

STUDY OF FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF DISTAL TIBIAL FRACTURE USING LOCKING COMPRESSION PLATE

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Abstract

Background: The objective of the study is to evaluate clinical results and outcomes of metaphyseal fracture, lower third tibia using locking compression plate by minimally invasive percutaneous plate osteosynthesis (MIPPO). **Materials and Methods:** Adult patients with fractures of lower third tibia, who underwent surgical management with locking compression plate, were prospectively followed up during 17 months period in our hospital. In that type III open fractures, multiple fractures, pathological fractures, delayed union and malunion were excluded. Of the twenty-nine Patients with distal Tibia fracture who were admitted and examined according to protocol both clinically and radiologically, one patient dropped out during the follow up. Fracture care was provided by trained orthopaedicians in our institution. The rest of twenty-eight patients were followed up regularly by clinical examination, Olerud and Mollander scoring and X rays were taken immediately after surgery, at 4 weeks, 8 weeks, 12 weeks and 24 weeks post operative. **Results:** Twenty-eight patients, age ranging from 24 - 82 years (mean age of 56.36 standard deviation 16.68) were followed for an average of 6 months (range 6-8 months) with mean fracture healing time of 19.43 weeks (16 to 23 weeks SD - 2.268). All those fractures were closed. Twenty-two patient had fractures (AO/OTA) type A, four have type B and two have type C fractures Three patients had surgical site infection, which subsided by parenteral antibiotic therapy in except one. That patient required early implant removal and plastic surgery intervention was needed for covering the skin necrosed area with flap. Average time taken for surgical procedure was 58.04 minutes ranging from 45 minutes to 80 minutes. The scoring system used for assessing functional outcome in this study is Olerud and Mollander scoring system. In which an average score of 85.54 (SD 13.077), ranging from 65 to 100. In which 10 patients have excellent result, 8 of them have good result and rest ten of them have fair results. The correlation coefficient between Olerud and Mollander score and age was - 0.883 (p<.0001 significant). As the age increases the score seems to be decreased. The elderly patients and those patients who did not follow the post-operative physiotherapy had complaints of ankle joint stiffness. But overall outcome was fair. **Conclusion:** This technique has resulted in effective stabilization of lower third tibial fractures. It does provide adequate stability and allows early mobilization. This technique not only helps in achieving reduction in difficult situation but also in rapid union because it facilitates preservation of blood supply to the fragment and anatomical reduction of fracture with greatest advantage being that fracture hematoma is not disturbed. This technique is effective in distal third tibia fractures where intramedullary nails often do not provide stability.

INTRODUCTION

The tibia is a subcutaneous bone, so it is vulnerable for trauma especially direct injury. The treatment of distal tibia fractures represents a significant challenge to most of the surgeons even today, because of many

complications like poor vascularity, subcutaneous location and limited soft tissue access. The fracture is not easily amenable for surgical reconstruction. The incidence of this fracture is 1 to 10% of all tibia fractures and less than 1% of all lower extremity fractures.^[1,2]

There are many methods of treatment for distal tibia fractures. Conservative treatment with cast application needs prolonged immobilization resulting in the knee and ankle stiffness, which may affect quality of life of the patient.^[3] The use of external fixators and tip locking nail are limited. Operative treatment is warranted for fixation of such complex fractures. For the past decade, fracture reduction using plate has been successful in treating distal tibia fractures. Introduction of locking compression plate is a drastic and far-reaching change in this treatment method. Thus, it allows early mobilization soft tissue access and avoids complications associated with immobilization.^[4-6]

The application of locking compression plate by minimally invasive percutaneous plate osteosynthesis synergizes the benefit. This provides conservation of vascularity to bone and fracture hematoma, thus helps in biological healing. Recently there is an increase in the trend for using LCP for distal tibia fractures. Compared to the conventional plates,^[7,8] locking compression plates imparts a higher degree of stability and prevents primary and secondary losses of reduction. Locking plates have biomechanical properties of internal and external fixators. They provide superior holding power because of fixed angular stability achieved through the head of locking screws. They do not rely on friction fit so needs minimal bone contact.^[9-11]

The key factors of stability of fixation are plate length and screw density.^[12] This technique of fracture fixation helps to obtain anatomic reduction and stable fixation so it can be safely used in distal tibia fractures. Due to the availability of pre contoured plates the surgical time will be minimal. The locking compression plates provides enhanced stability in these situations with minimum number of screws.

