Original Research Paper

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Orthopaedics

TO STUDY THE OUTCOME OF MINIMALLY INVASIVE PERCUTANEOUS PLATE OSTEOSYNTHESIS USING MEDIAL DISTAL TIBIA ANATOMICAL LOCKING COMPRESSION PLATES FOR DISTAL TIBIA FRACTURES

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ABSTRACT

BACKGROUND - Distal tibia fractures are a common result of road traffic accidents and fall injuries. Distal tibia fracture is a therapeutic challenge in modern orthopedics. Due to fracture pattern, periarticular location, minimal soft tissue coverage, the surgical treatment is complex one.

METHOD – The study was conducted at department of orthopaedics K. B. Bhabha Municipal General Hospital Bandra (W) Mumbai for treatment of distal tibia fracture. This is a prospective study of 18 cases over period of 2 years (June 2017 – June 2019).

RESULT - 95% of our patients were males. 50% of our cases were extra articular and 50% intra articular fractures. 44% of the fractures were compound in nature. 44% of our cases had associated injuries. All our cases were followed for a mean period of 14.2 months averaging from 28 months to 4 months. Out of the 18 cases bony union was obtained in 17 cases. The results were excellent in 54%, good in 29% and fair in 17% of patients. The average ankle dorsiflexion was 20^0.

CONCLUSION– Minimally invasive plate osteosynthesis using LCP proves to be a safer technique in the management of distal tibial fractures without intra-articular comminution by providing good fracture healing, enabling rapid functional recovery and avoiding major skin complications.

KEYWORDS : Distal tibia fracture, Locking compression plate, Minimally invasive percutaneous plate osteosynthesis

INTRODUCTION

Treatment of distal tibia fractures has always been a challenge. Distal tibia is a superficial bone with less soft tissue coverage and blood supply. Various modality of surgical treatment such as closed intramedullary nailing, Open Reduction Internal Fixation with conventional plate osteosynthesis and external fixation has been tried so far. But none of them have good functional outcome but high complication rate .[1,2]

Closed intramedullary nailing of distal tibia fracture can be a good option in AO type A fractures but the hourglass shape of the distal tibia does not allow anatomical reduction resulting in rotational and angular malalignment. Closed nailing is not an option, if the fracture line is less than 5cm from the articular margin (Type B and C fracture).[3,4]

External fixation is indicated in severe soft tissue injury or as a temporary stabilizing device. Pin tract infection, malreduction and joint stiffness are the drawbacks of external fixation.[5,6]

Though open reduction and internal fixation with conventional plating provides anatomical reduction and addressing the rotational, angular malreduction.

It is associated with extensive soft tissue dissection and periosteal stripping which devitalize the fracture fragment resulting in nonunion, infection and wound dehiscence.

The newer technique of fixation of distal tibia fractures - minimally invasive percutaneous plate osteosynthesis involves less soft tissue handling and the minimal periosteal stripping resulting in low infection rate and faster healing. The precontoured anatomical locking plate used on the medial aspect prevents the varus collapse, implant failure and also secure the fracture reduction without further displacement[7,8]

MATERIAL AND METHOD

The study was conducted at department of orthopaedics K. B. Bhabha Municipal General Hospital Bandra (W) Mumbai for treatment of distal tibia fracture. This is a prospective study of 18 cases over period of 2 years (June 2017 – June 2019). In this study the outcome of minimally invasive percutaneous plate osteosynthesis (MIPPO) using medial distal tibia anatomical locking compression plates for distal tibia fractures were studied. In this study distal tibia fracture was classified according to AO/OTA classification [9] and Ruedi and Allgower classification[10] .

Inclusion Criteria

1) Distal tibia fractures involving the lower one third of tibial Metaphysis and metaphyseo- diaphyseal junction AO/OTA classification type A, B, C distal tibia fractures
2) Ruedi Allgower type II & III pilon fractures.
3) Simple fractures.
4) Age: 20-80 years

Exclusion Criteria

1) Type I ruedi-allgower pilon fracture.
2) Compound fractures.
3) Delayed presentation of more than three weeks.
4) Non-union distal tibia fractures.

