

MIPPO in Distal Tibial Fractures: Differences in Outcome of Intraarticular vs Extraarticular Fractures

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Abstract

Introduction: Minimally invasive surgery has well established role in present day orthopedics. It has achieved a great success in minimising a variety of complications especially those related to soft tissues. The present prospective study compared the outcomes of minimally invasive percutaneous plate osteosynthesis (MIPPO) for intraarticular versus extraarticular closed fractures of distal tibia with thirty patients of each group.

Methodology and Results: Two groups of patients (intra articular vs extraarticular) each consisting of 30 patients operated by MIPPO technique were followed for two years. Patients were operated with MIPPO using locking plate using standard technique of indirect reduction after initial stabilization of soft tissue injury. Preoperative variables considered were age of patient, mechanism of trauma, fracture pattern and soft tissue status. Postoperative variables included wound status, timing of partial and full weight bearing, time to union, ankle score and any complication. We found MIPPO using locking plates to be a safe and effective method of treatment of distal tibial fractures whether intraarticular or extraarticular. At the follow up of one year all fractures united with average time to union 15.8 weeks in extraarticular group compared to 18.26 weeks in intraarticular group. Ankle stiffness was more common in intraarticular group found in nine patients as compared to only three patients of extraarticular group. Malunion (external rotation and valgus) was significantly higher in extraarticular group as compared to intraarticular group (3 VS 0). Average ankle score was comparable in both groups 80.7 in intraarticular group as compared to 81.9 in extraarticular group.

Discussion: Management of distal tibia fractures continue to be a source of controversy and debate because of all long bone fractures, management of fractured tibia requires widest experience, greatest wisdom and nicest of clinical judgment in order to choose the most appropriate treatment of a particular pattern of injury [7,13]. MIPPO in distal tibia is proving to be very safe and effective method of treatment in properly selected patients [2]. With the increased recognition of soft tissue status in fracture healing and importance of preventing additional trauma to soft tissue envelope due to open reduction and internal fixation, MIPPO is establishing its role in variety of fractures especially in distal tibial fractures.

Conclusion: We concluded that MIPPO using locking plate is a safe and effective method of treatment of distal tibial fractures whether intraarticular or extraarticular with increased ankle stiffness in intraarticular group and increased malunion in extraarticular group.

Keywords: Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO); Distal Tibial Fractures

Introduction

Minimally invasive surgery has an established role in present day orthopaedics. It has achieved a great success in minimising a variety of complications especially those related to soft tissue complications [4,5,12]. Fractures of distal tibia whether intraarticular or extraarticular have been a source of controversy and debate as far as the management point of view is concerned [7,13]. Conservative

treatment with cast or functional braces is possible in stable and minimally displaced fractures but is associated with prolonged immobilisation, ankle stiffness and osteoarthritis [1,21]. External fixation can reduce the amount of soft tissue complications but prolonged treatment, cumbersome construct and frequent pin tract infection reduce its widespread use [17]. Intramedullary nailing which is the treatment of choice for shaft fractures doesn't provide desired stability of fracture fragments in intraarticular and very distal fractures [10,20]. Open reduction and internal fixation in the setting of already traumatised soft tissue envelope can lead to infection and wound related complications for example wound dehiscence [22,24,25]. MIPPO in distal tibia fractures is increasing in popularity in properly selected patients. The purpose of current study was to find any statistically significant difference in the treatment of intraarticular versus extraarticular fractures treated by MIPPO using locking plate.

Materials and Methods

This was a prospective study between June 2009 to June 2013 consisting of 60 cases of distal tibia fractures 30 intraarticular and 30 extraarticular in orthopaedic department of our university. The study was conducted after approval from ethics committee of our institute and performed only after detailed information about procedure, cost and postoperative protocol was explained to the patients and written and informed consent was taken from the patient. All the patients were followed for one year after the surgery and no patient was lost to follow up. Patients with open fractures were excluded from the study. Fractures were classified using AO OTA classification [16]. The injured limb was elevated and splinted till the swelling subsided as evident by appearance of "wrinkle sign" and then patients were taken for surgery in order to minimise soft tissue related complications associated with distal tibial fractures [7,14,15,24,23]. The fractures were assessed with anteroposterior and lateral radiographs of the tibia including ankle and CT scan whenever deemed necessary in case of intra articular fractures [9,24]. Prophylactic intravenous antibiotics were given before surgery and surgery was performed under spinal or general anesthesia based on the discretion of anaesthetist [7]. The size of the locking plate, size and number of screws were selected based on pre-operative radiographs and modifications made accordingly based on intraoperative measurements. Surgery was performed under tourniquet and c arm control [8]. Fractures were reduced using indirect means of reduction like manual traction, external manipulation, use of femoral distractor, steinmann pins as joy sticks or sometimes using small incisions [7,13,18,19,24]. An oblique incision was made over medial malleolus and a subcutaneous extraperiosteal tunnel was created using the blunt end of the plate, Cobb elevator or scissors. Plate was fixed to the bone using locking and nonlocking screws. Lower screws were inserted via oblique incision and upper screws via separate stab incisions. Before closure fracture alignment and implant status was again checked under c-arm. Wound was closed and limb splinted and elevated and intravenous antibiotics were given for 24 hours after surgery [7]. Patients were assessed on first postoperative day, wound examined, splint removed ROM exercises of ankle started and patients were ambulated on crutches with toe touch weight bearing. Weight bearing was progressed depending upon the status of fracture, implant and postoperative X- Rays. Patients were examined two weekly initially and then every four weeks till fracture was united and then at six month intervals. Final assessment was done at one year after surgery and results were graded as per AO foot and ankle score [11,18]. Postoperative splints were used in some patients only depending on patient and fracture related factors [7,24]. Fractures were considered healed when mature bridging callus was identified on two views and patients reported no pain on full weight bearing [24].

