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ORIGINAL RESEARCH

A prospective study of functional outcome of expert tibia nail in upper third tibial fractures

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Abstract

Background: This was a prospective study of functional outcome of expert tibia nail in upper third tibial fractures.

Material and methods: The present prospective clinical study was conducted for a period of 18 monthson 30 patients with proximal fractures of tibia admitted under the department of Orthopedics of VIMS, Ballari. All these patients were clinically and radiologicallyconfirmed with proximal third fractures of tibia, and were eligible for the study. Aftercarrying out necessary laboratory investigations and obtaining physical fitness forsurgery, the subjects were surgically managed with Expert tibial nailing fixation. Further, the patients were followed up post operatively and at 3, 6 and 12 months regularly until the union was achieved both clinically and radiologically. Results: Majority belonged to the age group of 31 to 40 years (40.0%). Majority were males (73.3%), and the most common mode of injury was road traffic accidents (83.3%). The most common type of fracture was closed fracture (70.0%), followed bytype I GA open fractures (23.3%). About 40.0% cases suffered associated injuries which include ipsilateral fibula fracture, head injury, rib fracture and opposite limb injury. Based on modified KLEMM and Borner scoring system, the functional outcomewas excellent in majority(66.7%). The mean duration for radiological union was 22.03 ±2.62 weeks. Skin infection and anterior knee pain were the commonest complications.The study found statistically significant relation only in terms of age, type of fracture, presence of associated injuries and complications, thereby suggesting that younger theage of the subjects, simple the fracture, absence of associated injuries and complications, better was the functional outcome in the study. Conclusion: The functional outcome of Expert tibial nailing technique was excellent in about two third of cases with extra articular upper 1/3rd proximal tibial fractures. The union time for the fracture treated by Expert tibial intramedullary nailing was around 5-6 months. Anterior knee pain and skin infection were the commonest complications of Expert tibial intramedullary nailing of tibial fractures.

Keywords: Expert tibial nailing, Extra articular upper1/3rdproximal tibial fractures, Uniontime, Complications.

Introduction

The most frequent fractures of long bones are those of the tibia and fibula shafts. More than 45 both bone leg fractures occur every year per one lakh people in the average population.[1] Adult both bone leg fractures are most common in young males between the ages of 19 and 39, and are frequently from high-energy trauma.[2,3]

Tibial fractures have a wide range of injury mechanisms and degrees of severity connected with them. Despite the fact that the majority of fractures are closed, the tibia's subcutaneous position makes open fractures of the bone more frequent than in many other bones.[4,5] Because a third of its surface is subcutaneous over the majority of its length, open fractures

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are more frequent. In addition, the blood supply to the tibia is less secure than it is for bones that are encased in dense muscles.[6]

The presence of hinge joints at the knee and ankle prevents any modification for post-fracture rotatory deformity. Particularly following open fractures of the tibia shaft, problems such as delayed union, non-union, and infections are rather common.[7] It has grown to be a significant source of temporary impairment and morbidity due to its prevalence, geography, and mechanism of damage. Having a stable and functional extremity is the main objective of treatment for tibia fracture. But because there are so many different types of tibia injuries, no one type of treatment is effective for all fractures.[8]

Due to industrialization and high velocity trauma, tibia shaft fractures are on the rise. Orthopedic surgeons have long been particularly interested in the treatment of tibial shaft fractures. In addition to being rather prevalent, they are frequently hard to treat.[9] Until recently, surgeons were forced to rely on operative treatment such as "V" nailing, plates and screws, and external fixators, all of which had their own disadvantages such as prolonged immobilization, infection, delayed union, non-union, and malunion, as well as patient burden.[10,11]

Some of these issues have been resolved by reaming an intramedullary interlocking nail for tibial shaft fractures, which facilitates early mobilization of the patient. Because the fracture hematoma is not disturbed, healing takes less time, and infection rates are lower.[12]

The Expert Tibial Nail was created as a result of numerous changes to screw and nail design. It allows the surgeon to broaden the range of fractures that can be treated using intramedullary nails. Spongious bone screws in the proximal metaphysis obtain optimal purchase in the cancellous bone. The alignment and stability of short proximal or distal tibial segments are guaranteed by multidirectional interlocking screws.[13-15] Between the nail and the proximal oblique screw, the end cap creates angular stability. These modifications to the implant's construction increase the construct's stability and lessen the possibility of secondary misalignment. Hence, this was a prospective study of functional outcome of expert tibia nail in upper third tibial fractures.

Material and methods

The present study was conducted at Vijayanagara Institute of Medical Sciences, Ballari with the aim of assessing the functional outcome of expert tibia nail in upper third tibial fractures. Adult patients with proximal fractures of tibia, admitted under the department of Orthopedics of study center during the proposed study periodPatients with clinically and radiologically confirmed proximal third fractures of tibia, and were eligible for the study according to the above-mentioned eligibility criteria were included in the study after informed consent from the patient.

