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Locking Compression Plate Osteosynthesis In Fracture Of Distal Tibia – Result Of 27 Patients

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Abstract:
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. This study describes results of Twenty seven cases of fractures of the distal tibia treated by using the metaphyseal locking plate (LCP) as an internal fixator. Patient's outcome in terms of period of radiologic union of the fractured segments and period of full weight bearing capacity were access. There were 22 males and 5 females of mean age 37.7 years. All patients were fully weight bearing at 20 weeks (ranging 12- 32 weeks) showing radiological union. There were six superficial infections treated successfully using oral antibiotics, 2 deep infections and 7 patients had hardware related complication. MIPO is an effective method for distal tibial fractures. The use of indirect reduction techniques and small incisions is technically demanding but decreases surgical trauma to soft tissues.

Key words*: Distal tibial fractures, Minimally invasive plate osteosynthesis (MIPO)*

1.Introduction

Distal metaphyseal fractures of the tibia with or without intra-articular fracture extension in adults are among the most problematic injuries to treat. The most important variables that affected the final clinical result are the type of fracture, associated soft tissue injury, the method of treatment and the quality of the reduction[1, 2]. Conservative treatment of these fractures quite often results in a number of complications including malunion, nonunion and ankle stiffness[1, 2,3]. These fractures are generally not suitable for intramedullary nailing, despite certain reports indicating satisfactory results in some of these fractures[4, 5,6]. External fixation can be used as either a temporary or definitive method of treatment, especially in fractures with severe soft tissue injury[2,4,7,8,9], but malunion and delayed union continue to be the main problems with this method of fixation[10,11]. Conventional plate osteosynthesis with open reduction can further devitalise fragments and lead to higher incidence of nonunion, infection and implant failure[12, 13]. Therefore, minimally invasive osteosynthesis, if possible, offers the best possible option as it permits adequate fixation in a biological manner[5, 14,15]. However, an inadequate number of screws in a small oblique comminuted distal fragment presents a definite limitation even with this technique. The locking compression plate (LCP) provides enhanced stability in these situations with a minimum number of screws. In addition, it is possible to use these plates in a minimally invasive technique without fear of secondary displacement in the absence of perfect contouring[16]. This prospective study was undertaken to assess the outcome of patients treated with a MIPPO technique for closed distal tibial fractures.

2.Materials And Methods

Twenty seven consecutive adult patients in the Department of Orthopedics, MBS Hospital under Government medical college, KOTA with distal tibial fractures, including one patient with a bilateral metaphyseal fracture of the distal tibia, treated with three types of locking plates between June 2006 and December 2008. All patients were informed about nature of surgery and its outcome and they were given informed consent before included in the study. Patients with open fractures (Gustilo& Anderson grade IIIB & C), old fractures (>4 weeks), complex pilon fractures (AO 43C3) and pathological fractures were excluded from the study.

All patients received first aid in casuality with thorough examination to rule out associated injuries. Anteroposterior and lateral radiographs of the leg including the ankle joint were obtained to establish the fracture pattern, classification and pre-operative planning (Fig 1). Distal tibial fracture has been classified by Rüedi & Allgöwer[17] and by AO system. Using the AO classification, 19 fractures were type A (6 type A1, 10 type A2, 3 type A3), six fractures were type B (1 type B1, 3 type B2, 2 type B3) and two fractures were type C (1 type C1, 1 type C2).

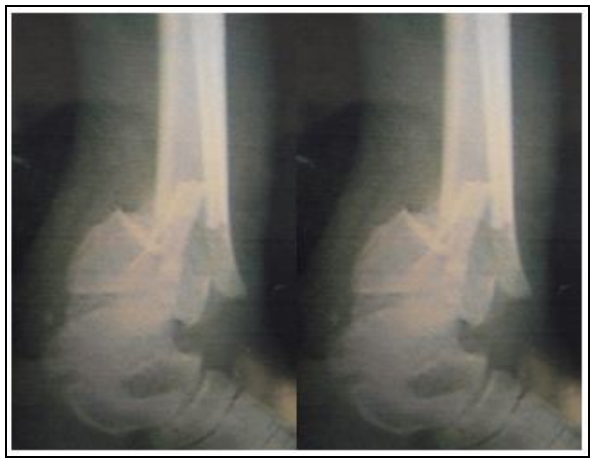

Figure1: Anteroposterior And Lateral Radiographs Of A 38-Year-Old Male Showing The Distal Tibial Fracture

A 3.5-mm one third tubular plate was used to stabilise the fibula before fixation of the tibia to maintain the alignment of the leg and ankle in the presence of tibialcomminution , thereby making the stabilisation of the tibia easier. Through a small incision over the medial malleolus, sparing the saphenous vein and nerve, the tibial plate was inserted extraperiosteally. Fracture fragments were reduced using indirect reduction techniques. Precontouring of the plate was performed so as to approximately match the contour of the distal tibia and was followed by stabilisation using proximal and distal locking screws. Closed reduction achieved anatomical alignment in 23 fractures and open reduction was required in the remaining four fractures. In 13 fractures at 4.5-mm limited-contact locking compression plate (LC-LCP) was used (Fig 2), 10 fractures were fixed with a metaphysical LCP and in the remaining 4 fractures; a distal medial tibial LCP was used. Choice of implant was primarily dependent on availability of implants.

