Original Article
Orthopaedics

FUNCTIONAL AND RADIOLOGICAL OUTCOME OF DISTAL TIBIAL FRACTURES TREATED WITH LOCKING COMPRESSION PLATE

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Abstract:

Background And Objective: Our objective was to evaluate clinical and radiological outcomes of metaphyseal distal tibia fractures treated with locking compression plate by open reduction technique and minimally invasive percutaneous plate osteosynthesis(MIPPO) technique.

Materials And Methods: Patients with distal tibia fractures admitted to Government Mohan Kumaramangalam Medical College and Hospital, Salem have been taken for this study after obtaining their informed written consent. This is a prospective study done from June 2012 to August 2014.

Results: Forty patients of distal tibia fracture treated with locking compression plate were followed for the period of 12 months (range 6-20 months) and the mean fracture healing time was 16 weeks (12-60 weeks). One patient had delayed union(20 weeks). Four patients developed superficial infection but fractures united completely and two had exposed implant treated with flap cover .

Conclusion: This technique has resulted in effective stabilization of distal tibia fractures. It does provide adequate stability and allows early motion. Open reduction helps in achieving reduction in difficult situation and MIPPO technique allows rapid union because it facilitates preservation of blood supply to the fragment with greatest advantage of being fracture hematoma is not disturbed. This technique is effective in extra articular fractures occurring within 5cm of joint line were intramedullary nails don't provide favourable outcome.

Key words: *locking compression plate, MIPPO, metaphyseal fractures.*

Introduction:

Distal tibia fractures constitute 1-10 % of all lower extremity fractures. Management of these fractures is a significant challenge to most of the surgeons even today. Orthopaedists in the first half of twentieth century believed that these injuries were so severe and were not amenable for surgical reconstructions. Conservative management of these fractures need prolonged immobilization, leading to ankle and knee stiffness affecting the quality of life of the patient. Introduction of locking compression plate was a revolution in the management of distal tibia fractures. It provides stable fixation and leads to early return of work by the patients.

The goal of this technique is

1. Stable plate fixation.
2. Maintaining the fracture biology and
3. Minimizing the soft tissue problems.

In comparison to conventional plates, locking plate gives a good amount of angular stability, avoids primary and secondary loss of reduction and wound complications. Locking plates have both the internal and external fixation biomechanical properties, with higher degree of holding power as it is having fixed angular stability provided by the locking head of the screws.

The locking plates can be applied by means of open reduction and internal fixation or by minimally invasive percutaneous plate synthesis technique called MIPPO.

In minimally invasive plate osteosynthesis, the bone is reached through the soft tissue windows. The principles of MIPPO includes

1. Access of bone through soft tissue windows.
2. Minimal trauma to the bone and soft tissue by indirect reduction.
3. Use the tools with small foot prints, when direct reduction is needed.
4. Stable fixation with locking plates.

Methods Of Treatment

Conservative treatment:

Undis placed fractures can be treated by cast application. High violence distal tibia fractures with metaphyseal or articular diplacement and comminution are rarely treated by this method.

External Fixation:

External fixators decrease the wound complication rate by decreasing soft tissue dissection. Many types of fixators are available like classic Ilizarov ring fixator, pin fixator and hybrid fixator that combines both pin fixation and wire fixation. External fixation on the same side of the joint has advantage over cross- ankle external fixation as the ankle movements are preserved in the former one.

Olive wire which is attached to the ring,used in the hybrid or ring fixator can be used to reduce articular fragments. But some of the comminuted distal tibia fractures can't be managed with external fixation. Another disadvantage of external fixation is pin and wire site infection and patient's compliance.

Open Reduction and Internal Fixation :

Open reduction and internal fixation in expert hands can be reasonably safe, with only a small rate of devastating complications.

However, the surgical techniques and judgement required to obtain these results may not be widely applicable to all surgeons.

Open reduction and internal fixation with locking compression plates:

Locking compression plates have superior holding power because of fixed angular stability through the head of locking screws ,independent of friction fit. It also have the biomechanical properties of both internal and external fixators.

Medial distal tibia plating by Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique not only restore the limb alignment but also provide good clinical outcome in high energy metaphyseal fractures of distal tibia and most patients can get back into normal function. But special considerations should be given for those patients who are at high risk like highly comminuted fractures,bone loss, or type II or III open fractures.

Materials and methods:

This is a prospective study done from june 2012 to august 2014.

Forty Adult patients with fractures of distal tibia admitted to Government mohan kumara mangalam medical college and Hospital, Salem was taken for this study after obtaining their informed, valid written consent.

