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Original Research Article

A Comparative Study of Intramedullary Nailing and Locking Compression Plate in Treatment of Proximal Tibia Extra Articular Fractures

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Abstract:

Background: Purpose of this study to compare these two treatment methods and assess the ability of each technique to obtain and maintain fracture reduction in proximal tibia extraarticular fractures.

Methods: The study was prospective, time bound, hospital based randomized comparative study. Patients was followed up for a period of 6 months to 1 year and evaluated clinically with Knee Score (Intsall modification) and range of motion and operation time and hospital stay time and union time the outcome was used for comparison. Patients were divided into two groups for undergoing surgery with Intramedullary Nailing (IMN) for one group and Locked Plating (LP) for the other group by randomization using the chit and box method.

Results: At final one year follow-up by Knee Society scoring system, 64 % had excellent results in Intramedullary Nailing (IMN) group and 43% patients had excellent results in Locked Plating (LP) group, 32% had good results in Intramedullary Nailing (IMN) group and 39% had good results in Locked Plating (LP) group, 4% had fair results in Intramedullary Nailing (IMN) group and 18% had fair results in PTP group.

Conclusion: Our comparison of intramedullary nail and proximal tibia platting for the treatment of extraarticular proximal tibia fractures showed advantage of intramedullary nailing and provides a newer alternative for a proximal tibia platting with the benefits of minimal invasive, shorter operative time, lesser hospital stay, early return to activities, and a higher percentage to near pre injury functional status, though through the ages proximal tibia platting provide an acceptable treatment option by MIPPO technique but better results can be achieved by high bend multiple locking intramedullary nailing which cause less complication like infection, soft tissue strapping nonunion stiffness decrease range of motion rehabilitation to routine life style, As we felt in our study period. In earlier period of our study alignment of fracture fragment is better in proximal tibia platting group but as a follow up of one year we conclude that both forms of treatment provide adequate fracture stability and union.

Keyword: Knee joint, Intramedullary nailing, MIPPO.

Introduction

The knee joint is one of the three major weight bearing joint in the lower limb. Fractures that involve proximal tibia affect knee function and stability. This fracture can either be intraarticular or extraarticular. [1]

Tibial shaft fractures are commonest long bone fractures. Extraarticular fractures of proximal tibia occur only in 5% to 11% of all tibial shaft fractures. As they are often the consequence of high energy transfer, a highly unstable situation with bone fragmentation and extensive soil tissue damage may result [2]. Most of these patients are managed operatively due to increased incidence of malunion and nonunion in conservatively managed patients[3] Treatment of these injuries is challenging and is associated with higher rate of complications than diaphyseal tibia fractures. [3]

In most instances, intramedullary nailing has become the method of choice for the fixation of diaphyseal tibial fractures and has been extended to the treatment of proximal fractures [4]. Minimally invasive plate osteosynthesis techniques have recently been applied to fractures of proximal and distal tibia and have been used in conjunction with newer designs of locked plating. Recently, the use of locked plate fixation utilizing minimally invasive techniques has been put forward as one way maintaining alignment in proximal tibia fractures. [1]

There is no head to head comparative study between proximal tibia platting and intramedullary nailing option for proximal tibia fractures. Due to lack of conclusive evidence to guide the selection of treatment option in such cases.

So, the purpose of this study to compare these two treatment methods and assess the ability of each technique to obtain and maintain fracture reduction in proximal tibia extraarticular fractures.

We are intended to compare these options in terms of operating time duration of hospital stay, period of non-weight bearing degree of reduction union rate malunion rate infection rate and other possible complication.

Materials and Methods

Study Design: The study was prospective, time bound, hospital based randomized comparative study.

Inclusion Criteria:

- Patients with proximal tibial fractures defined as a region extending from the knee joint distally 1.5 times the medial to lateral joint width.
- Skeletally mature and age groups more than 18 years.
- Consent to participate in the study
- Closed fractures

Exclusion Criteria:

- Paediatric age group
- Pathological fracture or Refracture.
- Patient with injury to blood vessels
- Patient having open fracture proximal tibia
- Patient having any medical contraindication to study
- Refuse to participate in the study

Patients were followed up for a period of 6 months to 1 year and evaluated clinically with Knee Score (Intsall modification) and range of motion and operation time and hospital stay time and union time the outcome was used for comparison. Patients were divided into two groups for undergoing surgery with Intramedullary Nailing (IMN) for one group and Locked Plating (LP) for the other group by randomization using the chit and box method.

