



ORIGINAL RESEARCH PAPER

FUNCTIONAL OUTCOME OF PRE-CONTOURED MEDIAL LOCKING COMPRESSION PLATE USING MIPO (MINIMAL INVASIVE PLATING OSTEOSYNTHESIS) TECHNIQUE IN TREATMENT OF DISTAL TIBIAL FRACTURES

Orthopaedics

KEY WORDS: Minimally Invasive Plate Photosynthesis (MIPO) 2. Locking Compression Plate (LCP)

Dr. Man Singh Shekhawat

Senior Resident J.L.N Medical College, Ajmer.

Dr. Nitin Jeenjwadia

Senior Resident J.L.N Medical College, Ajmer.

Dr. Sumer Singh Shekhawat*

Assistant Professor J.L.N Medical College, Ajmer. *Corresponding Author

Dr. S. K. Bhaskar

Senior Professor & HOD Orthopaedics J.L.N Medical College, Ajmer.

ABSTRACT

Introduction:- The management of distal tibial fractures remains challenging due to subcutaneous location of larger portion of tibia, paucity of soft tissue coverage and precarious blood supply of distal leg. Conservative management may be complicated by loss of reduction and subsequent malunion. MIPO (Minimal invasive plating osteosynthesis) has evolved as a newer concept to treat distal tibial fractures. It works on Biological fixation principle which assists physiological process of bone healing wisely with minimal operative intervention. **Methods:-** Prospective follow up study carried out at J.L.N. Medical College Ajmer from 1 Jan 2017 to 30 June 2018. 30 patients with distal tibial fractures were included and operated with pre-contoured medial locking compression plate using MIPO technique. Fractures were classified as per AO system and patients were followed and scored according to TEENY and WISS scoring criteria. **Results:-** Functional results according to TEENY and WISS scoring criteria was found excellent in 9 (30%), good in 16(53.33%), Fair in 3(10%) and poor in 2 (6.66%) patients. Poor outcome occurs due to development of complications **Conclusion:-** Internal fixation of distal tibial fractures with pre-contoured medial locking compression plate using MIPO technique is effective and safe and provides more stable construct with anatomical reduction.

INTRODUCTION

The management of distal tibial fractures remains challenging due to subcutaneous location of larger portion of tibia, paucity of soft tissue coverage and precarious blood supply of distal leg.

Conservative management may be complicated by loss of reduction and subsequent malunion. MIPO (Minimal invasive plating osteosynthesis) has evolved as a newer concept to treat distal tibial fractures. It works on Biological fixation principle which assists physiological process of bone healing wisely with minimal operative intervention.

MATERIALS AND METHODS

This study was carried out prospectively on the patients having fracture of distal leg bones, admitted in the Department of Orthopaedics, JLN Medical College and Hospitals, AJMER, Rajasthan, India during the year 2017-2018 by surgical methods; fulfilling following criteria.

Source Of Data:

This study was conducted in department of orthopaedics, JLN Hospital and Medical College, Ajmer. 30 cases for the study were randomly selected which operated for distal tibia fracture from Jan 2017 to June 2018.

Method For Collection Of Data:

- A case documentation form is used to obtain data, including age, sex, mechanism of injury, type of fracture according to AO/OTA classification.
- Radiological investigations
 - o Ankle with leg (AP & Lateral)
 - o Knee with leg (AP & Lateral)

Ethical Approval

The study was started after taking permission from ethical committee.

Inclusion Criteria:

- Closed fractures of distal leg bones
- Intra-articular/extra-articular fracture of distal tibia

- Patients consenting to study
- Skeletally mature

Exclusion Criteria:

- Open fracture
- Pathological fracture
- With neuro-vascular injuries

All cases were followed up for a minimum period of six months.

Clinical Assessment

On admission of the patient, a careful history was elicited from the patient and/or attenders to reveal 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. Methodical examination was done to rule out fractures at other sites.