Formal classifications in current use: Classification systems have been used to describe more accurately the range of distal tibial fractures. The AO/OTA classification system, which commonly in use provides comprehensive description of distal tibial fractures. Type A fractures are extra articular distal tibial fractures, they are subdivided in to groups A1, A2, and A3, based on the amount of metaphyseal comminution. Type B fractures are partial articular fractures, in which a portion of the articular surface remains in continuity with the shaft; these are subdivided into groups B1, B2, and B3, based on the amount of articular wide impaction and comminution. Type C fractures are complete metaphyseal fractures with articular involvement; these are subdivided into groups C1, C2, C3, based on the extent of metaphyseal and articular comminution. Type, C2, and C3 fractures are the fractures that are commonly considered as tibial plafond fractures.^[13] Another commonly used system, which has been that proposed by Ruedi and Allgöwer divides plafond fractures into three categories. Type fractures that are not displaced cleavage fractures which involves the joint surface; type II fractures are cleavage-type fracture with

displacement of the articular surface but minimal comminution; type III fractures are associated with metaphyseal and articular comminution.^[14]

Locking Compression Plates: the main aim of any surgical fracture treatment is to reconstruct the anatomy and restore its function. According to the AO ASIF, internal fixation is distinguished by anatomic reduction, stable fixation, preservation of blood supply and early functional mobilization. Better results can be obtained by using internal fixation with angular stability (internal fixators) in metaphyseal fractures and in osteopenic bone. The Locking Compression Plate (LCP) is combination of a stainless steel or titanium plate and screw system that merges locking screw technology with that of conventional plating techniques. The Locking Compression Plates (LCP) has the LC-DCP features like 80° of longitudinal screw angulation, 14° of transverse screw angulation, Uniform hole spacing, Load (compression) and neutral screw positions. The Locking Compression Plates have combination locking and compression holes (Combi holes). The Combi holes allow placement of standard cortex and cancellous screws on one side and or threaded conical locking screws on the other side of each hole. It has threaded hole section for locking screws, dynamic Compression Unit (DCU) hole section for standard screws. This is a prospective study includes patients with age above 18 years admitted in orthopedics ward from OP Department and Emergency department of Pushpagiri Institute of Medical Science after obtaining their informed, valid written consent.

MATERIALS AND METHODS

Inclusion criteria.

1. All patients with distal Tibia fractures treated with LCP
2. All skeletal mature patients (>18years) including Patients with osteoporosis. Closed and Open (type I and II) distal Tibia fractures
3. Patients willing to give consent for surgery and study

Exclusion Criteria

1. Patients of age less than 18 yrs
2. Open fractures type III
3. Pathological Fractures.
4. Patients having multiple fractures on same limb.
5. non-union and Delayed union

Procedure: On admission of the patient, a careful history was taken from the Patient and attendees to know the mechanism of injury and the severity of the trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. General condition assessment was done with the vital signs and systemic examination. Methodical examination was done, Antero-posterior and lateral radiographs of the affected leg along with ankle and knee were taken. Then the fracture patterns were classified based on the AO/OTA classification of fractures of distal tibia. The limb was then immobilized in an above knee Plaster of Paris slab till

definitive fixation with locking compression plate done. In those patients' antibiotics, analgesics symptomatic management were done. ad jointly All the patients were explained the surgical procedure, complications and post operative care. The patient was taken for surgery after routine investigation, obtaining fitness for surgery and valid written consent. The Instruments and Implants used were distal tibia medial locking compression plate, 5mm locking compression cortical screws, 3.2 mm locking cancellous screws, 4mm and 2.7 mm drill bits, 5mm and 3.2 mm drill sleeves, 2mm K-wires, 5mm and 3.2 hexagonal head screw drivers, Electric drill, T-handle, Pneumatic/ Esmarch's tourniquet, General instruments like retractors, number 20 surgical blade, curved and straight hemostats etc. Operative Procedure: Type of anesthesia - lumbar sub arachnoid block (Spinal), then the patient is Positioned supine with affected leg elevated on a pillow/sand bag. Then pneumatic/ Esmarch's tourniquet applied.

Surgical technique: Surgical incision After palpating the medial malleolus distally make a 3- to 4-cm incision starting just distal to the medial malleolus and extend the incision proximally overlying the subcutaneous surface of the tibia, halfway between the anterior and posterior border. Proximally make a longitudinal incision overlying the subcutaneous surface of the tibia, halfway between the anterior and posterior borders after palpating the plate. Plate length and screw density is calculated after assessing the fracture pre operatively and intra operatively Plate Contouring will be done accordingly to flush to the anatomy of distal tibia or can use the pre contoured plate. After fracture reduction the temporary plate placement done. The plates can keep in position by 1.8mm or 2mm k wires. Screw insertion After determining whether standard

