
10mm	11	18.33%	10	16.66%
Total	41	68.33%	20	33.33%

Partial weight bearing ability was delayed till 12 weeks in 75.01% (39) cases followed by, 14 weeks in 21.15% (11) cases and it took more than 14 weeks in 3.84% (2) cases irrespective of fracture configuration. The union rate in closed fracture was started earlier at 12.50 weeks in 80.76% (42) cases and it took 15.89 weeks in 13.46% in (7) cases and 19.50 weeks in 5.76% (3) cases for union in Type I and Type II fracture respectively. [Table 4]

Table No. 4: Patient Mobilization and union rate

Type of Fracture	Fracture union rate			Total	Full weight bearing (FWB)			Total
	Closed	Type I	Type II		12 weeks	14 weeks	>14 weeks	
Average Time	12.50 weeks	15.89 weeks	19.50 weeks		12 weeks	14 weeks	>14 weeks	
No. of Cases	42	7	3	52	39	11	2	52
Percentage	80.76%	13.46%	5.76%	100	75.01%	21.15%	3.84%	100

At final follow up 75.01% (39) cases were out of any complications and 25.01% of our study population shown complications of which predominantly 9.61% (5) cases were suffered with knee pain succeeded by 7.69% (4) cases were with superficial infections, 5.76% (3) cases were shown delayed union beyond 19 weeks and 1.92% (1) cases shown shortening of leg. [Table 5] All were of mild variety and occurred on kneeling down.

Table No 5: Predominance of Complications

Complications	No. of cases	Percentage
Without complications	39	75.01%
Malunion	0	0%
Superficial infection	4	7.69%
Deep infection	0	0%
Knee pain	5	9.61%
Implant failure	0	0%
Shortening	1	1.92%
Non union	0	0%
Delayed union	3	5.76%

Functional results were graded according to the criteria by Klemm and Borner (1986). 92.30% of patients achieved excellent results and 3.84% (2) cases were shown good results where as 1.92% (1) cases of each were shown fair and poor results accordingly [Table 6] and corresponding clinical photographs were also included. [Figure 1-9]

Table No 6: Functional Results

Functional results	No. of cases	Percentage
Excellent <ul style="list-style-type: none"> • Full knee and ankle motion • No muscle atrophy • Normal radiological alignment 	48	92.30%
Good <ul style="list-style-type: none"> • Slight loss of knee and ankle motion (<21°) • Less than 2 cm of muscle atrophy • Angular deformity 	2	3.84%
Fair <ul style="list-style-type: none"> • Moderate loss of knee & ankle motion (25°) • Morethan 2 cm of muscle atrophy • Angular deformity (5° - 10°) 	1	1.92%
Poor <ul style="list-style-type: none"> • Motion loss & knee and ankle motion (>25°) • Marked muscle atrophy • Angular deformity (>10°) 	1	1.92%



