A comparative study of distal tibia fracture treated with locking compression plate (LCP) versus expert tibia nail (ETN) - A prospective study

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Abstract

**Objective**: Distal tibia fractures can present a management challenge due to their instability, subcutaneous location and precarious blood supply. This study is conducted between two method, distal tibia fracture treated by locking compression plate and expert tibia nail to compare functional outcomes and complications.

**Material and Method**: The study conducted from September 2017 to September 2019. 60 patient with distal tibia extrarticular close fracture AO type 43A were randomly selected which was admitted to trauma center JLN medical college ajmer. 30 of them were treated with locking compression plate and rest 30 with expert tibia nail. Patient were follow up for 12 month and evaluated by Olerud & Molander scoring system.

**Results**: The mean age of patient was 48.4 years and majority were male (55%).Majority of patient had associated fibula fracture 83.33 %. Mean time for surgery was 74.63min in LCP which was significantly less (P value= 0.00252) in ETN 61.76 min. Average time for union 18.46 weeks in ETN compared to 22.46weeks in LCP which was significant (P value= 0.001698). Average time for full weight bearing in ETN was 10.6 weeks and in LCP was 13.56 weeks which was significant less in ETN (P value0.00356).The Olerued & Molender score were significant higher( pvalue0.0486) in ETN. In plating 5 patients showed superficial skin infection, 3 deep infection, 2 skin necrosis and implant exposure&5 had ankle stiffness whereas in nailing only 4 pt showed superficial skin infection and 9 had anterior knee pain.

**Conclusion**: The study found ETN was more successful in term of shortened operating time, early weight bearing and early union, low infection rate and ankle stiffness.

**Keywords**: distal tibia fracture, locking compression plate, expert tibia nailing

Introduction

Leg bone fractures comes at the top because it is most distal part of body and is actively involved in locomotive system [1]. Out of all the leg bone fractures, on basis of fracture location in tibia distal tibia fracture have second higest incidence [2].A significant number of cases are of distal tibia which are generally comminuted in nature and are unstable. As these fractures occur in proximity of weight bearing surface of ankle joint, a slight maladjustment in inclination of ankle joint may lead to permanent disability.

Management of distal tibia fracture is often more complex than the treatment of diaphyseal fracture because of its unique anatomical characteristics of subcutaneous location with precarious blood supply and proximal to ankle joint. The most important variables that affect the final outcome are type of fracture, associated soft tissue injury, the method of treatment and the quality of reduction [3, 4, 5]. Distal tibia fracture generally required operative management and can be managed by Close reduction and casting, external fixation, open reduction and internal fixation by plating or LCP by MIPPO technique, intramedullary nail.

New insight in reduction techniques and fracture healing are leading to the development of a “minimal invasive percutaneous plate osteosynthesis” (mippo) [18]. The emphasis now lies on indirect reduction, axial alignment and stable fixation without disturbing the fracture environment and thus preserving the most of the vascularization [6, 7] and fracture heamatoma, containing all necessary growth factors for bony healing.
Intramedullary nails have been greatly improved in recent years. In the recent years shortened IM nail, In which the distal tip of a standard IM tibia nail is cut by 1cm [5], has been developed and used to treat distal tibia fracture. The expert tibia nail (ETN) is a new kind of low, multidirectional locked tibia intramedullary nail. Its interlocking system was developed to attain increased angular stability and to enhance the axial & later stability attained by the nail fixation. The closed intramedullary nailing also has associated with significantly shorter operative time and fewer wound infection. This study is conducted between two method, distal tibia fracture treated by locking compression plate and expert tibia nail to compare functional outcomes and complications.

Material and Method

The study was performed on a total of 60 patients admitted in Department of Orthopaedics, JLN Medical College, AJMER between Sep. 2017 to sep. 2019 after obtaining patients informed and written consent. Adult (age more than 18 years) patient with closed extra articular distal tibia fracture as per AO classification 43A1, 43A2, 43A3, fractures extending into diaphysis (fracture within 8 to 10 cm from tibial plafond with minimum 4cm length of distal fragment) were included and All open fracture, pathological fracture, Patient unable to cooperative in post operatively due to other illness were excluded in this study.