Radiographic Assessment

Standard guidelines were followed to get radiographs. Anteroposterior and lateral radiographs of the affected leg along with ankle were taken and the fracture patterns were classified based on the AO/OTA classification of fractures of distal tibia

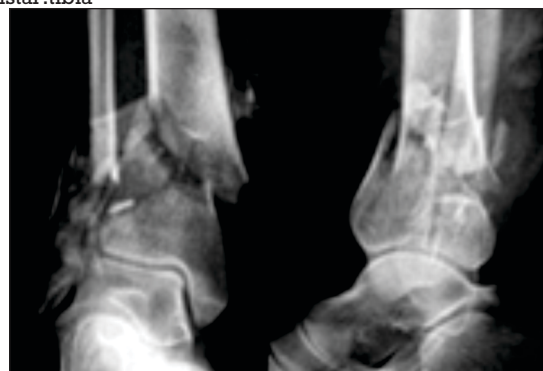
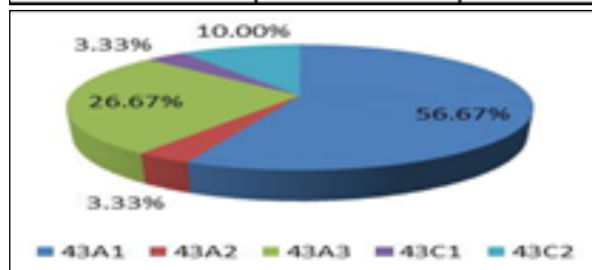


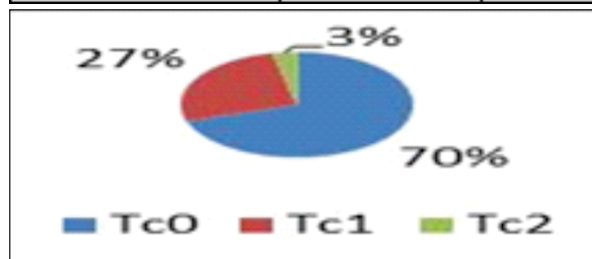
Fig- AO 43A3 fracture distal tibia

Type of Fractures	No of patients	%
43A1	17	56.66%
43A2	1	3.33%
43A3	8	26.66%
43C1	1	3.33%
43C2	3	10%



AO Classification

Nature of Fractures	No of patients	%
Tc0	21	70%
Tc1	8	26.66%
Tc2	1	3.33%



Tscherne Classification

Operative Procedure

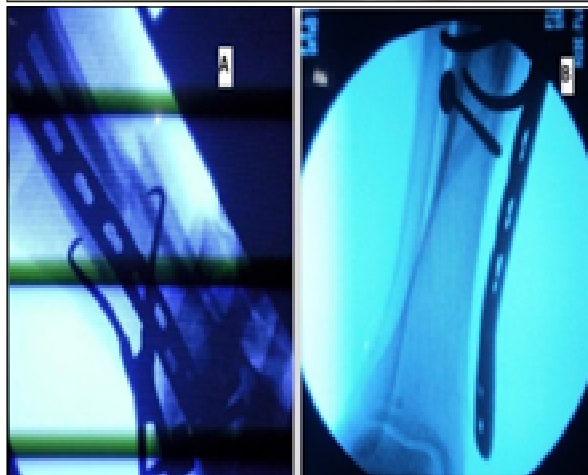
All patients were operated by Locking Compression Plate (LCP) done using MIPPO technique. Surgery was performed under spinal or General Anesthesia. Tourniquet was used. A vertical or curvilinear incision was made at the level of medial malleolus. Care was taken not to injure great saphenous vein and saphenous nerve. Subcutaneous plane was made without disturbing the fracture hematoma. Indirect reduction of fracture was done under C-arm guidance and fixed with LCP plate and screws. In some cases fibula fracture was fixed first by open reduction using DCP/1/3 semitubular plate and screws. have reported that the compressive strength of rubberized concrete can be improve when fine aggregate was fully replaced by fine crumb rubber. He also indicated that if the rubberParticles have rougher surface or given a pretreatment, the better and improved bonding may develop with the surrounding matrix, and that may result in higher compressive strength.



Fig– Pre-contoured Medial Locking Compression Plate



MIPO Incision



Close Reduction Under C-arm

Followed Up

Initially patients were followed up at 2 weeks for suture removal and then at regular intervals of four weeks up to six to ten months to assess clinically,functionally usingTenny & wiss Criteria Scoring systems.