Inclusion criteria :

1. Adults (aged more than 18 years) males and females
2. Distal tibia fractures (Extra articular fractures AO OTA A1,A2,A3), Partial articular (AO OTA B1,B2,B3), Intra articular fracture (AO OTA C1)
3. Gustillo & Anderson Type I, Type II compound fractures

Exclusion criteria :

1. Patients aged below 18 years.
2. Intra articular fractures(AO OTA C2,C3)

3. Gustillo& Anderson Type III open fractures
4. Pathological fractures
5. Patient medically unfit for surgery.

Surgical Technique

- Surgical procedure can be done once healing of soft tissue occurs.
- Patient is placed in supine position on a radiolucent table.
- Initially open reduction and internal fixation of fibula done with one third tubular plate through the postero lateral incision if the skin condition is good otherwise closed reduction and internal fixation with 'K' wire if the skin is unhealthy to maintain the length of the tibia.
- Then a small incision of size 2-3 cm is made over the distal end of tibia and another one of size 2 cm over proximal end of anticipated plate position.
- Tunnel connecting these two incisions made epiperiosteally.
- The plate is slidedepi-periosteally from the distal incision to the proximal incision.
- Locking screws applied distally first after that proximal scews applied.

Follow up:

The patients were followed up at intervals of three weeks for up to 6-10 months to assess the radiological union.

The patient is advised to continue knee mobilisation exercises and non weight bearing with walker till the radiological appearance of union.

The fracture was designated as united, when there was periosteal bridging callus 'at the fracture site at least in three cortices in the anteroposterior and lateral views.

Trabeculations extending across the fracture site was also taken into consideration

Partial and full weight bearing were allowed based on the radiological union and consolidation of the fractures.

Results

This study includes 40 cases of distal tibia fractures which was treated with locking compression plate by open reduction and MIPPO technique. The study period was from june 2012 to august 2014.

Age distribution

The age of the patients included in the surgery ranged from 22-75 yrs and most common in the 5th and 6th decade.

Age	No. of Patients	Percentage
21-30	2	5
31-40	5	12.5
41-50	6	15
51-60	11	27.5
61-70	10	25
71-80	6	15
Total	40	100

Fracture pattern:

A0/0TA was used to classify distal tibia fractures. Of the 40 cases 8 (20%) cases were A1,10 (25%) were A2, 17 (42.5%) were A3,2(5%) were B1,2 were B2 and 1 was B3.

Type No. of patients Percentage

Fracture type	No of patients	Percentage
A1	8	20
A2	10	25
A3	17	42.5
B1	2	5
B2	2	5
B3	1	25
C1	-	-
C2	-	-
C3	-	-

- Out of 40 patients, 25(62.5%) patients were male and 15 (37.5%) patients were female indicating male preponderance as travelling and working in the fields are more common in male gender.
- 24 (60 %) patients with right sided distal tibia fractures and 16 (40%) patients with left sided distal tibia fractures.
- Among 40 patients 29 (72.5 %) patients sustained injury due to Road Traffic Accident and 11(27.5 %) patients sustained injury due to fall.
- Out of 40 cases,33 (82.5 %)cases were closed fractures and 7 (17.5 %) cases were open fractures.
- Open fractures were classified using Gustillo Anderson Classification and 6 (85.7%) fractures were type I and 1 (14.3%) fracture was type II compound fracture.
- A0/0TA was used to classify distal tibia fractures. Of the 40 cases 8 (20%) cases were A1,10 (25%) were A2,17 (42.5%) were A3,2(5%) were B1,2 were B2 and 1 was B3.
- Out of 40 cases 35 distal tibia fractures were associated with lower third fibula fracture.
- One patient had associated supracondylar femur fracture with humerus fracture.

Duration of fracture union:

Among the 40 cases of distal tibia fractures treated with locking compression plate 17 (42.5%) cases united in 14 weeks,12 (30%) cases united in 16 weeks, 10 (25%) cases united in 18 weeks and 1 (2.5%) case united in 20 weeks.

