



COMPARISON OF INTRAMEDULLARY NAILING AND LOCKED PLATING IN THE TREATMENT OF EXTRAARTICULAR PROXIMAL TIBIAL FRACTURE –A RANDOMISED CONTROLLED STUDY.

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ABSTRACT

Background :High-energy injuries frequently result in non-articular proximal third tibial fractures. Plating has become the primary approach of treatment due to the deforming stresses caused by the extensor mechanism around the knee, as well as considerable comminution. Intramedullary nails (IMNs) have become increasingly popular for treating this fracture due to recent design modifications and supplementary fixing procedures. In this study, we assessed two treatment modalities IMN and LP for treatment of extra articular proximal tibial shaft fractures. **Material And Methods:** In this study a total of 30 patients were included. The patients were randomised in to two groups, one who underwent IMN(15 patients) and the second group who underwent plating(15 patients).The primary variables which influenced the outcome of the procedures in both the treatments were the time to union, weight bearing, duration of the stay and post operative complications. **Results:** Of the studied variables the difference between the two groups was statistically significant with the duration stay. The patients in IMN group and LP group fared equally with respect to knee society score at 3 weeks and 3 months but a significantly improved results were seen in IMN group at 6 months , and at the end of 1 year. There was statistically significant difference in weight bearing. Time to union in IMN group was 19.33weeks and in LP group was 17.87 weeks which was not significant statistically. **Conclusion:** In IMN and LP groups the return of the patients to their pre- injury functional levels were comparable. Both the technique were equally effective and choice of methods depends on fracture pattern, intraoperative fracture reduction difficulties and surgeon experience.

KEYWORDS : Intramedullary nailing, locking plate (LP)

Introduction:

One of the three major weight-bearing joints in the lower extremities is the knee joint. Fractures of the proximal tibia have an impact on knee function and stability. Intraarticular or extraarticular fractures are both possible.¹

Extraarticular proximal tibia fractures account for only 5% to 11% of all tibial shaft fractures. A highly unstable scenario with bone fragmentation and significant soft tissue damage may develop, as is commonly the case when substantial energy transfer occurs. ² These injuries are difficult to treat and are associated with a higher rate of morbidity than diaphyseal tibia fractures.³

Correction and maintenance of sagittal and coronal alignment, restoration of length and rotation, and early functional knee and ankle range of motion are all goals of surgical care. Medullary implants, half pin external fixation hybrid or thin wire external fixations, plate fixations, or a mix of procedures are all alternatives for treatment.

Intramedullary nails (IMNs) have become increasingly popular for treating this fracture due to recent design modifications and supplementary fixing procedures. Similarly, the introduction of percutaneous locked plating (PLP) has allowed surgeons to repair these difficult fractures without major incisions or the risk of soft tissue stripping, which can lead to infection and nonunion.⁴

Intramedullary nailing has become the procedure of choice for the fixing of diaphyseal tibial fractures in the majority of cases, and it has also been expanded to the treatment of proximal fractures. According to reports Intramedullary nailing of proximal metaphyseal fractures has been linked to a significant rate of malalignment and loss of fixation.⁴

Minimally invasive plate osteosynthesis techniques have lately been employed in conjunction with novel designs of locked plating to treat proximal and distal tibia fractures. The use of locked plate fixation with a minimally invasive approach has recently been proposed as a one-way alignment maintainer in proximal tibia fractures.¹

The goal of the study was to evaluate these two treatment procedures and assess each technique's capacity to achieve and maintain fracture reduction, as well as to identify union rates, malunion rates, infection rates, the necessity for implant removal, and any potential consequences.

Materials And Methods:

All adults between 18- 60 years of age with metaphyseal fracture of

proximal tibia admitted at KIMS hospital, Hubli - meeting the inclusion and the exclusion criteria (as given below) during the study period from November 2019to May 2021.

Inclusion Criteria:

1. 18 and above age
2. Metaphyseal fractures (Defined as region extending from the knee joint distally 1.5 times the medial to lateral joint width⁴)
3. Simple fractures (Closed fractures)
4. Consent to participate in the study.

Exclusion Criteria:

1. Diaphyseal fractures
2. Compound fractures
3. Pathological fractures
4. Intraarticular extension
5. Refusal to provide informed consent.