Followed Up

1. Pain
2. Distance
3. Support or Orthosis
4. Running
5. Toe raising
6. Hills (up or down)
7. Stairs (up or down)
8. Limp
9. Swelling
10. Plantar range of motion
11. Dorsal range of motion

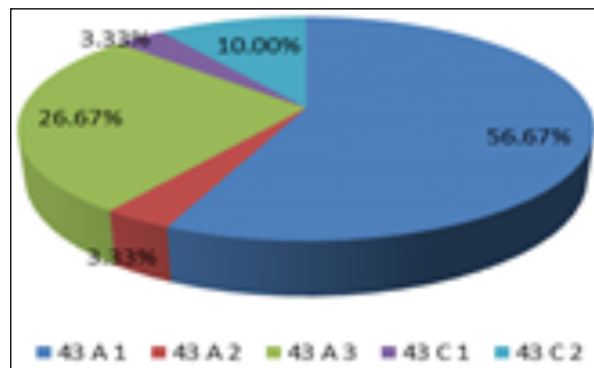
Tenny & wiss Criteria Scoring system

Rating	Scoring
Excellent	>92
Good	87-92
Fair	65-86
Poor	<65

RESULTS

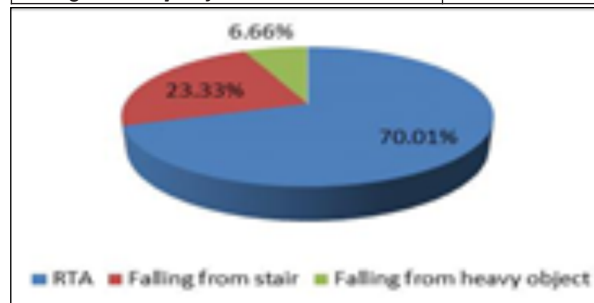
The age of the patients ranged from 20 to 65 years with mean age of 43 years. Most of the patients were in the age group of 20-40 years. There were 20 male and 10 female patients included in the study. The mode of injury in the majority of the patients was road traffic accidents. The majority of the fractures operated in our study were extra-articular fractures, i.e. AO/OTA 43-A (87%).

We also operated four (13.1%) intra articular AO/OTA 43-C fracture in our study. 21 patients (70%) had a both bone leg fracture, with majority of the fibular fractures occurring at the level of the tibial fracture, suggesting a bending mechanism. Out of the 21 patients with an associated fibular fracture, only 6 patients needed fixation of the fibula (20%). Of these, 4 fractures were fixed with one third tubular plates and 2 with rush nails.

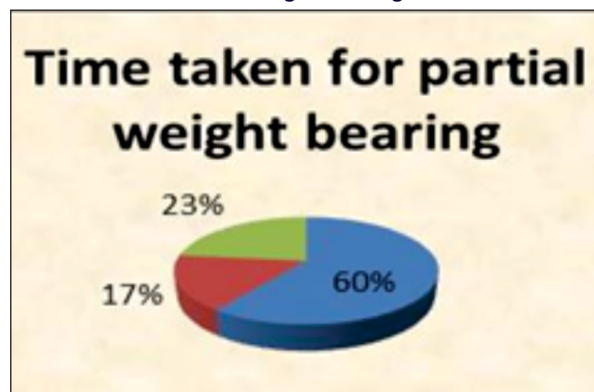


Mode Of Injury

Mode of Injury	%
RTA	70%
Falling from stair	23.33%
Falling of heavy object	6.66%



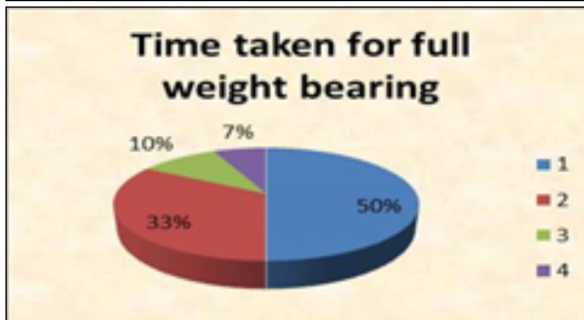
Time Taken For Partial Weight Bearing



Partial Weight bearing		
Weeks	No of patients	%
8 wks	18	60%
10 wks	5	16.66%
12 wks	7	23.33%