cortical screws or 3.5 mm locking screws to be used for fixation. A combination of both may be used. Postoperative treatment with Locking Compression Plates does not differ from conventional internal fixation procedures. After stabilizing the vitals patient will transfer out from the post-operative recovery room, post-operative regimen including Immobilization with above knee plaster of Paris slab and non-weight bearing of the patient using standard walking frame was done from the first post operative day under the supervision of a physiotherapist. Intravenous antibiotic regimen was continued for 5-7 days after the surgery. Suture or staple removal was done at 10th-12th postoperative day. The patients were followed up at intervals of three weeks to four weeks for up to 6-8 months to assess the radiological union. After the 1st follow up of weeks patient is allowed to bear weight with patellar tendon bearing cast. This patellar tendon bearing cast is continued for further 4 more weeks and later removed. The union of fracture assessed, when there was periosteal bridging callus at the fracture site, at least in two cortices in the antero-posterior and lateral views, Trabeculations extending across the fracture site. Olerud & Mollander scoring system was used in this study to assess the results, it is a subjective type of scoring system.^[15]

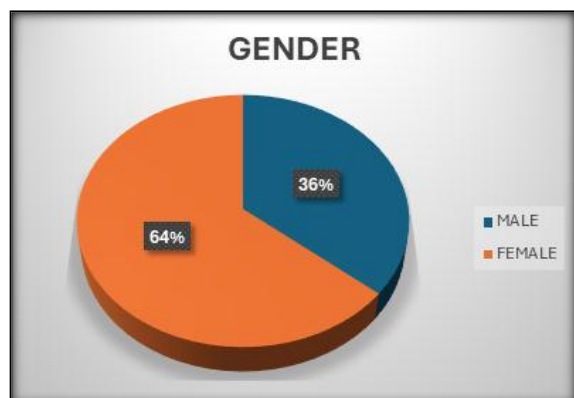
RESULTS

In the present study the age of patients ranged from 24 years to 82 years with an average age of 56.36. The fracture most common in sixth and seventh decade. Age distribution between genders (54.4 years (20.5) of males and 57.44 years (14.68) of females) was not significantly different ($p = 0.652$).

Table 1:

Fracture pattern	AO/OTA classification
TYPE A	22
TYPE B	4
TYPE C	2

Gender distribution:



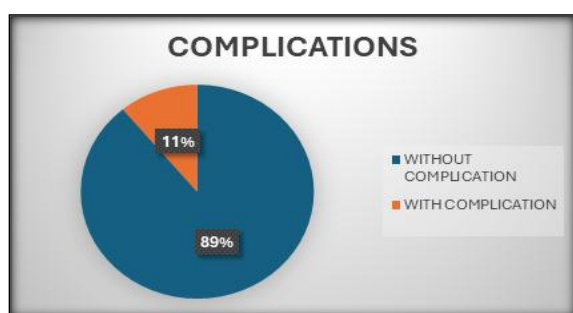
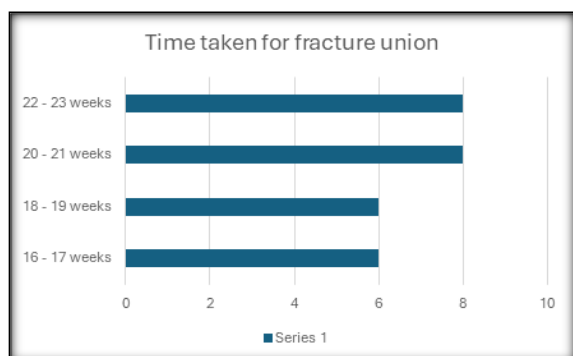
The present study 22 patients got fracture which was type AO/OTA (A), Which constitutes 79 % of total

patients. Four patients had type B fracture, while rest 2 patients got type C fracture pattern. Mode of injury in the present study 13 patients sustained distal tibia fracture due to road traffic accidents which is high energy trauma that is 46.4% and 15 patients sustained injury due to fall, low energy trauma. The union rate was better in the patients having road traffic accidents; this may probably due to the age of those patients. The patients with younger age are involved in RTA compared to the older age group.

The average time taken for surgery in our study was 58.04 minutes. The surgeries were done by experienced surgeons in our hospital. So, the time taken for surgery is comparable, but in some cases the reduction of fracture was difficult and it consumed more time.