Operative Procedure:

Surgical Procedure For Tibia IMIL Nailing:

For proximal fractures, the starting point was identified to be in line with the lateral tibial spine, thus slightly more lateral than for standard nailing. In the sagittal plane, the starting point was as far proximal in the tibia as possible while remaining extraarticular and the guide wire was inserted taking care to avoid posterior angulation, thus running along the anterior cortex as best as possible while staying intramedullary. This served to prevent flexion deformity. Temporary blocking screws and reduction clamp were used to achieve reduction and removed after fracture fixation. The intramedullary nail used had a proximal Herzog bend and four multilevel, multiplanar, and multidirectional screws (expert tibial nail).

Surgical Technique For Locking Compression Plating:

Patient placed in supine and under Spinal anaesthesia, and Pneumatic tourniquet was applied after exsanguinations and time noted. Patient was scrubbed draped and painted with betadine Through anterolateral approach, extraarticular fractures were exposed and reduced anatomically, by Open reduction and MIPPO technique. After achieving reduction, appropriate sized plate was taken and fracture was stabilized using cortical and locking screws. Cortical screws were put before putting locking screws. The average time taken for surgery in case of MIPPO technique was 50 minutes (range, 40-60 minutes) and 75 minutes (range, 60-90 minutes) in case of open reduction and internal fixation. The major intra-operative problems encountered were in case of comminuted fractures that were tried to reduce by MIPPO technique and later converted to open reduction after

unsuccessful attempts .Tourniquet was released and haemostasis secured.Wound closed leaving suction drain insitu.

Results :

In our study,15patients underwent IMN in group 1, and out of 15 patients in group 2, 4 (26.7%) patients underwent minimally invasive percutaneous plate osteosynthesis (MIPPO) and remaining underwent open reduction and locking compression plate. The mean age group of patient who underwent IMN was 38.13 years and who underwent LP was 38.73 years. In group1 ,13 patients were male and 2 patients were female. In group 2 ,14 patients were male and 1 female patient. The demographic data in both the groups were comparable.

The mode of injury in group1 included RTA in 12 patients and fall from height in 2 patients. The mode of injury in group 2 included RTA in 13 patients and fall in 2 patients. The duration of hospital stay in group 1 was 66.7% for 5-10days, 20% for 10-15 days ,13.3% for >15 days, whereas in group 2 13.3% for 5-10days, 53.3% for 10-15 days,33.3% for >15 days. In group 1- 12 patients had immediate weight bearing and 3 patients had delayed weight bearing. In group 2 --6 patients had immediate weight bearing and 9 patients had delayed weight bearing. There was significant difference between both the groups in terms of weight bearing. In Group 1, mean time of union was 19.33 weeks and in group2 was 17.87 weeks. Mean KSS at 3weeks in group 1 and group 2 was 58.2 and 59.07 respectively. There was no significant difference in KSS between both the groups at 3 weeks. Mean KSS at 3months in group 1 and group 2 was 66.13and 65 respectively. There was no significant difference in KSS between both the groups at 3months. Mean KSS at 6months in group 1 and group 2 was 72.40 and 69.47 respectively. Mean KSS at 1 year in group 1 and group 2 was 79.73 and 74.53 respectively. There was significant difference in KSS between both the groups at 6 months and 1 year with p value of 0.041 and 0.038 respectively . At final 1 yr. follow up by modified knee scoring system , In group 1 ,10 patients had excellent results,3 patients had good results, 1 patients had fair outcome and 1 patient had poor results. In group 2, 4 patients had excellent results,6 patients had good results, 4 patient had fair results and one patient had poor outcome. There was no statistical significant difference between the two groups in terms of clinical results. In group 1 i.e. IMN group 6.7% of subjects had superficial infection, 20% had malalignment and 13.3 % subjects had Nonunion, whereas in Plating group 13.3% of subject had superficial infection ,6.7% had malalignment ,20% of them had wound dehiscence and 6.7% had nonunion. Among the patients who underwent intramedullary nailing 2 patients had broken bolt. There was no complication related to the implant in the other group.

