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Research Paper

Results of Minimally Invasive Plate Osteosynthesis (Mipo) with Anatomical Distal Medial Plate for Distal Tibial Metaphysical Fractures

Medical Science

KEYWORDS : Minimally Invasive Plate Osteosynthesis, Distal Medial plate, Distal Tibia Fracture

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Introduction

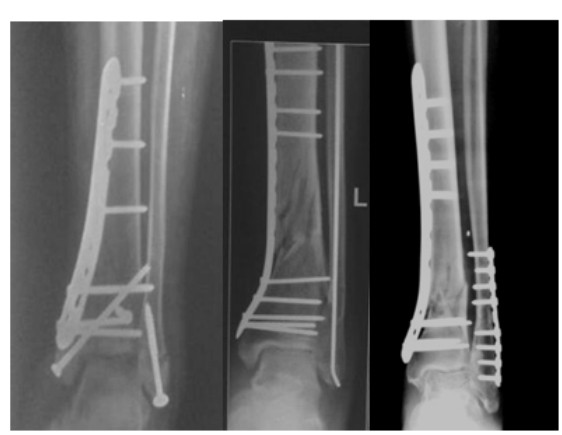
Lower end tibia is a subcutaneous bone with less vascular as compared to other bones. So fracture of lower end of tibia with or without intra articular extension is a management dilemma. Multiple methods for management are available with their own problems. Treatment modalities are conservative, closed nailing, external fixation or minimally invasive plate osteosynthesis. In conservative management with cast will cause stiffness and malunion. Intramedullary nailing is indicated in limited cases, it is also associated with malunion with varus or valgus deformity at ankle. External fixation is used as temporary or definitive treatment depends on soft tissue injury. External fixation used as definitive treatment when there is a severe soft tissue injury or open injury. It is also used as temporary bases to reduce oedema but it may lead to mal-union, non-union or pin tract infection. Open reduction and internal fixation is one conventional method but it will cause extensive soft tissue damage, devitalise the fragments and will ultimately leads to delayed union, skin healing problem, infection or implant failure. 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. This 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.

Material and methods:

In this study, we retrospectively evaluated clinical, radiological results and complications of 24 patients of distal tibial metaphysial fracture treated with Minimally Invasive Plate Osteosynthesis with distal medial tibial plate fixation. Out of 24 Patients, 14 were male patients and 10 were female paitents. 24 patients with exrtra or intra-articular distal tibial fracture were selected. Following trauma patients were given immobilisation in form of below knee splint. Patients were kept under observation to reduce oedema by wrinkle sign. 7 patients with open injury were treated initially by temporary external fixator to reduce oedema and for soft tissue healing. After reduction of oedema, patients were treated by definitive fixation.

Patient is placed supine on a radiolucent table, a support cushion is placed beneath the ipsilateral leg to elevate affected limb for feasible on lateral view on iitv and a pneumatic tourniquet is applied to the proximal thigh. The entire lower limb are prepared and draped in the usual sterile fashion. After exsanguinating the limb, the tourniquet is inflated. Initial attention is directed on fracture extension above and below on iitv , depend on that we take size of distal tibial anatomical plate. We choose the plate that at list three screws purchase the bone above the proximal fracture line. Medially a 3 cm incision is put over centre part of medial malleolus safeguarding the saphenous vein anteriorly. Cob's elevator is passed submuscularly above the periosteum over the medial tibia. We fix the locking drill seleve on locking screw side on the distal side of plate to easly pass the plate through submuscular plane. Check the position of the plate under fluoroscopy in both anterioposteior and Lateral view so it lies along the medial aspect of the tibia .some times we use pointed reduction clamp for reduction of fracture fragment, if fracture is not reduced with traction or spiral oblique type fracture, we fix proximal end and distal end of plate with 1.5mm k wire through small hole of plate. Percutenous stab incision over proximal end of plate is put for 3.5 mm cortical screw under iitv guidance. First proximal 3.5mm cortical screw is inserted and then one distal 3.5mm cortical screw is inserted to make the plate flush to the bone. In this way the distal metaphyseal articular fragment can be indirectly reduced to the proximal shaft by anatomical shape of the plate. If needed we can put lag screw across the fracture planes to maintain the reduction, to provide interfrgmentry compression, and to increase the stability of the construct. 3.5 mm cancellous locking screw on distal end of plate at least four in number and atleast four 3.5mm cortical screw on proximal end of plate are kept. The surgical incisions are irrigated and closed. Fibula was fixed according to fracture pattern by plate, malleolar screw or by nail. Sterile dressings are applied and the limb is immobilized in a well padded posterior splint with the ankle maintained in the neutral position for reducing oedema.

All patients receive 48 hrs of preoperative prophylactic antibiotics .Post-operatively the limb is maintained in the elevated position while the patient is in bed and toe movement begun. We start non weight bearing mobilization with walker once stitched removed. Stitch removal was done ten to twelve post operative days. Patients were followed up after one and half month and then every monthly to see the clinical and radiological union and complication.