Duration in weeks	No of patients	Percentage
14	17	42.5
16	12	30
18	10	25
20	1	2.5
Total	40	100

Objective criteria:

Rating	Ankle/ Subtalar motion	Tibiotalar Alignment	Tibial Shortening	Chronic Swelling	Pronation/ Supination	Equinus deformity
Excellent	>75% Normal	Normal	None	None	Normal	None
Good	50-75 %	Normal	None	Minimal	Normal	None
Fair	25-50 %	<5 degree Angulation	<1 cm	Moderate	Moderate decrease	None
Poor	< 2 5 % Present	>5 degree angulation	>1 cm	Severe	Marked decrease	present

Subjective criteria:

Rating	Pain	Return to work	Recreational activity	Limited walking	Pain medication	Limb
Excellent	None	Same work	Normal	No	None	None
Good	Mild	Same work	Mild modification	No	None	None
Fair	Moderate	Modified	Significant modification	Yes	Non necrotic	Occasional
Poor	Severe	Unable	None	Yes	Narcotic	yes

Our study

Objective criteria

Results	No of cases	Percentage
Excellent	25	62.5
Good	7	17.5
Fair	5	12.5
Poor	2	5

Objective criteria

Results	No of cases	Percentage
Excellent	24	60
Good	7	17.5
Fair	6	15
Poor	3	7.5

COMPLICATIONS

Intra operative complications:

No complications encountered during the surgical procedure.

Post operative complications:

1. Superficial skin infections:

Four of the patients developed superficial skin infections, which were treated with daily dressings and appropriate antibiotics after pus culture and sensitivity. All these infections subsided on the above said treatment.

2. Ankle stiffness

There were ankle stiffness in 4 patients probably due to incompliance of patient to the advised physiotherapy. The range of movement of ankle joint in stiffness patient ranged from 200 to 400.

3. Skin Breakdown:

The majority of infections and wound breakdowns have occurred in patients with closed fractures who underwent open reduction and internal fixation with plates and screws. We had 2 cases of skin breakdown with exposed implant who was treated with

flap cover.

4. Anterior angulation:

There were 3 patients with anterior angulation of 50 who were closely followed up at regular intervals for any progressive deformity using both clinical and radiographic findings.

Complications	No of patients	Percent
Superficial skin infection	4	10
Ankle movement restriction	4	10
Anterior angulation	3	7.5
Skin breakdown	2	5

Discussion

Fractures of distal tibia are among the most difficult fractures to treat effectively. The status of the soft tissues, the degree of comminution sustained at the time of injury affect the long term clinical results. The goal of operative treatment is to obtain anatomic realignment of the joint surface while providing enough stability to allow early motion.

This should be accomplished using techniques that minimize osseous and soft tissue devascularization in the hopes of decreasing the complications resulting from treatment.

The present study was undertaken to determine the efficacy of the locking compression plates in treatment of the fractures of the distal tibia metaphysis.

In our study, 40 patients with fractures of the distal tibia were treated with locking compression plate by MIPPO technique and open reduction method

This technique has resulted in the effective stabilization of these fractures. It's angular stability represents an improvement of the internal fixation of the complex periarticular fractures. So It provides adequate stability and allows early motion.

Minimally invasive technique, though technically demanding, preserves the biological environment by decreasing soft tissue injury with better outcome in terms of radiological union and functional outcome.

The MIPPO technique allows rapid union, because it facilitates biological healing .Thus the good results in this method can be explained by a combination of rapid healing due to preserved vascularity and a greatest resistance of the plate to a fatigue, since the stress is distributed over a longer length.

So these technique improves the rate of fracture healing in addition reduces the overall incidence of infection, refracture and the need for autogenous bone grafting.

It is effective in extra articular fractures occurring within 5cm of the joint line, where intramedullary nails often do not provide enough stability.

With good knowledge of operative technique and careful preoperative planning, these plates represent excellent and safe procedure for difficult articular fractures.

It is a simple and rapid procedure, takes less surgical time in extra articular and intra articular fractures due to newer anatomically contoured locking compression plates.

These internal fixators can maintain, but not obtain the fracture reduction, so care should be taken to ensure a proper reduction before insertion of the locking screws.

Although, a larger sample of patients and longer follow up are required to fully evaluate this method of treatment, we strongly encourage its consideration in the treatment of such complex fractures.

Figures:

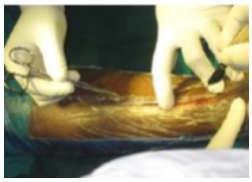
MIPPO Technique:

Skin Incision

Plate Insertion Epiperiosteal Plane

Skin Closure

Open Reduction:



Skin Incision

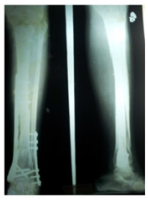
Fracture Reduction And Fixation

Skin Closure

Clinical And Radiological Outcome:

PRE OP AP AND LAT VIEW

IMMEDIATE POST OP



6 MONTHS POST OP

1 YEAR POST OP

1 YEAR FUNCTIONAL OUTCOME

Complications:

Skin Breakdown

Angulation

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