Evaluation of the functional outcome in distal tibia fractures managed by MIPPO technique using distal tibia locking plate

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Abstract

Introduction: Distal tibial fractures represent a significant challenge to most of the surgeons even today. They constitute 1-10% of all lower extremity fractures. Operative treatment is indicated for most tibial fractures caused by high energy trauma. Operative treatment allows early motion, and avoids shortening and other complications associated with prolonged immobilization. Minimally invasive percutaneous plate osteosynthesis (MIPPO) is a technique which aims to reduce iatrogenic soft tissue injury and damage to bone vascularity, as well as preserving the osteogenic fracture hematoma.

Material and Methods: In the present study, twenty four patients with extra articular tibia were operated with MIPPO with distal tibia medial locking plate over period of two years and the results were analyzed.

Results: At the end of the our study of 24 patients treated 14(58.3%) patients had excellent outcome, 5(20.8%) had good results, 4(16.7%) had fair outcome and 1(4.1%) had a poor result based on subjective result and 16(66.7) patients had excellent, 4(16.7%), 2 had fair(8.3%) and 2(8.3%) had poor result based on objective result according to scoring system designed by Ovadia and Beals.

Conclusion: Extra articular distal tibia fracture can be effectively treated with MIPO technique using medial distal tibia locking plate.

Keywords: Distal tibia fractures; MIPPO, Distal tibia locking plate

Introduction

Distal tibial fractures represent a significant challenge to most of the surgeons even today. They constitute 1-10% of all lower extremity fractures [1]. Controversy and debate continues to surround the management of fractures of the distal tibia [2]. Non-operative treatment can be technically demanding and may be associated with joint stiffness in up to 40% of cases as well as shortening and rotational malunion in over 30% of cases [3]. Operative treatment is indicated for most tibial fractures caused by high energy trauma. Operative treatment allows early motion, and avoids shortening and other complications associated with prolonged immobilization [4]. Conventional ORIF have been associated with complications like infection and delayed or non-union due to devitalisation of bony fragments and additional damage to the soft tissues [5]. Intramedullary nails often do not provide enough stability and external fixators which are usually applied for primary stabilization until soft tissue edema get subsided and delays the return to work.

Recently, the trend is towards use of a Locking compression plate for treatment of fractures of the distal part of the tibia [6, 7]. Compared with a conventional plate, a Locking compression plate imparts a higher degree of stability and provides better protection against primary and secondary losses of reduction and minimization of bone contact [8, 9]. Minimally invasive plate osteosynthesis (MIPO) is a technique which aims to reduce iatrogenic soft tissue injury and damage to bone vascularity, as well as preserving the osteogenic fracture haematoma [10]. This philosophy is especially applicable in the management of distal tibial fractures, owing to the vulnerable extraosseous-metaphyseal blood supply in the distal region of the tibia [11]. The purpose of this study was to evaluate the functional outcome, duration of union, advantages and complication following use of MIPO with LCP for meta-diaphyseal fractures of distal tibia.
Patients and methods

We undertook a review of 24 patients treated by MIPO (Minimal Invasive Plate Osteosynthesis) for unstable fractures of the distal tibia in MVJ Medical College and Research Hospital between June 2013 to June 2015.

Inclusion criteria
1. Adults (aged more than 18 years) males and females.
2. Complex extraarticular meta-diaphyseal fractures of the lower third of tibia.

Exclusion criteria
1. Open fractures
2. Intra articular fractures

The mean age of the study group was 40.8 years (Range 22-58). Out of 24 patients 21 (87.5%) are male patients and 3 (12.5%) were female patients showing increased male preponderance in view of travelling, working in fields and factories. In our study 17 patients (70.8%) sustained injury following RTA and 7 patients (29.1%) sustained injury following fall from height.