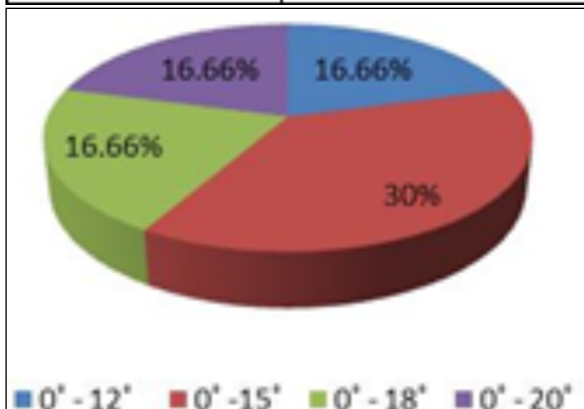
Time taken for full weight bearing

Full weight bearing		
Weeks	No of patients	No of patients
12	15	50%
14	10	33.33%
16	3	10%
18	2	6.66%

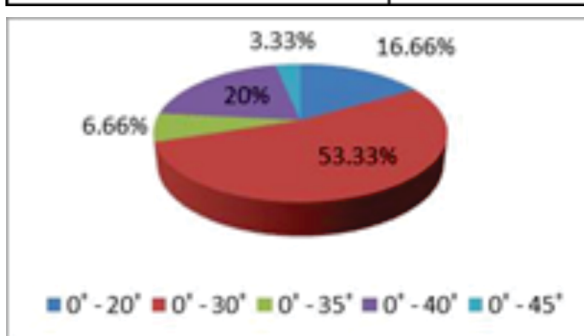


Range Of Motion At The Ankle Joint

Dorsiflexion	%
0° - 12°	16.66%
0° - 15°	30%
0° - 18°	16.66%
0° - 20°	16.66%



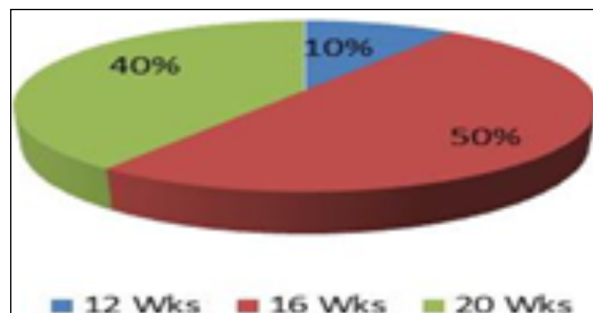
Plantar Flexion	%
0° - 20°	16.66%
0° - 30°	53.33%
0° - 35°	6.66%
0° - 40°	20%
0° - 45°	3.33%



Radiological Union

Union in weeks	No. of Patients	%
12 Wks	3	10
16 Wks	15	50
20 Wks	12	40

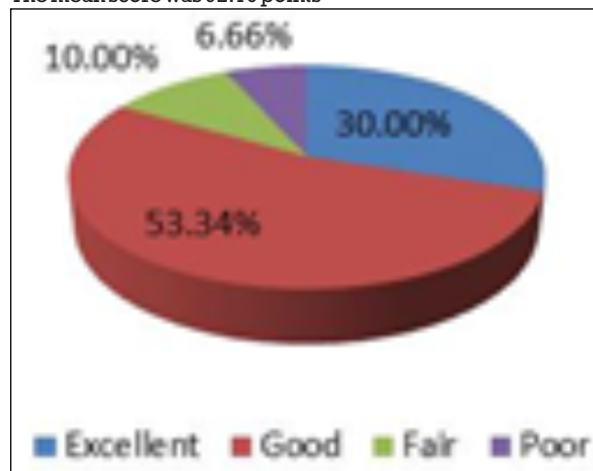
The mean union time was 17.2 weeks



Functional Outcome

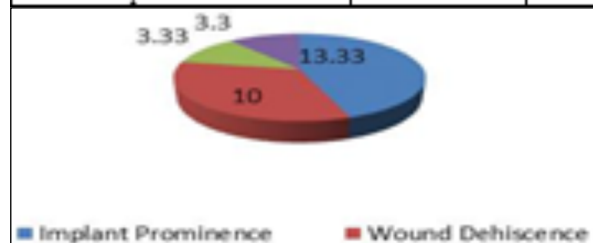
Result	No. of Patients	%
Excellent	9	30
Good	16	53.33
Fair	3	10
Poor	2	6.66

The mean score was 92.16 points



Complication

Post Operative Complication	No. of Patients	%
Implant Prominence	4	13.33
Wound Dehiscence	3	10
Superficial Infection	1	3.33
Implant failure	1	3.3



We encountered superficial infection in 1 (3.33%) of our patients which were managed with dressings and appropriate antibiotics. As the study progressed we realised that the key to preventing infection was gentle handling of the soft tissues. On long term follow up of these patients the superficial infection healed well.