METHODOLOGY

After initial resuscitation a meticulous history was taken and thorough clinical examination was done to rule out other associated injuries. Distal vascularity and neurological status should be assessed. Any open injury should be addressed vigorously with thorough wound debridement and stay sutures applied. Informed and written consent for the surgery and willingness to participate in the study are obtained from all the patients.

X-ray Ankle and Leg in AP/LAT/MORTISE view and CT of ankle with leg also done. Fracture classified according to AO and Rudi allgower classification. Medical and anaesthetic fitness was obtained for all the patients before surgery.

Choice of implant in this study was medial distal tibia anatomical locking plate for tibial fracture and one third tubular plate system for fibula fracture. Ideal time to operate distal tibia fracture by MIPPO technique is within seven days of injury before the fracture site become sticky and the evidence of wrinkle sign. Surgery was performed under spinal anesthesia, supine position and sand bag under the gluteal region.

Fibula is fixed first with one third tubular plate by open technique to achieve stable lateral fixation which helps indirectly to restore the length of tibia and avoid over distraction. After fixing the fibula fracture, reduction of tibia is checked under C-ARM, then it is fixed with minimally invasive percutaneous plate osteosynthesis. A transverse incision of about 1cm is made over the medial malleolus to access the medial malleolus, a subcutaneous tunnel is created using a periosteal elevator. After fracture reduction, a medial distal tibia

anatomical locking plate is slide under the soft tissue into the tunnel to bridge the fracture site, temporarily fix the plate with pins, check the position under C-ARM and finally fixed with locking screws. In post operative period the patients lower limb is immobilized in a above knee slab, Post-op IV antibiotics to cover gram positive and negative spectrum were given for 5-7 days, the sutures are removed in 12thday and at the end of 3 weeks the above knee slab is removed and ankle brace is applied. Initially to start with gentle ankle motion exercise then patient is allowed for non - weight bearing mobilization with the help of walkingaid. After 6 weeks, based on radiological union allow the patient to partial weight bearing. Full weight bearing advised once the fracture is united clinically and radiologically. The functional outcome is evaluated by clinical and radiological (AP/LATERAL) aspects at 6th week, 12thweek, 3rd month, 6thmonth and one year interval using Olerud Molander Ankle Questionnaire/ Score (OMAS).

OBSERVATION AND RESULT

The age groups varied from 21 years to 51 years with the mean age of 36.5 years. Incidence of fracture was observed maximum between 30-40 years of age. Among the 18 cases, males were predominant with female to male ratio being 1:17. Right side was common in our series in the ratio of 5:4.

The commonest mode of injury was road traffic accident. The study contains equal number of intra articular and extra articular fractures. Eight among the eighteen cases had associated injuries such as head injury, distal end radius fracture, distal femur fracture, patella fracture. Eight out of the eighteen cases were compound injury. There was a mean delay of 1 week for surgery. The mean time for bone union was 18 weeks.

Table 1 – Distribution of the study participants according to time for union.

Time of union	Number of cases	Percentage
< 16 weeks	11	66
16-24 weeks	4	23

Table 2 – Distribution of the study participants according to Olerud – Molander Ankle Score.

Olerud-Molander Ankle Score

Olerud- Molander Ankle Score	12thWeek	Percentage	24thWeek	Percentage
0-20	0	0	0	0
21-40	4	26%	0	0
41-60	2	14%	0	0
61-80	9	60%	3	21%
81-100	0	0	11	79%

In the present study, of the 18 cases; 9 (54%) of the cases observed excellent results and 5 cas

Table 3 – Distribution of the study participants outcome grading

Grading	No Of Cases	Percentage
Excellent	9	54
Good	5	29
Fair	3	17

In our study, there were 2 patients with delayed union, 2 patients with shortening and joint stiffness. We had marginal skin necrosis in 4 cases, they healed with regular dressings and none of the cases went for skin and soft tissue procedures.