60 patient with distal tibia extrarticular close fracture AO type 43A were randomly divided into two groups; group A (30 patient) treated by plating (LCP) and group B (30 patient) treated by nailing (expert tibia nail). Patient advised to follow up on 3rd, 6th, 12thweek and 6 month, final follow up at 1 year.

Results

This study is a prospective study to compare results of distal tibia fracture treated with LCP by MIPPO and EXPERT TIBIA NAIL in terms of benefits, functional out comes and complication.

Duration of surgery

| Fracture union time |
|---------------------|
| **Table 1:** Comparison of surgery duration in two groups |
| **Duration (In Min.)** | **Group A(LCP)** | **GROUP B(Expert tibia nail)** |
| **No. Of Patient** | **Percentage** | **No. Of Patient** | **Percentage** |
| <60 | 4 | 13.33% | 14 | 46.66% |
| 61-70 | 11 | 36.66% | 12 | 40.00% |
| >70 | 15 | 50% | 4 | 13.33% |
| Total | 30 | 100% | 30 | 100% |

P Value: 0.00252.

The mean duration required for surgery was 74.63 min in group A and it was 61.76 min in group B, which is significant less in group B.

Fracture union time

| Fracture union time |
|---------------------|
| **Table 2:** Comparison of fracture union time in two groups |
| **Time (In Weeks)** | **Group A (LCP)** | **Group B(Expert tibia nail)** |
| **No. Of Patient** | **Percentage** | **No. Of Patient** | **Percentage** |
| 12-16 | 3 | 10% | 4 | 13.33% |
| 16-20 | 9 | 30% | 21 | 70% |
| > 20 | 18 | 60% | 5 | 16.66% |
| Total | 30 | 100% | 30 | 100% |

P Value: 0.001698

Average time taken for union of fracture in this study groups was 22.46 weeks in Group A and 18.46 weeks in Group B. There was statistically significant difference (p<0.05) in the time of surgery

Complications

| Complication | **Table 3:** Comparison of complications in two groups |
|--------------|-----------------------------------------------------|
| **Complication** | **Group a (LCP)** | **Group b(expert tibia nail)** | **P value** |
| **No. of patient** | **Percentage** | **No. of patient** | **Percentage** |
| Superficial skin infection | 5 | 16.66% | 2 | 6.66% | P=0.2276 |
| Deep skin infection | 3 | 10% | 0 | 0 | P=0.0755 |
| Skin necrosis and implant exposure | 2 | 6.66% | 0 | 0 | P=0.1503 |
| Angulation(5-10 degree in any plane) | 4 | 13.33% | 8 | 26.66% | P=0.3329 |
| Ankle stiffness | 5 | 16.66% | 4 | 13.33% | P=0.7174 |
| Ant knee pain | 0 | 0 | 9 | 30% | 0.0011 |

Functional Score (Olreud-Molander Ankle score)

| **Table 4:** Comparison of Olreud-Molander Ankle score in two groups at final follow up |
| **OMAS** | **Group a (LCP)** | **Group b(expert tibia nail)** |
| **No. of patient** | **Percentage** | **No. of patient** | **Percentage** |
| Good | 13 | 43.33% | 5 | 16.66% |
| Excellent | 17 | 56.66% | 25 | 83.33% |
| Total | 30 | 100% | 30 | 100% |

P Value: 0.0486

Mean Olreud-Molander Ankle score at final follow up for Group A was 86.33 and Group B was 91.06. There was higher no of patient in excellent category in Expert tibia nail group with compared to LCP group, which is statistically significant (p<0.05)

Discussion

Distal tibia fracture are common consequence of road traffic accidents. Its management is often more complex than the treatment of diaphyseal fracture because of its unique anatomical characteristics of subcutaneous location with precarious blood supply and proximal to ankle joint. Distal tibia fracture generally required operative management and can be managed by Close reduction and casting, external fixation, open reduction and internal fixation by plating or LCP by MIPPO techniue, intramedullary nailing. This study is conducted between two method, distal tibia fracture treated by locking compression plate (MIPPO) and expert tibia nail to compare functional outcomes and complications. Patient were follow up for 12 month and evaluated by Olreud & Molander scoring system [9]. In this study male patient preponderance were more, mean average age of patients was 48.4 years. The youngest patient
was 22 years and oldest was 85 years. this average age of patients was similar to studies done by Roshan raj KM[10] et al and kumar YC[11], et al. the distal tibia fracture is more common in 40-60 years, possibly due to the male dominance in travelling and occupation in this age group.