Figure 2: Anteroposterior And Lateral Radiographs Of The Same Person In Which The Tibial Fracture Was Stabilised With The 4.5-Mm LC-LCP

As different plates evolved over time a 4.5-mm LC-LCP was used initially then metaphyseal LCP and distal medial tibial LCP. Primary bone grafting was performed in five cases to fill up the gap at the fracture site caused by compression of cancellous bone. In the event of significant impaction of the cancellous bone resulting in a gap, acute docking of fragments was done to achieve better contact between tibial fragments even if it resulted in mild shortening (average 7 mm). Limb elevation, to achieve gravity-assisted venous drainage along with active toe and ankle movements were carried out in the initial two weeks. The stitches were removed at approximately two weeks in the majority of patients apart from 2 patients with significant pre-operative swelling, where they were left in place for three to four extra days to prevent wound dehiscence.

Non-weight-bearing ambulation was permitted at approximately two weeks, after proper wound healing and appearance of the wrinkle sign. Patients were followed up clinically and radiological in the fracture clinic at monthly intervals for the first six months and then every two months up to one year to assess progress of union and possible complications. Full weight-bearing was permitted only after clinicoradiological evidence of union. The union was defined as bridging of three of the four cortices and disappearances of the

fracture line on the plain radiographs for a patient who was able to bear full weight. A fracture in the process of union but not united at six months was considered as delayed union. Nonunion was defined as a fracture that did not heal within a year. Malunion was defined as the incongruity of the articular surface of more than 2 mm or malalignment greater than 5° in any plane. At the end of one year, final functional outcomes were assessed using the Ovadia and Beals scoring system[1].

3.Ethical Considerations

Informed consent was taken from the patients prior to operation and for the inclusion to the study. The study was performed according to the Declaration of Helsinki, and the Institutional Ethical Board approved it.

4.Result

A total of 31 patients was operated upon. Four patients not having a minimum follow-up of one year were excluded from the review, leaving 27 patients having fractures (22 men and 5 women) with a median age of 37.7 years (range: 21–60 years) (shown in table 1); 22 patients were injured after road traffic accidents and 5 patients had a fall. Most (21) cases under 50 years of age were victims of RTA and 2 cases above 50 years of age were victims of the fall. Most of the cases involved in the high velocity accident were in the 21- 40 years age group. Seven cases had associated injury resulting from same trauma. The injuries were noted ipsilateral supracondylar fracture of femur, subtrochentric fracture of femur of contralateral side, fractured ribs, fractured pubic rami, contralateral fractured tibia. There were 2 cases associated with head injury.

Age	Male	Female	%
21- 30	6	1	25.92
31- 40	10	2	44.44
41- 50	4	1	18.51
51- 60	2	1	11.11

Table 1: Age And Sex Distribution Of Cases

The average time of 10.74 days between injury and surgical procedure (range: seven to fifteen days) was due to delay in reporting to the hospital or time taken to reduce the gross swelling. The operative time was around 75 minutes. Operative time reduced as experience was gained during the study. All fractures went to union except 2, one for delayed union and 1 for malunion. The 18 (66.66%) cases showed union between 12-20 weeks, while 9 (33.34%) showed union between 20- 32 weeks (Fig 3).

Figure 3: Follow-Up Radiographs Of Tibia Showed Union At 5 Months

Average period of union was 20 weeks. Average time taken for full weight bearing was 24 weeks. It was more for cases with bilateral limb injuries. there were 6 superficial infection treated with antibiotic, 2 patient develop deep infection requiring plate removal, 7 patient had hardware problem like irritation in skin, 1 patent had reflex sympathetic dystrophy and 3 developed ankle stiffness. One of the cases with delayed union had an anterior gap in the tibia due to cancellous bone impaction and required secondary bone grafting before union could be achieved. The distribution of functional outcome according to the Ovadia and Beals[17] score in the four groups is shown in Table 2.

No.	Grade	No. of Case	%
1	Excellent	16	59
2	Good	4	15
3	Fair	4	15
4	Poor	3	11

Table 2: Final Functional Result

5.Discussion

The treatment of distal metaphyseal fractures of the tibia by closed intramedullary nailing or by open reduction and internal fixation using plates may be associated with complications such as malunion, nonunion, secondary loss of reduction, wound dehiscence, local septic complications and stiffness of adjacent joints[4,6,13]. MIPO of these fractures is technically feasible and advantageous in that it minimises soft tissue compromise and devascularisation of the fracture fragments[7,14,18,19]. The procedure includes three important components: closed reduction, minimal soft tissue dissection and stabilisation with a long percutaneously inserted plate fixed with a limited number of widespread screws. Even though early intervention is advantageous, it is desirable to delay surgery in the presence of gross local swelling until subsidence of swelling.

In our study 66.66% of cases showed radiological union in12 - 20 weeks while in 33.34% it was in 20- 32 weeks. These results are quite comparable to other studies. AKsekili et al reported a mean duration of radiological union to be 20.7 weeks (range: 16- 28 weeks) in open and 17.96 weeks (range: 10- 36 weeks) in closed fractures[20]. While Shrestha et al[21] reported an average duration of 18.5 weeks (range: 14- 28 weeks) for the fracture segment union. In studies of Helfet et al[22], Hazarika et al and Eid A[23], fracture union result was 100%. In series Helfet et al[22] and Hazarika et al there was two stage procedures first they applied external fixator to convert open fractures to close fractures and in 2nd stage MIPO for the close fracture fixation. While Eid[23] used an anatomical pre-bent plate rather than a manually contoured plate that we used in our study.

Obviously, our group of patients is relatively small and the indications limited. However, the consistent positive results using this approach support our opinion such that we feel our described use of this plate is easy and very well tolerated by patients. In our hands it has indeed been a useful addition to the techniques used to address these challenging problems.

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