The fracture pattern was classified based on Rudie and allgower classification for fractures of distal tibia. Of the 24 cases studied, 5 are A1, 8 are A2, 11 are A3. 16 out of 24 cases studied had an associated fracture of the lower third of fibula and 2 had upper third fibula fracture.

Local examination of the injured extremity revealed swelling, deformity and loss of function. Palpation revealed abnormal mobility and crepitus at the fracture site. Distal neurovascular status was assessed by the posterior tibial artery and dorsalis pedis artery pulsations, capillary filling, local temperature, pallor and paraesthesia.

Antero-posterior and lateral radiographs of the affected leg along with ankle were taken and the fracture patterns were classified. The limb was then immobilized in an above knee plaster of Paris slab till definitive fixation with locking compression plate done.

All the cases were taken for early primary fixation with locking compression plate. 3 cases were delayed for 10 days due to swelling and those cases were operated after appearance of wrinkle sign.

Surgical Technique

Medial approach is most commonly used for the Mipo technique. Plate inserted from distal to proximal through epiperoisteal tunnel between periosteum and intact soft tissue. Fracture is reduced by indirect maneuvers using ligamentotaxis and directly by percutaneous reduction maneuvers. Using another drill sleeve as manipulator at proximal end the plate is fixed using locking cortical locking screws inserted in one of the distal holes just above ankle joint approximating the plate to bone which prevents overlying soft tissue irritation. Fracture reduced by closed reduction maneuvers.

ORIF of fibula was part of first stage of fixation, which aids reduction of tibia. Epiperoisteal tunneling made towards the diaphysis by blunt tip of plate or tunneling instrument. Plate is inserted from distal to proximal on anteromedial surface using drill sleeve as plate manipulator. Fracture is by passed and plate is first adjusted to periarticulararea and locking screws inserted in one the distal holes just above ankle joint following fall from height.

Post-operative regimen

Non-weight bearing of the patient using standard walking frame and ankle range of movement exercises was done from the first post-operative day under the supervision of a physiotherapist. Intravenous antibiotic regimen was continued for 3 days after the surgery. Suture or staple removal was done at 10th-12th post operative day.

Follow up

The patients were followed up at intervals of two weeks, 4 weeks, 6 weeks, 3 months, 6 months, 10 months and 12 months to assess the radiological union. After the 1st follow up of 4 weeks patient is allowed to partially bear weight. The fracture was designated as united, when there was periostal bridging callus at the fracture site at least in three cortices in the antero-posterior and lateral views. Trabeculations extending across the fracture site was also taken into consideration.

Patients were assessed at the end of follow up period according to the scoring system designed by Ovadia and Beals which includes both objective and subjective evaluation of the patients.

Results

All the fractures united with an average of 16 weeks. There were 2 delayed union with 20 weeks signs of radiological callus formation. Fractures of 10 (41.7%) patients united in 14 weeks, 6 (25%) patients united in 16 weeks, 6 (25%) patients united in 18 weeks and 2 (8.3%) patients united in 20 weeks. All cases fibula fracture healed without complications.

Objective and subjective criteria

<table>
<thead>
<tr>
<th>Rating</th>
<th>Ankle/ subtalar motion</th>
<th>Tibiotalar alignment</th>
<th>Tibial shortening</th>
<th>Chronic swelling</th>
<th>Equines Deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>&gt;75% normal</td>
<td>Normal</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Good</td>
<td>50-75%</td>
<td>Normal</td>
<td>None</td>
<td>Minimal</td>
<td>None</td>
</tr>
<tr>
<td>Fair</td>
<td>25-50%</td>
<td>&lt;50 angulation</td>
<td>&lt;1cm</td>
<td>Moderate</td>
<td>None</td>
</tr>
<tr>
<td>Poor</td>
<td>&lt;25%</td>
<td>&gt;50 angulation</td>
<td>&gt;1cm</td>
<td>Severe</td>
<td>Present</td>
</tr>
</tbody>
</table>