Table 5: Comparison of studies- duration of surgery

| Group A (LCP) | Group B (Expert tibia nail) |
|---------------|-----------------------------|
| Yong Li et al.[12] | 90.4 | 76.10 |
| Eknath D Panwar et al. [13] | 70.36 | 57.20 |
| Roshan Raj KM et al. [10] | 98.13 | 72.19 |
| Im GI et al. [14] | 72 | 89 |
| Our study | 74.63 | 61.76 |

Time Taken for radiological Union

In our study the average time taken by the patient for fracture union was 22.46 weeks in Group A and 18.46 weeks in Group B. non union was not seen in any patient [17]. The results of our study were comparable with other studies.

Table 6: Comparison of studies- radiological union time (in weeks)

| Group A (LCP) | Group B (Expert tibia nail) |
|---------------|-----------------------------|
| Yong Li et al.[12] | 23.1 | 21.30 |
| Eknath D Panwar et al. [13] | 21.40 | 17.43 |
| Roshan Raj KM et al. [10] | 24.13 | 19.25 |
| Im GI et al. [14] | 18 | 20 |
| Vallier HA et al. [15] | 27.8 | 22.6 |
| Our study | 22.46 | 18.46 |

Olreud-Molander Ankle score (OMAS)

OMAS score at the final follow up showed that excellent results were achieved in 56.66% cases in Group A and 83.33% cases in Group B. Good results were obtained in 43.33% cases in Group A and 16.66% cases in Group B. poor results not seen in any patient. Mean OMAS score at final follow up for Group A was 86.33 and Group B was 91.06. Statistically calculated P value for the OMAS score is 0.0486 which is statistically significant indicating that the function outcome was better in group B.

Table 7: Comparison of studies- Olreud-Molander Ankle score

| Group A (LCP) | Group B (Expert tibia nail) |
|---------------|-----------------------------|
| Yong Li et al.[12] | Excellent: 73 | Good: 26 |
| Roshan Raj KM et al. [10] | Excellent: 50 | Good: 87.5 |
| Im GI et al. [14] | Excellent: 88.2 | Good: 11.8 |
| Our Study | Excellent: 56.66 | Good: 83.33 |

Complications

Complications seen in our study included superficial and deep skin infection, skin necrosis with implant exposure, angulation, ankle stiffness. In our study superficial skin infection was more common in Plating group accounting for 16.66% infection rate, it was only 6.66% in nailing group. Deep skin infection was 10% in plating group. Skin necrosis with subsequent exposure of the implant was much more common in LCP group i.e. 6.66% cases, skin necrosis not seen in nailing group. 5 (16.66%) patients in LCP group had ankle stiffness and 4(13.33%) patient had ankle stiffness in nailing group. Ankle stiffness ranged from restriction of ankle movement by 20-40degrees. In our study angulation was more common in expert tibia nail group accounting for 26.66% with more number of valgus angulation, whereas It was 13.33% in LCP group. P-value by Statistical calculation was not significant in all above results. The above results are comparable to some other similar studies conducted by other authors Yong Li et al. [12] Eknath D Panwar et al. [13] Roshan Raj KM et al. [10] Im GI et al. [14], Shan wei Yang et al. [19], Redfern DJ et al. [20]

Conclusion

Study shown that expert tibia nail is better and effective method for treating distal tibia fracture in terms of less operating time, early weight bearing, early union of fracture, decrease complication like skin infection, skin necrosis, ankle stiffness and other implant related problems.
Clinical photographs
Case 1: Expert tibia nail