Statistical Analysis: Data collected were entered into MS Excel spread sheet were summarized in form of tables and graphs. Statistical analysis of results was carried out by using epi info version 7.2.1.0. The difference between the two groups concerning nominal or categorical variables were summarized as frequency and percentage and were analysed by using chi square test for independent groups. Quantitative variables were summarized as mean and standard deviation and were analysed using unpaired t test, level of significance in each case was found by Levine's test for equity of variances and p value <0.05 was considered as significance difference between the two groups.

Observation and Results

Table 1: Age wise distribution

Variable	PTP Group	IMN Group	p-value
Age	41.14 ± 13.68	40.46 ± 13	0.910

Mean age of the 28 patients who underwent fixation proximal tibia platting was 41.14 years and, mean age of 28 patients who underwent fixation intramedullary nailing (IMN) was 40.46 years. The number of cases in age group 20-29 yrs were 7 in group I (PTP) and 7 in group II (IMN GROUP), age group 30-39 yrs were 8 in group I (PTP GROUP) and 8 in group II (IMN GROUP), age group 40-49 yrs were 5 in group I (PTP GROUP) and 7 in group II (IMN GROUP), age group 50-59 were 4 each in group I and group II and age group 60+ yrs was 4 in group I and 2 in group II.

Table 2: Distribution of study subjects according to type of fracture

Type of fracture	PTP Group		IMN Group		Total	
	N	%	N	%	N	%
41A2	17	60.7	22	78.6	39	69.6
41A3	11	39.3	6	21.4	17	30.4
Total	28	100	28	100	56	100

Chi-square =1.351 with 1 degree of freedom; p =0.245(NS)

In groups I, 17 out of 28 were AO classification type 41 A2 fracture and 11 were type 41 A3. In group II, 22 out of 28 were AO classification type 41 A2 fracture and 6 were type 41 A3.

The p value was 0.245 and there was no significant difference in the type of fracture between both the group.

Table 3: Comparison of mean duration of surgery (min) among study groups

Group	N	Mean	Std. Deviation
PTP Group	28	86.79	6.29
IMN Group	28	76.07	12.86

t-test - t = 3.962 with 54 degrees of freedom; P <0.001 (S)

The mean duration of surgery in group I was 86.79 minutes with Std Deviation 6.29 minutes and in group II was 76.07 minutes with Std. deviation 12.86 minutes with p value is < 0.001 which is significant.

Table 4: Comparison of mean duration of hospital stay (days) among study groups

Group	N	Mean	Std. Deviation
PTP	28	13.21	3.19
IMN	28	9.57	1.64

t-test - t = 5.373 with 54 degrees of freedom; P <0.001 (S)

The mean hospital stay in group I was 13.21 days and group II was 9.57 days. The difference was statistically significant with a p value of <0.001.

Table 5: Comparison of mean union time (weeks) among study groups

Group	N	Mean	Std. Deviation
PTP Group	28	25.68	3.94
IMN Group	28	19.86	2.55

t-test - t = 6.57 with 54 degrees of freedom; P <0.001 (S)

The mean Time of union in group I was 25.68 weeks and groups II was 19.86 weeks. The difference was statistically significant with a p value of < 0.001.

Table 6: Frequency of complications among study groups

Complication	PTP Group		IMN Group		P value
	N	%	N	%	
Infection	3	10.7	2	7.1	1.000
Delayed union	5	17.9	1	3.6	0.195
Non union	0	0.0	1	3.6	1.000

- Early complications in the form of superficial in infection was seen in 2 patients in Intramedullary Nailing (IMN) group and 3 patients in Locked Plating (LP) group.
- There was 1 case of delayed union in Intramedullary nailing group (IMN) 5 case of delayed union in proximal tibia platting (ptp). These patients underwent bone grafting following which there were union noted.
- There was 1 case of nonunion in intramedullary nailing group noted that patient was underwent in exchange nail and bone marrow aspirate insertion then union is noted.

Table 7: Comparison of Follow Up Knee Score (Install Modification)

Follow up time	PTP Group	IMN Group	P value
2 weeks	36.89 ± 6.22	40.64 ± 3.57	0.008 (S)
6 weeks	45.93 ± 6.7	50.86 ± 6.17	0.006 (S)
10 weeks	55 ± 7.17	59.75 ± 5.30	0.007 (S)
12 weeks	63.64 ± 7.74	68.93 ± 4.97	0.004 (S)
6 months	71.11 ± 8.57	76.29 ± 4.98	0.008 (S)
1 year	75.86 ± 15.94	83.25 ± 5.43	

There was significant difference between the two groups in KSS at 2 weeks, 6 weeks, 10 weeks, 12 weeks, the KSS at 6 months were much better for group 2 than group 1, the difference was statistically significant with the p-value of 0. At the end of 12 months the difference of KSS between the 2 groups became significant with a p-value of 0.024.