In our study out of 30 patients 9 patients (30%) had complications, Four (13.33%) patients had the problem of implant prominence which was due to implant placed subcutaneously. This is most common complication encountered in our study.

DISCUSSION

Distal tibial fractures remain one of the most substantial therapeutic challenges that confront the orthopaedic traumatologist. Though conservative management of these fractures has been described these methods have been largely superseded by operative techniques for displaced or irreducible fractures, and fractures with intra-articular extension.

MIPO is by now an established technique of management of fractures of the distal third tibia.

In the present study, the mean age of 43 years is comparable to the studies by Sitnik et al. and Hazarika et al. The age of the patient had no bearing on the time to union in our study.

In the 6 patients with a concomitant fibular fracture needing fixation. We recommend one or preferably two percutaneous lag screws of adequate length in all spiral/oblique fractures from lateral to medial side before MIPO so as not to jeopardise medial plate application. This provisional fixation makes further MIPO easier. For this we have used cannulated screws (4.5 mm). If possible lag screws can be inserted through plate and they provide better strength to the fixation construct (Fig. 4A and B).



Fig. (A) Preoperative X rays showing AO 43-C1 fracture. (B) Post-operative X rays showing lag screw across fracture site through the plate

In the present study, 1 patient (3.33%) had post-operative superficial wound infection and 3-patient had a wound dehiscence infection. In all the five cases with superficial infection, the pilon plate had been used. All the cases healed after treatment with appropriate antibiotics and aseptic dressings and the infection did not appear to have any long term effect on fracture healing or the rehabilitation of the patient. The mean time to union in these patients was 21 weeks. The infection rate in the current series is similar to other studies.

In our series of fractures the mean time to union was 17.2 weeks with a range of 12-20 weeks. 96% fractures united within a period of 25 weeks. We defined union as painless full weight bearing and radiological union of 3 cortices in standard antero-posterior and lateral X-rays. Lau et al.²⁴ reported the average time to radiological bony union as 18.7 weeks, which ranged from the shortest 12 weeks to the

longest 44 weeks. In the study of Bahari et al. mean fracture healing in distal tibial fractures was found at 22.4 weeks Redfern, Syed and Davies in their study reported that the mean time to union for distal tibial fractures was 23 weeks (range: 18-29 weeks), without need for further surgery.

In the present study clinical results were evaluated according to the Tenny and Wiss score chronologically and at union. On union, 25 patients had an Tenny and Wiss score of 87 or greater out of a possible 100 points. The mean score was 92.16. Collinge and Protzman reported a good to excellent result with a mean Tenny and Wiss score of 85. In the study undertaken by Redfern et al., all patients returned to their pre-injury occupation or level of activity.

The locking compression platen (LCP) is part of a new plate generation requiring an adapted surgical technique and new thinking about commonly used concepts of internal fixation using plates. Understanding of the mechanical background for choosing the proper implant length and the type and number of screws is essential to obtain a sound fixation with a high plate span ratio and a low plate screw density. A high plate span ratio decreases the load onto the plate. A high working length of the plate reduces the screw loading, thus fewer screws need to be inserted and the plate screw density can be kept low. Selection of mono or bi-cortical screws is done according to the quality of the bone structure and it is important to avoid problems at the screw thread bone interface with potential pullout of screws and secondary displacement. We recommend bicortical locking screws for the tibia, since the working length of the monocortical screw depends only on the thickness of the bone cortex.

CONCLUSION

The MIPO technique is a reliable fixation approach to fractures of the distal third tibia, preserving most of the osseous vascularity and fracture haematoma and thus providing for a more biological repair. The bone healing, though slightly delayed, was universal with this type of fixation. This technique can be used in fractures where locked nailing cannot be done like distal tibial fractures with small distal metaphyseal fragments, vertical split and markedly comminuted fractures. Due to preserved vascularity, there is lesser incidence of delayed union and non-union. There was reduced incidence of infection due to limited exposure. Infection can also be prevented by careful handling of soft tissues and by minimising the operating time.

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