

Minimally Invasive Plate Osteosynthesis in Distal Tibial Fractures.

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Abstract : The concept of biological osteosynthesis refers basically to the conservation of vascularity of the bone during surgical intervention to ensure the continued vitality of the individual fragments and to achieve improved fracture healing. Distal tibial fractures are difficult to control with an intramedullary device, increasing the frequency of malalignment. Also, Metaphyseal comminution is a challenge to conventional plate fixation. The present study was carried out for evaluation & analysis of the role of Minimally Invasive Plate Osteosynthesis (MIPO) in cases of distal tibial fractures. Total of 40 patients were taken up & after proper pre-operative assessment, plating was done and the results were evaluated. On the basis of the finding of this study it was concluded that: MIPO technique preserves most of the osseous vascularity thus providing for a more biological repair.

INTRODUCTION

Treatment of distal tibial fracture with or without articular extension is challenging because of its unique anatomical characteristics of subcutaneous location with precarious blood supply and proximity to the ankle joint. Most of these fractures are managed with an operative intervention such as closed reduction and intramedullary interlocking (IMIL) nailing or open reduction and internal fixation (ORIF) with plating or closed reduction and per cutaneous plating or external fixators. Each of these techniques has their own merits and demerits. IMIL nailing has been reported with higher rate of malunion because it is difficult to achieve two interlocking screws distally.^{1,3} Wound infection, skin breakdown and delayed union or non union requiring secondary procedures like bone grafting are some of the complications associated with conventional osteosynthesis with plates.^{4,7} Similarly, pin tract infection, pin loosening, malunion and nonunion leading to osteomyelitis is potential complication of external fixators and hence not preferred as definitive fixation method.⁸⁻¹¹

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. In order to improve fracture healing, more "biological" methods have been developed over the last decades trying to lessen the surgical dissection, preserving the blood supply to the bony fragments and containing at least partially the fracture haematoma. 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, containing all necessary growth factors for bony healing.

Recently, techniques of closed reduction and minimally invasive plate osteosynthesis (MIPO) with locking compression plate (LCP) has emerged as treatment alternative. When applied subcutaneously, LCP does not endanger periosteal blood supply, respect fracture haematoma and also provides biomechanically stable construct.^{12,13}

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Minimally invasive techniques in distal tibial fractures are technically feasible and may be advantageous in that it minimizes soft tissue compromise and devascularization of the fracture fragments^{14,15}. This technique involves conventional open reduction and internal fixation of the associated fibular fracture when present, followed by minimally plate osteosynthesis of distal tibia utilizing precontoured plates and percutaneously placed screws. In minimally invasive technique, the operative exposure and soft tissue stripping are minimized with vascular pedicle preserved throughout¹⁶.

MATERIAL AND METHODS

40 patients of distal tibial fractures admitted in Rajindra hospital, Patiala, were operated by minimally invasive plate osteosynthesis and results were observed. Fractures were classified according to AO/OTA classification system.

Under regional or general anesthesia, involved leg was prepared and draped. Tourniquet was routinely applied but inflated only when necessary. Open reduction and internal fixation of fibular fracture, if present, was initially performed with the help of a 1/3rd semitubular plate through the lateral approach. The attention was then directed to the tibia and the articular fragments were anatomically reduced by percutaneous method, utilizing fluoroscopy and pointed reduction forceps. A 2-3 cm incision was made along the antero-medial aspect of the tibia, proximal to the fracture and distally at the level of the medial malleolus. Typically, a subcutaneous tunnel was created between the two incisions and along the medial aspect of the tibia by blunt dissection using a periosteal elevator. Pre contoured low metaphyseal LCP was tunneled into subcutaneous plane and its position was reconfirmed with C arm. Before fixing the plates with screws, shagging of distal fragment was prevented by putting towel roll under the fracture site. Provisional non locking screw was applied to bring the plate on the bone. If necessary, interfragmentary compression was achieved by a screw through the plate or outside the plate. Compression osteosynthesis was achieved in simple fracture by using non locking screw on proximal to fracture site as a hybrid fixation.¹⁷ At least 3 screws were then placed at either side of fracture through the two incisions and in the mid position via small percutaneous stab incisions. Skin was closed with non absorbable sutures and limb was



Fig. 1 : Showing Preoperative and postoperative X-ray



Fig. 2 : Showing Preoperative and postoperative X-ray

splinted with below knee brace or posterior back slab.