Table 8: Distribution of study subjects according to final results (Knee society score)

Final results	PTP Group		IMN Group		Total	
	N	%	N	%	N	%
Excellent	12	42.9	18	64.3	30	53.6
Good	11	39.3	9	32.1	20	35.7
Fair	5	17.9	1	3.6	6	10.7
Total	28	100	28	100	56	100

Chi-square = 4.067 with 2 degrees of freedom; P = 0.131 (NS)

At final one year follow-up by Modified Knee scoring system, 64.3% had excellent results in Intramedullary Nailing (IMN) group and 42.9% patients had excellent results in proximal tibia Plating (PTP) group, 32.1% had good results in Intramedullary Nailing (IMN) group and 39.3% had good results in Locked Plating (LP) group, 3.6% had fair results in Intramedullary Nailing (IMN) group and 17.9% had fair results in Locked Plating (LP) group.

Discussion

The incidence of proximal tibia fractures has not only increased with increase in RTA but also the complexity of fracture has changed due to high velocity direct impact causing more of commination at fracture site.

Treatment modalities have been continuously changing in quest of better results.

Hence orthopedic surgeons have to encounter the challenges posed in the treatment of complex proximal tibia fracture more frequent to the coming days.

The mean duration of hospital stay in Intramedullary Nailing (IMN) group was 10 days and the mean duration of hospital stay in proximal tibia Plating (PTP) group was 14 days. The difference in the duration of hospital stay in both groups, was significant, the mean stays lesser in Intramedullary Nailing (IMN) than proximal tibia Plating (PTP) group. So intramedullary nailing gives better results in term of hospital stay.

In this series we studied 56 fractures out of which, 69.6% of the fractures fall into type 41 A2, and 30.4 % in type-41 A3 of AO classification of proximal tibia extra articular fractures.

Our Study			**Lindvall et al [2]**		
Type	**No. of Patients**	**% of patients**	**Type**	**No of Patients**	**% of patients**
41A2	39	69.6	41A2	9	16.07
41A3	17	30.4	41A3	47	83.09

In our series we operated 19 (68%) patients in proximal tibia plating in plating group (PTP) with minimally invasive percutaneous plate osteosynthesis (MIPPO) using lateral locking compression plate for reduction and fixation in proximal tibia. In which both duration of procedure and soft tissue injuries are less compare in ORIF technique, wound healing also better and faster compare to ORIF technique. By MIPPO technique, there we less of tissue dissection and decreased postoperative pain which helped as to mobilize the knee joint earlier and avoid knee joint stiffness, which were noted in patients with ORIF technique. And 28 patients of intramedullary nailing with closed reduction and internal fixation gives better results than both minimally invasive percutaneous plate osteosynthesis (MIPPO) and ORIF technique of platting in term of duration of procedure, wound healing rehabilitation.

In our study, the mean time for union was 19. 86 weeks for Intramedullary Nailing (IMN) group and 25.68 weeks for proximal tibia plating group (PTP). The difference between time to union in our study was significant with a p value of <0.001. The mean union time was comparable to other studies like Ricci et al [5] had a mean union time of 16 weeks.

Peter A cole et al [5] treated proximal tibial fractures and achieved a mean union time of 16.8 weeks.

Rc Meena et al [6] treated proximal tibia fracture treated with mean union time in imn group 18.26 weeks and PTP group 22.84 week.

Union rates after the initial fixation analyzed in our study, the IMN group was 96% and the proximal tibia platting was 100%, which are compared with other series i.e. Lindvall et al [2] with union rates in IMN group 77% and LP group was 94%.

In another studies. George [7] et al using IIIizarov circular fixation achieved union rates of 100%.

The mean KSS at 2 weeks was 40.64 for Intramedullary Nailing (IMN) group and 36.89 for Locked Plating (PTP) group, the difference is noted.