DISCUSSION :

The average age of patients in our series is lower to those reported in Western literature viz. 42 years⁴ 45 years⁵ and 53 years⁶ But one western study⁷ reported an age group of 38 years which correlated with our study . In our series majority of the patients were males i.e. (Group1-86% Group2-93%), which can be attributed to our Indian setup where the female population largely work indoor and do not travel much. In our study the commonest mode of injury was Road traffic accident i.e(Group 1-80%, Group2-86%) the other being fall (Group 1-20%, Group2-13%) ,which correlated with a western study⁷

The difference in the duration of hospital stay in both groups was significant, the mean stay was lesser in Intramedullary Nailing (IMN) than Locked plating (LP) group. As due to post operative complications seen in plating group such as wound dehiscence infection.

In our study mobilization was started after 3 days when pain subsided. Partial and Full weight bearing allowed earlier in IMN groups than locked plating . Nail implants have load sharing property which allows early mobilization compared to load bearing extramedullary implants. In our study there was significant difference of immediate and delayed weight bearing between the two groups. In our study mean time of union for group 1 was 19.3weeks and 17.8 for group 2 .There was no significant in time of union between the two groups in our study. The mean union time was compared to other studies like Patel et al⁸ which noted time of union to be 20 and 17weeks in group 1 and group 2 respectively .

In our series we operated 4(26.7%) patients in Locked plating group(LP) 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 to ORIF technique, wound healing also better and faster compare to ORIF technique . By MIPPO⁹ technique we noted that there was less of tissue dissection and decreased postoperative pain which helped us to mobilize the knee joint earlier and avoid knee joint stiffness, which were noted in patients with ORIF technique. In our study patients operated by MIPPO technique were less due to difficult fracture reduction intraoperatively.

At final one year follow-up by Knee Society scoring system. 66% had excellent results in IMN group and 26% patients had excellent results in Locked Plating (LP) group, 20% had good results in intramedullary Nailing (IMN) group and 40% had good results in Locked Plating (LP) group, 6% had fair results in Intramedullary Nailing (IMN) group and 26.7% had fair results in Locked Plating (LP) group and 6.7% had poor results in intramedullary Nailing (IMN) group and 6% had poor results in Locked Plating (LP) group. In our series, we also noted that in the Locked Plating (LP) group, patients with MIPPO technique showed better functional outcome and results compared to patients managed with ORIF, these difference is due duration of procedure and soft tissue injuries are less compare to ORIF technique, wound healing also better and faster compared to ORIF technique. In a study conducted by, Ha SH and Kim DH examined MIPPO technique for treating extraarticular proximal tibia fractures produced great outcomes. In our study we noticed Plating had higher chances of skin infection and superficial necrosis which could be due to extensive dissection needed in plating, 101 prolonged intraoperative duration and then type of fracture, i.e., plating being used in high velocity injury. Similar study¹⁰ done by Sharma AK et al noted that, 2 patients in Plating group developed deep infection. They were treated with debridement and IV antibiotics and infection was controlled. One patient had late postoperative infection i.e., at the end of 12 months and was treated with implant removal. In nail group, one patient developed superficial infection which was managed with I.V. antibiotics for 3 weeks with alternate day dressings. The results found in our study were comparable with the above study. In our study we noted malalignment rate was higher in group 1 i.e. 20% as compared with group 2 which is 6.7%. Malreductions of >50 in proximal tibia fracture is well documented. Apex anterior and valgus malalignment¹¹ of proximal fragment are most common deformities. Anterior translation of proximal fragment was seen in 2 patients in IMN group .Factors that may contribute to sagittal plane deformity include the pull of patellar tendon, the pull of anterior compartment muscles¹¹, lack of a posterior cortex¹¹, the wedge effect of bent nail in the distal fragment¹² a medial starting point in the area of narrow anteroposterior diameter of the proximal tibia¹⁵,and a distal starting point of nail insertion¹³. In our study ,there were 2 cases of non union in Intramedullary nailing group(IMN). These patients underwent bone grafting following which , union was achieved .There was single case of nonunion noted in Locked Plating (LP) group. These results were comparable with study of Lindvall et al² and Ricci et al¹⁴. Implant related complications like Broken bolts were noted in 1 case in Intramedullary nailing (IMN) group due to early weight bearing by patients. The bolts were removed following the union of fracture. It was seen in 6% of patients which can be compared to Lindvall et al² of 4%. Cole et al reported a 5% incidence of hardware removal, whereas Boldin et al noted an 8% incidence.