Table 2: Objective criteria

<table>
<thead>
<tr>
<th>Rating</th>
<th>Pain</th>
<th>Return to work</th>
<th>Recreational activity</th>
<th>Limited walking</th>
<th>Pain medication</th>
<th>Limp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>None</td>
<td>Same work</td>
<td>Normal</td>
<td>No</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Good</td>
<td>Mild</td>
<td>Same work</td>
<td>Mild modification</td>
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<td>None</td>
</tr>
<tr>
<td>Fair</td>
<td>Moderate</td>
<td>Modified</td>
<td>Significant modification</td>
<td>Yes</td>
<td>Non narcotic</td>
<td>Occasional</td>
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<tr>
<td>Poor</td>
<td>Severe</td>
<td>Unable</td>
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<td>Yes</td>
<td>narcotic</td>
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Table 3: Objective Results

<table>
<thead>
<tr>
<th>Results</th>
<th>No of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
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<td>66.7</td>
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<tr>
<td>Good</td>
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<td>16.7</td>
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<tr>
<td>Fair</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Poor</td>
<td>2</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Table 4: Subjective Results

<table>
<thead>
<tr>
<th>Results</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>14</td>
<td>58.3</td>
</tr>
<tr>
<td>Good</td>
<td>5</td>
<td>20.8</td>
</tr>
<tr>
<td>Fair</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Poor</td>
<td>1</td>
<td>4.2</td>
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</table>

Post-operative complications

Three of the patients developed superficial skin infections, which were treated with daily dressings and appropriate antibiotics according to the culture and sensitivity reports. All the infections subsided on the above said treatment. We had 1 patient with ankle stiffness, probably due to the lack of compliance to the advised physiotherapy at home after discharge of the patient. Ankle stiffness ranged from restriction of ankle movement from 20-40%.

Radiographs

CASE 1
Discussion

Fractures of the distal tibia were among the most difficult fractures to treat effectively. The status of the soft tissues, the amount of comminution sustained at the time of injury affect the treatment modality and the long term clinical results. The primary goal of operative treatment is to anatomically align the fractures fragments while providing enough stability to allow early motion. This is achieved with minimal bony and soft tissue devascularisation in order to decrease the complications resulting from the treatment. Gao et al. studied 32 adult patients with very short metaphyseal fragments in fractures of distal treated with a polyaxial locking system. The polyaxial locking system shown results of 87.3% excellent to good functional out come with American Orthopedic Foot and Ankle Society score which offer more fixation versatility, may be a reasonable treatment option for distal tibia fracture with very short metaphyseal segments [12]. Hazarika et al. studied a series of 20 patient of distal tibial fracture treated using locking compression plates through MIPO technique. This provided 87.5% of good to excellent results. Fractures were classified according to the AO system and performed as scored stage surgery after sterilization with external fixators primarily [13]. At the end of the our study of 24 patients treated 14(58.3%) patients had excellent outcome, 5(20.8%) had good results, 4(16.7%) had fair outcome and 1(1.2%) had a poor result. Cory collinge et al. had an average union of 21 weeks [14] and Abid mushaq et al had an average of 22 weeks [15]. Our study had an average fracture union of 16 weeks which were comparable with studies conducted using the locking compression plates

Conclusion

According to this study, 24 patients with fractures of the distal tibia which have undergone closed reduction through MIPO techniques and application of the locking compression plates states that this technique has resulted in strong and effective stabilization of these fractures. It does provide excellent stability and allows early range of motion at ankle. The closed reduction not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment and helps to achieve near normal anatomical reduction of the fracture. Its greatest advantage is closed reduction and internal fixation with locking compression plates in near normal anatomical reduction where the fracture hematoma is not disturbed much. It is effective in extra articular fractures where it is a simple, has a rapid and straight forward application and has a reduced surgical time in extra articular fractures due to newer anatomically contoured locking compression plates for the distal end tibia fractures.

Reference