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Lower end tibia fracture with tibia fibula fixation

Results:
In our study, 14(58.3%) male and 10(41.7%) females with an average age of 38.25 years. Average injury – surgery time was 5 days (2-12 days). Surgery was delayed to reduce oedema and soft tissue healing to prevent complications. We had seven patients of open injury who were initially treated with external fixator and conversion to internal fixation is done when skin condition permits. Out of which, one patient was having Gustillo Anderson open grade -3 A injury with lower third fibula crushed and directly exposed to exterior. This patient initially treated by debridement, irrigation and external fixation for one and half months for skin healing. In our patient, Average union time was 18.5 weeks (14-28 weeks). Two cases went in delayed union and were treated with bone grafting. Out of which one patient came with broken implant treated with revision plating and bone grafting which ultimately led to union. 22(91.7%) patients achieved full range of motion within one month of operation. All patients achieved functional range of motion of ankle. No patient developed varus or valgus malunion. Hardware prominence is discomfort along the medial aspect of the tibia. Implant removal were done in 3 patients due to irriation of medial malleolar skin. 2 patients developed local infection at proximal screw site which ultimately led to implant removal at the end of union.

Discussion:
Collinge and Sanders[1] have described indirect fracture reduction and percutaneous plating techniques for the lower extremity, as an evolutionary step in biological plating. Borrelli et al[2] have demonstrated that the distal metaphyseal region of the tibia has a relatively rich extraosseous blood supply, provided primarily by branches of the anterior tibial and posterior tibial arteries. They also demonstrated that open plating in this region produces significantly greater disruption of this extraosseous blood supply than minimally invasive plate application. Lower end tibia is also not surrounded by muscles so it is less vascular bone as compared to other bones. Redfern et al [3] and Borg et al[4] reported good results for MIPO, using closed, indirect reduction and contoured dynamic compression plates for distal tibial fractures. So by passing submuscular MIPO plate placed over the periosteum help in achieving biological union without hampering blood supply of lower end of tibia.

Helfet et al[5] described their experience with MIPO in 20 closed pilon fractures and advocated routine use of external fixation acutely, followed by definitive fixation 5—7 days later once the swelling has subsided. In our study average injury—surgery time was 5 days (2-12 days). This delay was for reduction of oedema and improving of soft tissue condition before definitive fixation. And whenever required we applied temporary external fixator before definitive fixation. Despite prolonged usage of the fixators in many of our cases, there was no documented evidence of pin-site sepsis occurring at any point, especially at the time of definitive surgery.

Average union time was 18.5 weeks (14-18 weeks). Usually lower end tibia is a less vascular bone. And primary union is taking place at this site. So it will take long time for radiological signs of union. Callus is usually not seen. Clinical judgment is very important in form of pain relief, no fracture site tenderness and absence of post operative edema. But we allowed partial to full weight bearing only after radiological union to avoid implant failure. In our study one patient with comminuted distal tibia fracture presented with broken implant at 6th month follow up. This was due to early weight bearing before union. This patient was treated with bone grafting and revision plating which ultimately led to union. Redfern et al permitted their group of patients to fully weight bear based on clear radiological evidence of callus formation and clinical evaluation. Patients progressed to full weight bearing prior to fracture union.

Advantage of this anatomical plate is that we can insert multiple locking screws near ankle joint so that we can mobilize ankle early. In our study 22 patients achieved full range of motion within 1 month and all the patients achieved full functional range of motion.

Open fractures of the distal tibia, in the presence of severe skin, bone and muscle damage have been associated with a poor prognosis. This is secondary to the major rates of infection, nonunion and amputation especially in Gustilo type 3B and C fracture. In our study of 7 patients out of 24 were open fractures. In two of them developed delayed union and two patients with chronic discharging sinuses. None of them had other major complications. Our encouraging results are preserving the soft tissue viability and bone vascularity, through delayed fixation and by minimally invasive surgical technique. In study of Hazarika et al[6] 2 out of 12 patients of delayed wound breakage in distal tibia fractures treated by 4.5mm DCP. it may due to 4.5 mm DCP have been attibuted to the bulkiness of the implant an incidance of metal work discomfort along the medial aspect of the tibia. In our study no case of wound break down due to irritation of skin, may be due to low profile of anatomical plate as compared to DCP. But irritation of skin is a major problem with anatomical plate. Development of pressure sores over the distal end of the plate, especially when under a plaster or fracture boot. Plate prominence under the skin of the medial ankle and distal tibia, with the two types of locking implants used, may will be a factor in the delayed wound complications that we reported.

Conclusion:
MIPO distal tibial plating is an excellent method as far as functional, clinical and radiological outcome is concerned by providing biological stable fixation, without hampering blood supply of lower end tibia and early mobilization. Delaying the surgery by few days and giving support by external fixation prior to definitive fixation gives better clinical outcome and reduce the complication .However medial skin irritation and skin healing problems are to be kept in mind especially in a case of open injury and extensive soft tissue oedema.

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