Post-operative check x-rays was taken to assess the reduction. Partial Weight bearing was initiated depending on the clinical and radiological evaluation. Full weight bearing was not permitted until consolidation of the fracture site. The progress of healing was assessed with routine anteroposterior and lateral radiographs at 4 weekly intervals up to 24 weeks, then every 3 months up to one year, and 6 monthly thereafter. Bone union was defined as bridging callus across the fracture site on both anteroposterior and lateral radiographs in the absence of migration, loosening or breakage of hardware, and a painless fracture site during weight bearing. Clinical and functional outcomes were assessed using Tenny and Wiss clinical assessment criteria for fractures around ankle joint.¹⁸



Fig. 3: Showing Dorsiflexion & Plantar flexion at Ankle

RESULTS

In this study mean age of patients was 36.2 years (range 22-50). Of the 40 patients, 24 were males and 16 were females. Road traffic accidents was the commonest mode of trauma. Mean time

of radiological union is 15.2 weeks (range 12-24 weeks).

In this study, The range of motion at ankle on average was 15.2 degrees of dorsiflexion (range 10-20 degrees) and plantar flexion averaged 25 degrees (range 15-35degrees).

The overall results were tabulated into four groups i.e excellent, good, fair and poor, according to the criteria laid down by Tenny and Wiss clinical assessment criteria¹⁸ which are based on 100 points system. The results were excellent in 19 cases, good in 18 cases and fair in 3 cases. No case of distal tibial fracture with this technique had a poor result.

Overall there were 3 cases who had early infection; all three were superficial, that healed after appropriate antibiotics and antiseptic dressing. There was one patient presented with late infection, that was superficial, patient was diabetic in nature. The patient was treated by a course of antibiotics and antiseptic dressing that subsequently progressed to uneventful bony union. The rehabilitation was not affected by late infection.

Out of total 40 cases, there was no pain in 31 cases; 5 cases had mild pain with walking or running, but no change in activities of daily living and 4 had Slight pain after long walks or sports or mild pain at end of day. 3 patients had varus angulation of $>5^{\circ}$. One case of delayed union which was managed conservatively. There was no case of non union.

DISCUSSION

MIPO technique has become widely practised in the operative management of articular, metaphyseal and transitional zone fractures over the last few years¹⁹. It has the advantages of respecting soft tissue via small skin incisions, minimal surgical dissection, indirect fracture reduction and minimal hardware application. As a result, healing time is accelerated, and complication rates are low²⁰. MIPO is easy to insert and gives better results with respect to alignment correction. Mechanism of action depends on principles of "biological internal fixation" where the aim is to produce the best biological conditions for healing rather than absolute stability of fixation which usually requires a fairly extensive surgical approach to the bone. This takes advantage of indirect reduction of the fracture and application of a bridging plate with minimal screw insertion through stab incisions to fix the plate.

Advantages cited for MIPO are:²¹

1. Simpler technique and easy to master. Learning curve short.
2. No need of additional expensive instrumentation.
3. Improved rates of fracture union.
4. Decreased infection rate.
5. Decreased need for bone grafting.
6. Ideal technique for dealing with the multiply injured patients.
7. Early mobilization of the extremity possible
8. Decreased incidence of refracture after plate removal.

In the present study, overall results were tabulated into four groups i.e excellent, good, fair and poor, according to the Tenny and Wiss clinical assessment criteria for fracture around ankle joint. Out of 40 cases, 37 cases had an acceptable result (i.e 19 excellent and 18 good), whereas 3 cases had fair result. Vasu Pai, Gareth Coulter and Vishal Pai²² in their study of minimally invasive plate fixation of the distal tibia reported excellent results in 11 patients, good in 9, fair in 2 and poor result in one patient.

CONCLUSION

MIPO technique is an effective method of treatment for fractures of the distal tibia. The use of indirect reduction techniques and small incisions decreases surgical trauma to soft tissues. Technique preserves most of the osseous vascularity and fracture hematoma thus providing for a more biological repair. There is rapid fracture consolidation due to preserved vascularity. There are fewer incidences of delayed union and non-union. There is a decreased need for bone grafting and incidence of infection is less due to limited exposure.

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