After collecting required information, and carrying out necessary laboratory investigations and obtaining physical fitness for surgery, the subjects were surgical managed with Expert tibial nailing fixation.Patients were followed up post operatively and at 3, 6 and 12 months regularly until the union was achieved both clinically and radiologically.Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software.Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Fischer’s exact test was used as test of significance for qualitative data which does not fulfill the criteria for Chi-square test (2x2 tables only). Yates correction was applied where ever chi- square rules were not fulfilled (for 2x2 tables only).Normality of the continuous data, was tested by Kolmogorov–Smirnov test and the Shapiro–Wilk test. Continuous data was represented as mean and standard deviation.

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Results

Table1: Age distribution of the study subjects

		Frequency(N)	Percentage(%)
Age group	<30years	6	20.0%
	31to40years	12	40.0%
	41to50years	8	26.7%
	51to60years	4	13.3%

	Mean	SD	Median	Minimum	Maximum
Age(in years)	39.07	10.11	38.50	21.00	59.00

In the study, majority of the subjects belonged to the age group of 31 to 40 years(40.0%). The next common age group was 41 to 50 years (26.7%). The mean age of thesubjects was 39.07 ± 10.11 years.

Table2: Distribution of the study subjects based on gender

		Frequency(N)	Percentage(%)
Gender	**Male**	22	73.3%
	Female	8	26.7%

In the study, majority of the subjects were males (73.3%), and the remaining were females (26.7%).

Table 3: Duration between injury and surgery among the study subjects

	Mean	SD	Median	Minimum	Maximum
Duration till Surgery	5.33	2.17	4.00	3.00	10.00

In the study, the interval between the injury and the surgery was ranged between3 and 10 days. The mean duration was estimated to be 5.33 ± 2.17 days

Table 4: Distribution of the study subjects based on the functional outcome(KBS)

		Frequency(N)	Percentage(%)
Modified KLEMM and Borner Scoring System	**Excellent**	20	66.7%
	Good	6	20.0%
	Fair	3	10.0%
	Poor	1	3.3%

In the study, modified KLEMM and Borner scoring system was used to assess the functional outcome among the subjects. Accordingly, the result was excellent in majority of the subjects (66.7%). The next common outcome was good (20.0%), followed by fair results (10.0%). Only 1 individual showed poor outcome (5.0%).

Table 5: Duration for achieving radiological union among the study subjects

	Mean	SD	Median	Minimum	Maximum
Radiological Union	22.03	2.62	21.50	18.00	28.00

In the study, the duration for union of fracture which could be appreciated radiologically, was ranged between 18 and 28 weeks. The mean duration was estimatedto be 22.03 ± 2.62 weeks.

Table 6: Distribution of the study subjects based on the complications

		Frequency(N)	Percentage(%)
Complications	**Yes**	10	33.3%
	No	20	66.7%

In the study, the complications were absent in majority of the subjects (66.7%),and remaining

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10 individuals presented with one or more complications.

Table 7: Complications among study subjects

	Frequency(N)	Percentage(%)
Skin Infection	5	16.7%
Anterior Knee Pain	5	16.7%
Restricted ROM	2	6.7%
Delayed Union	1	3.3%

In the study, the complications were present in only 10 individuals. Among them, skin infection and anterior knee pain were evident in 5 cases each. Restricted range of movements was observed in 2 patients, while one individual showed delayed union. On analyzing the association between the characteristics of the subjects and the functional outcome, the study showed statistically significantrelation only in terms of age group, where the outcome was affected significantly in different age groups. Thus the outcome was excellent to goodin younger age group while fair to poor in elder age group. On the other hand, factors such as gender of the subjects, mode and laterality of injury,made no difference in affecting the outcome. On analyzing the association between the details of the injury and the functional outcome, the study showed statistically significant relationin all aspects, where the outcome was affected significantly with respect to type of fracture, presence of associated injuries and complications. Thus, on observing the poor outcome, it was evident more in cases with complex fractures, associated injuries and complications. On analyzing the association between the specific complications and the functional outcome, the study showed statistically significant relation in all aspects, where the outcome was affected significantly with respect to the presence of each complication such as skin infection, anterior knee pain, restricted range of movements, and delayed union. Thus, on observing the poor outcome, it was evident more in cases with each complication.