SUMMARY AND CONCLUSION:

Our comparison of Intramedullary Nail and Locking compression Plate for the treatment of extra-articular proximal tibial fractures showed that IMN had advantages in terms of less invasive, shorter operative time, lesser hospital stay, early return to activities and a higher percentage of near preinjury functional status. However, following disadvantages were noted in IMN groups such as Malalignment, nonunion and difficulty in reduction of fracture intraoperatively. We also noted that nonunion and malalignment rate can be reduced by using newer technique such as Poller blocking screws.

Though, through the ages, Intramedullary Nail has provided an acceptable treatment option in extra articular proximal tibia fractures, better results can be achieved using a Locking compression plate which causes lesser complications like malalignments and non union.

In our study we noted that patents in LP group, patients with MIPPO technique showed better functional outcome and results compared to patients managed with ORIF, these difference is due to duration of procedure and soft tissue injury are less compared to ORIF technique, wound healing also better and faster compared to ORIF technique .We noted that complications such as infection ,wound dehiscence ,plate

exposure were seen in LP groups With the experience in our study, both the groups showed similar clinical results in the earlier part of the study. However by the end of the first year clinical results were significantly better with Intramedullary nailing. It is concluded that both the technique were equally effective and choice of methods for Extra-articular proximal tibia fractures fixation depends on fracture pattern , intraoperative fracture reduction difficulties and the surgeon experience.

CONFLICT OF INTEREST : Authors show no conflict of interest LIST OF TABLES:

1. Table showing mean age group:

Variable	Group	Min	Max	Mean	SD	Median	IQR	P-value
Age	Nailing	25	65	38.13	12.78	34.00	18	0.65
Age	Plating	26	64	38.73	10.47	37.00	15	0.65

2. Table showing weight bearing:

Weight bearing	Nailing		Plating	
	Count	%	Count	%
Immediate	12	80.0%	6	40.0%
Delayed	3	20.0%	9	60.0%
Total	15	100.0%	15	100.0%
P=0.06				

3. Table showing time of union:

Variable	Group	Min	Max	Mean	SD	Median	IQR	P-value
Time of union weeks	Nailing	12	24	19.33	3.83	20.00	8	0.23
Time of union weeks	Plating	14	24	17.87	2.75	18.00	3	0.23

4. Table showing postoperative complications:

Post op complications	Nailing		Plating	
	Count	%	Count	%
Infection	1	6.7%	2	13.3%
Malalignment	3	20.0%	1	6.7%
Wound dehiscence / Plate exposed	0	0.0%	3	20.0%
Nonunion	2	13.3%	1	6.7%
NIL	9	60.0%	8	53.3%
Total	15	100.0%	15	100.0%
P=0.38				

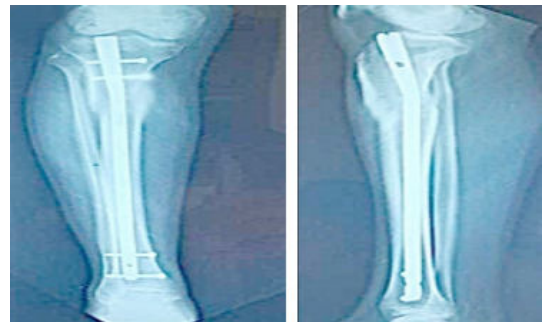
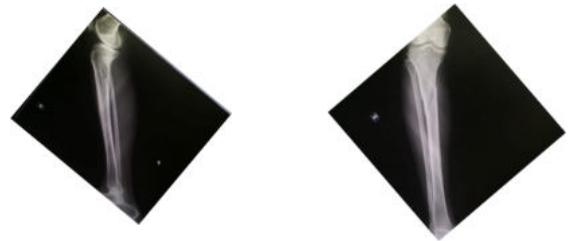
5. Table showing KSS :

Variables	Group	Min	Max	Mean	SD	Median	IQR
KSS 3W	Nailing	42	64	58.20	6.35	60.00	6
KSS 3W	Plating	40	68	59.07	7.41	62.00	6
KSS 3M	Nailing	50	78	66.13	6.99	68.00	8
KSS 3M	Plating	48	74	65.00	7.04	68.00	10
KSS 6M	Nailing	58	78	72.40	6.68	74.00	10
KSS 6M	Plating	58	84	69.47	7.39	68.00	10
KSS 1Y	Nailing	60	90	79.73	8.38	82.00	6
KSS 1Y	Plating	60	90	74.53	8.26	74.00	14

Case:1



PRE OP X-RAY Case:2



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