
CASE SERIES**Minimal Invasive Percutaneous Plate Osteosynthesis for Distal Tibial Fractures: A Prospective Study***Nitin Samal^{1*}, Sanjay Deshpande¹, Vasant Gawande¹, Romil Rathi¹**¹Department of Orthopaedics, Jawaharlal Nehru Medical College, Sawangi (Meghe) Wardha-442 005 (Maharashtra) India*

Abstract:

Background: Fractures of distal tibia and pilon fractures are one of the most common fractures and are difficult to treat on account of, absence of muscle tissue attachment on lower ¼ tibia and metaphyseal cancellous comminution. Most of them are compound fractures and result in poor blood supply to the distal tibia. The conventional technique of Open Reduction and Internal Fixation (ORIF) with plating of distal tibia fracture requires wide exposure, extensive soft tissue stripping with subsequent risk of infection and skin necrosis. Minimal Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique avoids all of the above and hence is associated with better functional results. *Aim:* The purpose of the study was to assess the complications and treatment outcome of closed extra-articular distal tibia fracture. *Material and Methods:* The results of the management for 50 patients with closed extra-articular distal tibia fracture percutaneous plating were reviewed prospectively. The variables included Arbeitsgemeinschaft fur osteosynthesefragen (AO) classification of tibia fracture, the mean duration of union, malunion, and nonunion. *Results:* The most common type of fractures seen were A1 type observed in 33 patients. Initial union occurred in 44 patients. 2 patients had superficial wound infection and 1 had deep infection in plating group while the rest of 3 patients had other complications. None of the patients had restriction in knee and ankle motion. All fractures healed within one year. There was no fracture malunion. *Conclusion:* The use of indirect reduction techniques and small incisions to insert hardware is technically more demanding and requires strict radioscopic control throughout the procedure, but it considerably decreases surgical trauma to the soft tissues.

Keywords: Distal Tibia, Minimal Invasive Plate Osteosynthesis, Open reduction and fixation.

Introduction:

The surgical treatment of fractures has evolved a great deal since the development of the original “Open Reduction and Internal Fixation (ORIF)” technique by the Arbeitsgemeinschaft fur osteosynthesefragen group. To obtain maximal mechanical stability in fracture exact anatomical reduction and strict rigid fixation were emphasized in the beginning [1]. This however can rarely be obtained without significant dissection of the surrounding soft tissues. Well-known complications like infection and delayed or non-union are frequently attributed to the devitalisation of bony fragments and additional damage to the soft tissues [2]. Reports from various institutions suggest treatment modalities ranging from minimally invasive technique, Open Reduction and Internal Fixation (ORIF), Intramedullary Nailing, Hybrid or ring external fixation [2-5, 8-14]. These treatment modalities are associated with their benefits and complications. Evidence shows that ORIF can often be complicated by infection and wound infection using plate and plate osteosynthesis. More and more, new insights in reduction techniques and fracture healing lead to the development of “Minimal Invasive Percutaneous Plate Osteosynthesis”. The emphasis now lies on indirect reduction, axial alignment and stable fixation without disturbing the fracture environment and thus preserving most of the vascularisation and fracture haematoma [3].

Material and Methods:

A prospective study of 50 patients with closed intraarticular or extraarticular fracture of distal fourth tibia was done to study the outcome of treatment by MIPPO. Out of 50 patients, 38 were males and 12

were females. The patients were in between the age group of 20 to 50 years with an average age of 35-36 years. Mode of injury in most of the patient's was fall from height in 22 patients (55%), vehicular accidents, 28 patients (40%) resulting in twisting and compression injury around the ankle.

Our protocol in management of distal tibia or pilon fracture consisted of immediate reduction with temporary skeletal traction. Elevation of the fractured limb was given on bohler's brown splint to reduce the swelling. X-rays were taken of fracture including both the joints. Further radiological investigations like CT scan were avoided because of poor socio-economic condition of the patients. Open injuries were treated with intravenous antibiotics, adequate wound debridement and lavage prior to any definitive fixation. Fractures were considered healed when mature bridging callus was identified on two views and patients reported no pain on full weight bearing. All fractures were classified using the AO classification while final evaluation was done for distal tibial fractures as per Teeny and Wiss clinical assessment criteria which was based on 100 points system [5].

Results:

Most of the patients were in age group of 20-40 years (70%) with mean age of 36 years. Road traffic accidents were found to be the commonest mode of trauma (65%). Right lower limb was involved more often (60%) than the left.