Discussion

The present prospective clinical study was conducted for a period of 18 months on 30 patients with proximal fractures of tibia admitted under the department of Orthopedics of VIMS, Ballari. All these patients were clinically and radiologically confirmed with proximal third fractures of tibia, and were eligible for the study. After carrying out necessary laboratory investigations and obtaining physical fitness for surgery, the subjects were surgically managed with Expert tibial nailing fixation. Further, the patients were followed up post operatively and at 3, 6 and 12 months regularly until the union was achieved both clinically and radiologically. In the present study, majority of the subjects belonged to the age group of 31 to 40 years (40.0%). The next common age group was 41 to 50 years (26.7%). Further, on comparison with the previous studies, it was observed that the proximal tibial fractures often seen in adult age group. This can be made clear with the mean age being compared with the previous literature as follows;

Studies	Meanage
Present Study	39.07years
Anil Pet al[16]	38.00years
Vallier et al[17]	38.40years
Seyhan et al[18]	40.32years
ZhuDCet al[19]	40.70years
Mohammad FA et al[20]	41.80years

Majority of the subjects in the present study were males (73.3%), and the remaining were females(26.7%). Thissort of male predominance was observed in mostof the previous studies

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which has been showed in the following table. This is mainly because of the fact that males are often exposed to harmful environment, which couldresult in fractures.

Studies	Male:Female
Present Study	73.3 : 26.7
Anil Pet al[16]	61.9 : 38.1
ZhuDC et al[19]	68.2 : 31.8
Li et al[21]	78.3 : 21.7
Sun Q etal[22]	80.8 : 19.2

In the present study, the most common mode of injury was road traffic accidents(83.3%), followed by injury due to fall from height (10.0%). This has been universal asroad traffic accident was the commonest cause in most of the previous studies such as Fu B et al23 (65.2%), Xu H et al24 (58.3%), Bleeker NJ et al25 (49.6%), and Courtney PM et al26 (43.0%). The most common type of fracture in the present study was closed fracture (70.0%), followed by type I GA open fractures (23.3%). Remaining 6.7% suffered typeII GA open fractures. This mimics the findings in the previous studies such as HansenM et al27, Trlica J et al28, Weninger P et al29 and Tijoriwala P et al30, where the closed fractures were more frequent, followed by Gustilo I fractures. About 40.0% of the subjects in the present study suffered associated injuries which include ipsilateral fibula fracture, head injury, rib fracture and opposite limb injury. Remaining 60.0% cases presented without any associated injuries. Even in previousstudiessuch as Emran AM et al31 , AttalR et al32 , Anil P et al33 and Mohammad FA et al34 , the commonest associated injury was observed to be ipsilateral fracture offibula. In the present study, the functional outcome was assessed by clinically examining the range of motion and other relevant actions among the subjects using modified KLEMM and Borner scoring system. Accordingly, the result was excellent inmajority of the subjects (66.7%). Further, on comparison with the previous studies, it was observed that the Expert tibial nailing fixation was effective in yielding excellent outcomes in greater proportions. This can be substantiated with the results being compared with the previous literature as follows;

Studies	Excellent outcome
Present Study	66.70%
Manikandan N et al[35]	60.00%
HashimS M etal[36]	60.00%
Haggag EM et al[37]	65.00%
Mohammad FA et al[34]	71.42%
Tijoriwala Pet al[30]	75.00%
Koichade MR et al[38]	76.00%

The duration for radiological union of the fracture in the present study, was ranged between 18 and 28 weeks. The mean duration was estimated to be 22.03 ± 2.62weeks. Even on comparison with the previous studies, it was observed that the proximaltibial fractures often unites in around 4-6 months. This can be justified by comparing the duration for radiological union with the previous literature as follows;

Studies	Meanage
PresentStudy	22.03±2.62weeks
Guoet al[39]	17.70±3.30weeks
RenC et al[40]	18.90±2.10weeks
Fenget al[41]	21.10±3.00weeks

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Li etal[42]	21.30±3.50weeks
YangL et al[43]	22.60±4.30weeks

In the present study, skin infection and anterior knee pain were the commonestcomplications which were evident in minor proportions, thereby suggesting that Experttibial nailing yields the outcome with least complications, and 100.0% union rate. Although the union rate was 100.0% in most of the previous studies such as Sun Q et al22, Yang L et al43, Xu H et al24, and Courtney PM et al26, these studies had found anterior knee pain as the most common complication. Few studies such as Marecek et al44 and Mitchell et al45 observed infection as the frequent complication. Overall, on analysis, the present study found statistically significant relation only in terms of age, type of fracture, presence of associated injuries and complications,thereby suggesting that younger the age of the subjects, simple the fracture, absence ofassociated injuries and complications, better was the functional outcome in the study.

Conclusion

The functional outcome of Expert tibial nailing technique was excellent in abouttwo third of cases with extra articular upper 1/3rd proximal tibial fractures. The union time for the fracture treated by Expert tibial intramedullary nailing wasaround 5-6 months

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