DISCUSSION

Ruedi and Allgower were the pioneers in open reduction and internal fixation (ORIF) of pilon fractures. They changed the outlook of management of distal tibia fractures in the early twentieth century. They achieved 74% good functional results following ORIF for distal tibia fractures. But it was later recognized that all their cases were results of low velocity injuries. They could not reproduce similar results following the principles of open reduction internal fixation in high velocity injuries. This led to the development of procedures that respect the soft tissue envelope. These biological methods of fixation are currently the procedures of choice in the challenging distal tibia fractures. [1,10]

Two methods are currently popular in pilon fracture management. Hybrid external fixators are used in severely comminuted pilon fractures with significant soft tissue damage. Minimally invasive plate osteosynthesis, is used in fractures without articular comminution and with minimal soft tissue damage.

Helfet[16] et al introduced a 2 stage MIPO for distal tibia fractures. Stage 1 fibular internal fixation and spanning external fixation of tibia, stage 2, limited ORIF for distal tibia. 40% of their cases were intra articular fractures 60% were extra articular fractures. They had a 10% incidence of >5^0 valgus deformity and a 10% incidence of > 10^0 recurvatum deformity. The average ankle dorsiflexion achieved was 14º and plantar flexion was 42º.

In our prospective study of 18 cases of distal tibial fractures treated with MIPO using specially designed distal tibial LCP. We did medial plating in all cases.

The age group of our patients varied from 21 years to 51 years with the mean age of 36.5 years. 95% of our patients were males. 50% of our cases were extra articular and 50% intra articular fractures. 44% of the fractures were compound in nature. 44% of our cases had associated injuries.

We did not perform preliminary external fixation as in the Helfet et al.'s series. We selected patients with apparently good soft tissue condition. Thus a single stage MIPO protocol was followed thereby providing a shorter duration of treatment. This single stage procedure reduced the surgical insult thus preventing complications like wound dehiscence, sepsis, delayed or non-union. The MIPO technique enables a bridging fixation without disturbing the comminuted segments and the surrounding soft tissue. We used an anatomically prebent plate unlike Helfet et al. thus achieving stronger fixation in the metaphyseal region as it permitted insertion of 2 or 3 cancellous 6.5 mm screws in the small distal segment.

The mean duration between injury and surgery in our study was 1 week. The average time for bone union was 18 weeks.

We achieved 54% excellent, 29% good and 17% fair results. The average ankle dorsiflexion was 20^0. The incidence of complications Delayed union 11%, Shortening 11%, Ankle stiffness 11%, Valgus angulation 11%, Marginal skin necrosis 22%, Deep infection 11%. [12,13] All our cases were followed for a mean period of 14.2 months averaging from 28 months to 4 months. Out of the 18 cases bony union was obtained in 17 cases (one patient died during follow up). 2 cases had delayed union. The prime reason for delayed union in both the cases was intact fibula which made the fracture site to distract. There was no case of implant failure. The average time of bony union was 18 weeks compared to 18.5 weeks by Shrestha et al and 21.2 weeks by Hasenboehler et al. There were 2 cases that were complicated by ankle stiffness. Both the patients had poor compliance in the post operative period which was the result of ankle stiffness. Shortening of <2 cm was seen in two patients both of which had highly communited distal tibial fractures with diaphyseal extension. They were managed with heel raise. Though we had marginal skin necrosis in 4 cases, they healed with regular dressings and none of the cases went for skin and soft tissue procedures. [14,15]

CONCLUSION

Hence from our study, we conclude that minimally invasive plate osteosynthesis using LCP proves to be a safer technique in the management of distal tibial fractures without intra-articular comminution by providing good fracture healing, enabling rapid functional recovery and avoiding major skin complications.

Case Illustration
Case 1
Pre Operative X-rays

POST OPERATIVE X -RAYS

Post Operative Wound Condition

Post Operative X -ray **Fracture Union**

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