The mean KSS at 6 weeks 50.86 for IMN group and 45.93 for PTP group and the difference is noted

At 10 weeks KSS for IMN group is 59.75 and PTP group was 55

The mean KSS at 12 weeks was 93.55 for Intramedullary Nailing (IMN) group and 63.64 for Locked Plating (LP) group, significant difference between the score at 12 weeks was noted.

Similarly, even at 6 months the scores of intramedullary nailing group fared better than proximal tibia platting group with statistical significance scoring of 76.29 and 71.11 respectively.

At the end of 1 year follow up, the scores were 83.25 for Intramedullary Nailing (IMN) group and & 75.86 in proximal tibia platting (LP) group, and there was significant difference at the final follow up.

An average of 121º knee joint range of motion in both the groups was achieved. Both Cole et al [6]

and Egol et al [8] reported similar range of movement results (range 0 to 122º and 0 to 109º respectively).

At final one year follow-up by Knee Society scoring system, 64.3% had excellent results in Intramedullary Nailing (IMN) group and 42.9% patients had excellent results in proximal tibia plating (PTP) group, 32.1% had good results in Intramedullary Nailing (IMN) group and 39.3% had good results in proximal tibia Plating (PTP) group. 3.6 % had fair results in Intramedullary Nailing (IMN) group and 17.9% had fair results in proximal tibia Plating (LP) group.

As the comparison of our study which with Ricci et al [5], the average LEM score was 88 (range 55-100, SD 11). Among the remaining patients, 5 had scores between 80 and 90, 3 between 90 and 95, and 6 greater than 95.

In our series, we also noted that in that in the intramedullary nailing, patients showed better functional outcome and results compared to patients managed with ORIF, and MIPPO technique of proximal tibia platting this difference is due to duration of procedure and soft tissue injuries are less compare to plating techniques, wound healing also better and faster compare to plating technique.

In our series, superficial infection was noted in 3 patients in proximal tibia platting group and in 2 patients in intramedullary nailing group.

The 2 patients in Intramedullary nailing group were treated with IV antibiotics (Ceftriaxone and Amikacin) and infection was controlled. 2 patients in proximal tibia platting also treated with IV antibiotics and infection was controlled.

The 1 patient out of 3 in proximal tibia platting (PTP) group underwent debridement later in postoperative period and received IV antibiotics (Ceftriaxone and Amikacin). Infection was controlled and later patients developed stiff knee. It was also noted that these patients were treated by ORIF and buttress plating which might be the one of the causes infections in the postoperative because more soft tissue handing and injury.

The infection rate in our series was 10.7% in PTP group and 7.1 % in IMN group. These findings are comparable with the studies conducted by Egol et al [who] reported infection, Standard et al [31] reported 5.9% rate of infection and Cole et al [28] with 4% rate of infection.

In following studies, Bhandari et al [8] lindvall et al [2] R C Meena et al [6] viewed both plating and IMN of proximal tibial fractures and concluded that infection rates range from 0 to 8% in nailing patients and 0 to 14 % in plating patients but in the study lindvall et al noted significantly higher infection rate the most probable reason for this is the higher proportion (42.8%) of patient with open fracture in their study. in systemic review by Bhandari et al [8] the in which infection rate were 2.5% in the nailing group and 14% in the plating group. And in study of RC Meena et al [6] infection rate were 5.3 % in intramedullary nailing group and 8% in PTP group. In our study infection rate were 10.7% in PTP group and 7.1% in IMN group. Which favours less infection in IMN group in comparison to PTP group.

Conclusion

Our comparison of intramedullary nail and proximal tibia platting for the treatment of extraarticular proximal tibia fractures showed advantage of intramedullary nailing and provides a newer alternative for a proximal tibia platting with the benefits of minimal invasive, shorter operative time, lesser hospital stay, early return to activities, and a higher percentage to near pre injury functional status, though through the ages proximal tibia platting provide an acceptable treatment option by MIPPO technique but better results can be achieved by high bend multiple locking intramedullary nailing which cause less complication like infection, soft tissue strapping nonunion stiffness decrease range of motion rehabilitation to routine life style, As we felt in our study period. In earlier period of our study alignment of fracture fragment is better in proximal tibia platting group but as a follow up of one year we conclude that both forms of treatment provide adequate fracture stability and union. But with the advantages in intramedullary nailing, it becomes better option for proximal tibia extra articular fractures as a good intramedullary fixation and due to reaming endogenous bone grafting also occurs simultaneously. And patient goes far nearly to his routine activity with better rehabilitation. So, with the advance options intramedullary nailing is better option for proximal tibia extra articular fractures.

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