Figure 1: Ankle Plantar Flexion



Figure 2: Ankle Dorsi flexion



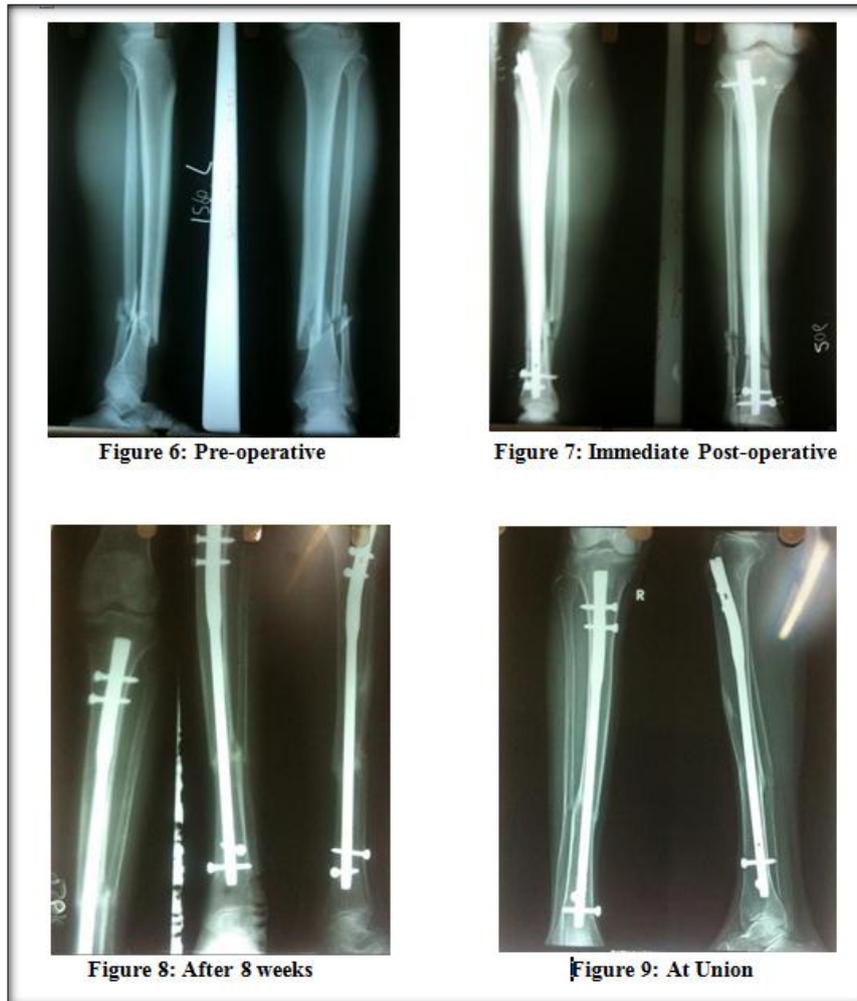
Figure 3: Knee Flexion



Figure 4: Knee Extension



Figure 5: Full Weight Bearing



DISCUSSION

Study conducted by Keating et al,^[9] showed duration of union was 29.5 weeks with rate of complications 4% of non-union, 4.5% malunion, 10% infection, 9% screw breakage and 57% of knee pain. In one other study lead by Court Brown et al,^[10] showed 22.7 weeks of union duration with complications of 14.7% non-union, 6.7% infection and 56.2% of cases with knee pain. Larsen et al,^[11] studies showed 9% of malunion and 4.5% of screw damage. Blachut et al,^[12] studies showed 18 weeks of union time with 2% of infection, 4% of non-union and malunion respectively. Whereas in a study conducted by Rahul Katta et al,^[13] the union duration was reports as 17 weeks with further complications of 9.3% of infections, 0.9% of non-union and 1.5% of malunion. In our present study results were more significant in comparison to earlier studies with 12.5 weeks of average duration time for union in closed fractures, 15.89 weeks in type 1 and 19.50 weeks in type 2 fractures and majority 75.01% of the cases are without any complications and showed FWB as early as 12-week duration. As per Klemm and Borner criteria 92.30% of our study subjects achieved excellent results.

Table 7: Comparison of results with earlier operative studies with tibia interlocking nail

Author	Year	Sample size	conclusion
Kadiri Venkata Ranganath et al, ^[14]	2016	30	Closed minimal and undisplaced fractures have united well. Displaced, comminuted fractures of tibial shaft with intact fibula are prone to delayed union and non-union. Intramedullary interlocking nailing minimizes the hospital stay and reduces the economic burden and enhances the early return to work.
Yograj Rathwa et al, ^[15]	2017	50	Tibial intramedullary interlocking nailing has advantages as it preserves periosteal blood supply, maintains length, rotation, alignment, lowers the infection and malunion. Closed internal fixation with intramedullary interlocking tibial nail is a standard surgical procedure for management of tibial diaphyseal fractures. The advantage of rapid rehabilitation and relatively few complications serve to recommend it for wider use.
Dr. Jainish Patel et al, ^[16]	2019	50	Closed fractures of the tibia shaft treated with interlocking intramedullary tibia nailing involve minimal surgical trauma and negligible blood loss. It provides the advantages of early ambulation, lower rates of infection and non-union. A significant advantage of interlocking nail in addition to early joint mobilization, is early weight bearing which allows earlier return to work. Hence the study concluded that closed interlocking intramedullary nail is the treatment of choice in closed tibia shaft fracture.
Mohamed Ashraf Ali et al, ^[17]	2021	30	The most common age group who presented was between 18-30 years and the average age was 36.7 years.36.67% had grade I injury, 40% had grade II injury, meanwhile, grade IIIA injuries constituted 20% and grade IIIB injuries constituted 3.33%. The average functional score was 33.33 which showed overall good result. The average RUST score was found to be 11.33 denoting union. Hence, we observed that intramedullary interlocking nailing is a good procedure in terms of functional and radiological outcome if done within 24 hours of

			injury.
Present study	2022	52	A significant advantage of interlocking nail in addition to early joint mobilisation, is early weight bearing which allows earlier return to work. Hence the study concluded that closed interlocking intramedullary nail is the treatment of choice in closed tibia shaft fracture.

CONCLUSION

The present study shows that closed tibial fractures treated with interlocking intramedullary tibia nailing involves minimal surgical trauma and negligible blood loss. It provides the advantages of early ambulation, lower rates of infection and non-union. A significant advantage of interlocking nail in addition to early joint mobilization, is early weight bearing which allows earlier return to work. Hence the study concluded that closed interlocking intramedullary nail is the treatment of choice in closed tibia shaft fracture.

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