Fig 1: Pre operative

Fig 2: 6 month

Fig 3: Squatting

Fig 4: Dorsiflexion

Fig 5: Planter flexion

Fig 6: Knee banding

Case 2: Locking compression plate

Fig 7: Pre operative
Fig 8: 6 month

Fig 9: Planter flexion

Fig 10: Dorsiflexion

Complication

Fig 11: Superficial skin infection

Fig 12: Deep skin infection

References
1. Tornetta P, court-Brown C, Heckman JD, McKee M, McQueen MM, Ricci W et al. Rockwood, Green, and Wilkins fractures in adults and children: Eighth edition, 2014, 4026.
2. Court-Brown CM, Birnie MC. The epidemiology of tibia fractures, Jbone joint surg. 1995; 77B:417-421.
3. Othman M, Strzelczyk P. Results of conservative treatment of pilon fracture. Ortop Traumatol Rehabil. 2003; 5:787-794.
4. Sarminto A, Latta LL. 450 closed fracture of distal third of tibia treated with functional brace. Cin Orthop Relat Res. 2004; 428:261-271.
5. Shrestha D, Acharya BM, Shrestha PM. Minimally invasive plate osteosynthesis with locking compression plate for distal diaphyseal tibia fracture. Kathmandu Univ Med J (KUMJ). 2011; 9(34):62-8.
6. Anglen JO. Early outcome of hybrid external fixation for fracture of the distal tibia. J orthop Trauma. 1999; 13:92-97.
7. Watson JT, Moed BR, Karges DE, Cramer KE. Pilon fractures. Treatment protocol based on severity of soft tissueinjury. Clin orthop Relat Res. 2000; 375:78-90.
8. Gorczyca JT, Mckale J, Pugh K, Pienkowski D. Modified tibia nails for treating distal tibia fractures. J Orthop. Trauma. 2002; 16:18-22.
9. Olerud C, Molander H. A scoring scale for symptom evaluation after ankle fracture. Arch Orthop Trauma Surg., 1984, 103.
10. Roshan Raj KM, Nanda Kumar R, Manoharan M. Comparison of functional outcome between expert tibial nail and distal tibial medial locking plate by mippo technique for closed extra articular distal tibial fracture, International Journal of Orthopaedics Sciences. 2019; 5(3):257-262.
11. YK C, SM SVT. Treatment of distal tibia fracture: plating versus intramedulary nailing. Int J Res. orthop. 2016; 2(3):116.
12. Yong Li, Lei Liu, Xin Tang, Fuxing Pei, Guanglin Wang, Yue Fang et al. Comparison of low, multidirectional locked nailing and plating in the treatment of distal tibia metadiaphyseal fracture. International Orthopaedics (SICOT). 2012; 36:1457-146.
13. Eknath Pawar D, Saurabh Agrawal R, Atul Patil W, Sandeep Choudhary, Ghaniuzzona Asadi. A Comparative study of intramedullary interlocking nail and locking compression plate fixation in management of extraarticular distal tibia fracture. Journal of Evolution of Medical and Dental Science. 2014; 3924):6812-6826.
14. IM GI, Tae SK. Distal metadiaphyseal fractures of tibia: A prospective randomized trial of closed reduction and
intramedullary nail versus open reduction and plate and screws fixation, J Trauma. 2005; 59(5):1219-23.

15. Vallier HA, Cureton BA, Patterson BM. Randomized, prospective comparison of plate versus intramedullary nail fixation for distal tibia shaft fracture. J Orthop Trauma. 2011; 25(12):736-41.

16. Bedi A, Le TT, Karunakar MA. Surgical treatment of non-articular distal tibia fracture. J Am Acad Orthop Surg. 2006; 14(7):406-16.

17. Yang SW, Tzeng HM, Chou YJ, Teng HP, Liu HH, Wong CY. Treatment of distal tibia metaphyseal fractures, plating versus shortend intramedullary nailing. Injury. 2006; 37(6):697-703.

18. MIPPO- An update current orthopaedics. 2008; 22(3):202-207.

19. Kasper Janssen W, Jan Biert, Albert van Kampen. Treatment of distal tibia fractures: plate versus nail, A retrospective outcome analysis of matched pairs of patients, international orthopaedics (SICOT). 2007; 31:709-714.

20. Redfern DJ, Syed SU, Davies SJM. Fractures of the distal tibia: minimally invasive plate osteosynthesis. Injury. 2004; 35(6):615-20.