Results

All the sixty patients 30 each of intraarticular and extraarticular were reviewed after one year and compared regarding various variables. All fractures united, extraarticular fractures earlier than intraarticular fractures 15.8 weeks vs 18.26 weeks. Patients in extraarticular group were able to bear full weight earlier 13.6 weeks as compared to 15.86 weeks in intraarticular group. The injury surgery interval and time of hospital stay was almost equal in both groups with no statistically significant difference. The AO Foot and Ankle Score was also comparable in both groups 80.7 in intraarticular group vs 81.9 in extraarticular group meaning both the groups did better with minimally invasive technique. However as far as the complication rate is concerned there was significant difference in the rate of ankle stiffness 9 in intraarticular variety as compared to 3 in extraarticular variety meaning that ankle stiffness is more common

in intraarticular variety. Malalignment was found more common in extraarticular variety than intraarticular variety 3 vs none. Palpable implant was found in almost equal number of patients in both groups 6 vs 5 intraarticular vs extraarticular. Superficial infection was found in 3 cases in both groups. One patient in intraarticular group required reoperation and there was one case of delayed union in intraarticular group as compared to extraarticular group.



Figure 1: Preoperative AP X ray of extraarticular fracture.



Figure 2: Preoperative lateral view.



Figure 3: Final AP X ray.



Figure 4: Final lateral X ray.



Figure 5: Clinical photograph showing external rotation deformity on left side in case of extraarticular fracture.

Discussion

Management of distal tibia fractures continue to be a source of controversy and debate because of all long bone fractures, management of fractured tibia requires widest experience, greatest wisdom and nicest of clinical judgment in order to choose the most appropriate treatment of a particular pattern of injury [7,13]. MIPPO in distal tibia is proving to be very safe and effective method of treatment in properly selected patients [2]. With the increased recognition of soft tissue status in fracture healing and importance of preventing additional trauma to soft tissue envelope due to open reduction and internal fixation, MIPPO is establishing its role in variety of fractures especially in distal tibial fractures [15,22,24]. The purpose of current study was to see differences in outcome of intraarticular and extraarticular distal tibial fractures treated by minimally invasive technique using locking plate. Collinge C., *et al.* evaluated results of MIPPO in metaphyseal distal tibia fractures with minimal or no intraarticular involvement in 38 patients for an average of 32 months. Mean fracture healing time was 21 weeks with one case of malunion, one case of loss of fixation and two patients required reoperation. They concluded that MIPPO using hybrid locking plate technique in metaphyseal fractures of distal tibia predictably restored limb alignment with good to excellent ankle scores [6]. Borens O., *et al.* evaluated the results of “biologic fixation” with a minimally invasive technique in the treatment of pilon fractures in seventeen patients. All the patients united at an average time of fourteen weeks with no plate failure or loss of reduction. There were two superficial infection. Average ankle hindfoot score was 86.1 [3]. The study compared the results of MIPPO using locking plate in intraarticular and extraarticular fractures of distal tibia in thirty patients of each variety. Most of the patients in our study were young and predominantly males with road traffic accidents being most common cause of fracture in both groups. In our series MIPPO was found to be useful in the management of both intraarticular as well as extraarticular fractures of distal tibia. All fractures united in both groups at an average duration of 18.26 weeks in intraarticular fractures as compared to 15.8 weeks in case of extraarticular fractures which may be partially due to small incisions required to achieve anatomic reduction in case of intraarticular fractures resulting in partial evacuation of osteogenic fracture haematoma. There was one case of delayed union in the intraarticular group. Superficial wound infection and incidence of palpable implant was comparable in both groups and only one patient in the intraarticular group required reoperation because of inadequate reduction after first surgical procedure and fracture united but with infection and ankle stiffness. Ankle stiffness as a complication was found significantly higher in intraarticular group treated with MIPPO than extraarticular group as ankle stiffness was seen in 9 patients in intraarticular group as compared to 3 patients in extraarticular group. This may be probably due to intraarticular small step off deformity not picked up by orthogonal radiographs, formation of intraarticular adhesions due to prolonged post-operative immobilisation often required in case of intraarticular fractures. Ankle stiffness can be minimised by achieving good intraarticular reduction, use of arthroscopy assisted reduction and minimising postoperative immobilisation and early postoperative range of motion exercises. There were 2 cases external rotation deformity and one case valgus malunion in extraarticular group as compared to none in intraarticular group. All of these cases occurred in our earlier cases when we had not enough experience with minimally invasive techniques and we paid more emphasis on articular reduction in case of intraarticular fractures as compared to extraarticular fractures. All the three cases were asymptomatic and did not require any surgical correction. External rotation deformity can be minimised by giving proper attention to the position of foot as compared to patella and preparing and draping of both limbs for intraoperative comparison. The final AO foot and ankle score was also comparable in both groups treated with MIPPO.

Conclusion

Minimally invasive percutaneous plate osteosynthesis offers useful and reproducible method of treatment of distal tibial fractures with or without articular extension in properly selected patients. Ankle stiffness is more common in intraarticular patients and malunion is more common in extraarticular patients but further long term studies including large number of patients are required before any definite conclusion can be made with certainty.

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