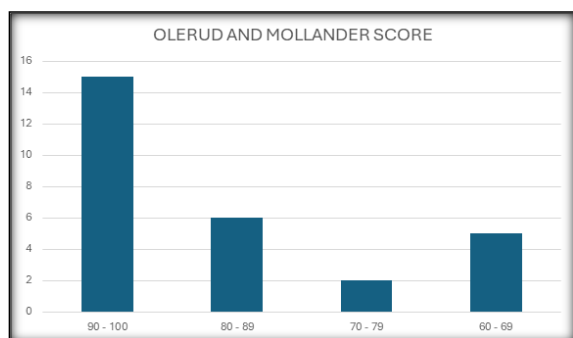
The average time for fracture union in various studies was 16-24 weeks. Our study had an average fracture

union of 19.43 weeks ranging from 16 to 23 weeks which were comparable with studies conducted using the locking compression plates. Our study had an average fracture union of 19.43 weeks ranging from 16 to 23 weeks which were comparable with studies conducted using the locking compression plates.



In the current study initially, there were 29 patients in which one patient was dropped out due to unavailability of follow up, three patients got infection in the surgical site. In all the three cases the soft tissue healing was delayed. In one case plastic surgery intervention needed for covering the necrosed skin area with flap in other two, antibiotic and other supportive therapy needed. In that case early implant removal was done and was treated by cast application. In those cases, union was delayed up to 23 Weeks That is 11% of patients got superficial skin infection.

Olerud and Mollander score:



DISCUSSION

Fractures of the distal tibia can be challenging to treat because of the limited soft tissue, the subcutaneous location, and poor vascularity. The goal of operative treatment is to obtain anatomic realignment of the joint surface while providing enough stability to allow early motion. This can be achieved by using techniques that decrease bone and soft tissue devascularisation. The present study was undertaken to determine the efficacy of locking compression plates in treatment of the distal third tibia fractures by MIPPO technique. We evaluated our results and compared them with those obtained by various other studies utilizing different modalities of treatment.

In 29 in house patients one patient was dropped out, rest of the patient's outcome is assessed by Olerud and Mollander scoring system. The present study contains fracture pattern AO/OTA type A 22 which constitutes 79% while type B four patients (14%), and type C two patients (7%). In study of Melih Guven et al. 73% type A, 15% type B and 12% type C respectively.^[12] In another study done by Mario Ronga et al. 57% type A fracture, 24% type B and 19% type C fracture types.^[11] We had a higher percentage of type A fracture. The average time for fracture union in various studies was 16-24 weeks. Our study had an average fracture union of 19.43 weeks ranging from 16 to 23 weeks which were comparable with studies conducted using the locking compression plates. Melih Guven et al had an average fracture union of 22.3 weeks and Hazarika et al. had an average of 18.1 weeks.^[16] In another study Hasenbholer et al. had an average time for fracture union of 23 weeks and Bahari et al had 22.4 weeks.^[7,18] In our study out of 28 patients, three patients got infection in the surgical site. In all the three cases the soft tissue healing was delayed. In one case plastic surgery intervention needed for covering the necrosed skin area with flap in other two, antibiotic and other supportive therapy needed. In that case early implant removal was done and was treated by cast application. In those cases, union was delayed up to 23 Weeks That is 11% of patients got superficial skin infection. A study done by Hazarika et al, 5% patients got post-operative infection.^[16] another study done by Borg et al the infection occurred in 14.3% of patients.^[17] In the current study the outcome of study is assessed by assessing the time taken for union of fracture and using Olerud and Mollander scoring system, The average score is 85.54. The Olerud and Mollander scoring system is a subjective type of scoring system. The score is less in the older age group. The score is comparatively better in the younger patients and those who have no post-operative infection. The hardware complication is less; the diminution of score is mainly due to the ankle stiffness, difficulty in squatting and running. In the present study 36% patients have excellent outcome, 28% have good outcome and 36% have fair outcome.^[18]

CONCLUSION

According to the study done in Pushpagiri Institute of medical Sciences and Research Centre 29 patients with fractures of the distal tibia had undergone open reduction and internal fixation with distal tibia locking compression plate through MIPPO technique. One patient could not be followed; in 28 patients this technique can achieve effective stabilization of fracture. It provided adequate stability and allows early mobilization. The locking compression plates help not only in the precise anatomic reduction but also better healing by conserving the vascularity to the bone and fracture hematoma. Thus, it helps in biological repair. The outcome of the patients treated with locking compression plate is fair. This technique allows early mobilization, prolonged immobilization is not necessary like in conservative treatment with cast application. Due to the availability of pre contoured plates the surgical time is also reduced. This technique of fracture fixation can be - used in the distal tibial fractures with small metaphyseal fragments, vertical split, intra articular extension and markedly comminuted fractures, where the use of intramedullary locking nail is limited. Although, a larger sample of patients and longer follow up are required to fully evaluate this method of treatment, it is strongly recommended to use the locking compression plate for fixing the distal tibia fractures.

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