The time taken for partial weight bearing was 6-8 weeks and for full weight bearing was 10-12 weeks. The mean interval for radiological union was 12 weeks. The range of motion at the ankle and knee was started from the post-operative day one. Superficial infection was seen in twelve patients, but ultimately it healed before the patient was discharged by culture sensitive and broad spectrum antibiotics (Fig. 1).

There was no-fracture due to rigid fixation. There was no chance of vascular complication as the insertion of the plate was in sub muscular plane on the medial surface through limited incisions. There was no need of any special instruments and was less time consuming and cost effective. The hospitalisation time was less thus being beneficial to the poor socio economic patients also. No varus deformity was seen after or during weight bearing.



Fig. 1- 30 Year Old Male Patient with Distal Tibial Fracture



Fig. 2 & 3- Post-Operative X-Ray of the same Patient



Fig. 4- Clinical Photo with Full Ankle Movement & Skin Condition of the same Patient



Fig. 5 and 6 - Showing 2 Months Post-Operative and Lateral X-Ray of Patient



Fig.1, 2& 3- 40 Years Patient with Pre-Op and Post-Op Distal Tibial Fractures and Inter-Fragmentary Screw



Fig. 4. Post-Op 3 Months Follow Up of Other Patient



Fig. 7 and 8 -Showing 6 Months Post-Operative of Patient Evidence of Fracture Union



Fig.9 and 10- Showing Incisions and Making Space for Subcutaneous Plate Insertion



Fig.11 - Showing Plate Insertion and Temporary Plate Fixation with 2 K-Wires after Reduction of Fracture followed by Locking Screws

Discussion:

Conventional ORIF is associated with extreme operative dissection leading to complications like deep infection, skin flap necrosis; ankle stiffness ultimately leading to ankle arthriti. MIPPO avoids extensive dissection and periosteal stripping. A small incision is needed for plate insertion thus aiding early wound healing causing less wound complications. Biological fixation without disturbing fracture hematoma also aids in achieving early union. The principles of MIPPO have been elaborately elucidated by Sirkin et al (CORR 2000). They have advocated the use of longer plates (for improved mechanical leverage) and fewer screws (to avoid unnecessary bore and soft

tissue damage). Lag screws are preferably inserted through the plate to avoid excess soft tissue stripping. By this technique plate becomes a load bearing implant till callus appears. In our study, long plates and minimal cortical screws are used to achieve stability. In our opinion the Recon / AO L.C.P. plate used for MIPPO fixation act mainly on the principle of bridge or span plate. Reconstruction plate is not strong plate enough to allow lag screw fixation through plate as they might cause loss primary reduction if contouring is not proper. Locking compression plate always has gap between bone and plate, and in case lag screw is used to fix the two fragments the screw will break. So we put cortical screw which brings the plate closer to the bone.

In the past, conservative means of treatment was commonly advocated [5]. Leach et al [1] advocated ORIF of the fibula and non-operative management of the tibia. Rouff et al [2] advocated ORIF of the fibula and limited internal fixation of the tibial fragments. McFerran et al [3] investigated complications in 52 tibial plafond fractures most of which were treated by ORIF. Overall 54% incidence of local complications and 8 of 11 open fractures were associated with complications. Teeny and Wiss [5] have encountered 37% infection rate in fractures treated by ORIF and 26% required ankle arthrodesis. They reported poor results in 67% of fractures treated with ORIF. Watson et al [6] analyzed 39 tibial pilon fractures with variety

of external fixation devices. They have found 64% of failures consisted of malunion or non-union of diaphyseal–metaphyseal junction.

The L.C.P plate has an advantage of two plate systems i.e. conventional D.C.P. along with fixed angle locking compression plating. The plate definitely has an advantage over other plates in form of not requiring accurate contouring of the plate for fixation, and prevention of loss of primary and secondary reduction, good fracture healing and less stress shielding as there is no plate bone contact resulting in less subperiosteal damage to cortex.

Conclusion:

The technique of MIPPO is relatively safe and effica-

cious modality of the treatment for distal fourth tibial fractures with following advantages:

- (1) Biological reduction with least disruption of soft tissue and fracture hematoma
- (2) Early ankle mobilization leading to complete restoration of joint motion.
- (3) Reduced surgical time and tourniquet time along with smaller incision.
- (4) Reduced incidence of wound complications.
- (5) Early union of fracture.
- (6) No incidence of varus deformity.

We recommend the MIPPO technique as a standard mode of treatment for all distal tibia and pilon fractures.

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