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Original Article

Outcome Analysis of Distal Tibial Fractures Managed by Open Reduction Internal Fixation using Plate Osteosynthesis

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Abstract

Introduction: Fracture of the distal tibia is one of the common fractures encountered by an orthopedic surgeon. Many studies have been associated even as little as 1 mm incongruence of articular surface landed with worst outcome. Distal tibial fractures are complicated by poor bone stock, soft tissue complication, poor vascularity leading to nonunion, gross comminution, and malalignment.

Aim: The aim of the study was to evaluate functional outcome analysis of distal tibial fractures managed by open reduction internal fixation using plate osteosynthesis.

Materials and Methods: This was a prospective study conducted at KAPV Medical College, Tiruchirappalli. A total of 20 patients were treated with distal tibial plating. Fibular plating was done in eight of these patients. Patients were analyzed using Karlström and Olerud scoring system, with follow-up of 3–18 months.

Results: Ten patients had excellent functional results, six patients had good results, three patients had acceptable results, and 1 patient had a poor result. Quality and vascularity of bone seem to influence the outcome to a large extent.

Conclusion: Based on our study, we conclude that distal tibial fractures managed with plate minimally invasive plate osteosynthesis technique allow early mobilization of the patients and provide a good functional outcome.

Key words: Distal tibial fracture, Minimally invasive procedure, Plate and screws

INTRODUCTION

Distal tibia fractures include extra- and intra-articular fractures. The Müller AO classification of distal radius fractures was first published in 1987 as a part of the group's overall classification system for long bone fractures.[1] Incidence rates of distal tibial fractures vary considerably by age and gender, rangeing from a low of 3 per 10,000 per year among 30–34 years old women to a high of 28 per 10,000 per year among 15–19-year-old boys.[2] Mechanism of injury is mostly due to low-energy trauma, usually leading to simpler fracture patterns with minimal soft-tissue injury, while high-energy trauma with axial compression (fall from height and road traffic accident) produces complex intra-articular fractures with metaphyseal impaction and bone loss. Direct fractures are usually transverse, oblique, or comminuted, while indirect ones are torsional and rotational fractures.[3,4] There are various treatment options for distal tibial fractures including non-operative, external, and internal fixation. The indications differ based on the patient, demands, and type of fractures.[5] Open reduction and internal fixation (ORIF) with plate osteosynthesis leads to skin necrosis and infection in >40% eventually leading to implant failure and malunion. The intramedullary (IM) device gives inadequate stability due to wide medullary cavity leading to implant failure and screws breakage.[6]

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Aim

The aim of the study was to evaluate functional outcome analysis of distal tibial fractures managed by ORIF using plate osteosynthesis.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Orthopaedics and Traumatology, KAPV Government Medical College and Hospital, between 2017 and 2018. 20 distal tibial fractures were operatively treated with plating at our institutions, of which 15 were male and 5 were female. Age group of the patient was 20–60 years. The most common mode of injury was road traffic accidents. There were six compound fractures. Compound cases were surgically debrided on day 1 and wound management was done; then, flap cover and plating were done within 3 weeks.

Inclusion Criteria

The following criteria were included in the study:

- Age >20 years with closed fracture and unstable fractures of the distal tibia
- Grade I and Grade II compound distal tibial fractures.

Exclusion Criteria

The following criteria were excluded from the study:

- Grade III open fractures
- Irreducible fracture deformity
- Compartment syndrome
- Poor local skin conditions
- AO type C3 fractures (articular comminution were excluded from the study),

Surgical Technique

Patients were placed on C-arm compatible table in supine position, articular surface was visualized found maintained after fracture reduction, and then, the appropriate plate was chosen and then either anteromedial or anterolateral plating was done. Minimally invasive plate osteosynthesis (MIPPO) technique with locking plate was used in 10 patients. Contoured narrow dynamic compression plate was used in 10 patients. The plate was placed as distally as possible. At least six cortex fixations in proximal and distal fragments were ensured.

Post-operative Protocol

Physiotherapy with active assisted exercises is started immediately after the operation, a below knee plaster splints applied in a neutral position for 4 weeks. The lower limb is kept elevated with isometric knee and ankle exercises on day 1 after removal of the suction drains. After 5–7 days, ambulation is started with non-weight bearing, allowing toe-touch partial weight bearing after the 2nd week, depending on the quality of fixation and reconstruction, as well as on patient compliance. Full weight bearing was started after 8–10 weeks, depending on radiological fracture consolidation and clinical follow-up. Follow-up was done at immediate post-operative, 3 weeks, 6 weeks, and every 3rd month up to 15 months. Anteroposterior and lateral view X-rays were taken. The radiological union was evaluated. Functional scoring of Karlström and Olerud was done.

RESULTS

According to Karlstrom and Olerud, functional scoring system was done for all patients.

Criterion (symptoms)	Number of patients			
	Excellent score	Good score	Acceptable score	Poor score
Subjective-ankle pain	10	7	3	–
Gait	11	6	2	1
Work and sports	10	6	3	1
Angular and rotational displacement	16	3	1	–
Shortening	18	1	1	–
ROM restraint-ankle	–	10	8	2

Overall 10 patients had excellent functional results, six patients had good results, three patients had acceptable results, and 1 patient had poor result.

Evaluation of post-operative radiographs for adequacy of reduction revealed excellent results in 14 cases (70%). Good reduction was achieved in four cases (20%). Poor reduction occurred in two cases (10%).

Complication

Complication	Number of patients (%)
Wound healing problems (infection and dehiscence)	2 (10)
Nonunion	1 (5)
Malunion	1 (5)
Implant loosening	3 (15)
Secondary osteoarthritis	Nil

DISCUSSION

Non-surgical treatment of distal tibial fractures can increase the incidence of malalignment with unacceptable shortening.[7] The most common surgical methods for treating distal tibial fractures are IM nailing or plating. However, malalignment of the distal tibia is common after nailing. Plate osteosynthesis allows the articular reduction and varus/valgus realignment. Our study included 20 patients who were treated with distal tibial fractures and managed with plate osteosynthesis, and their functional

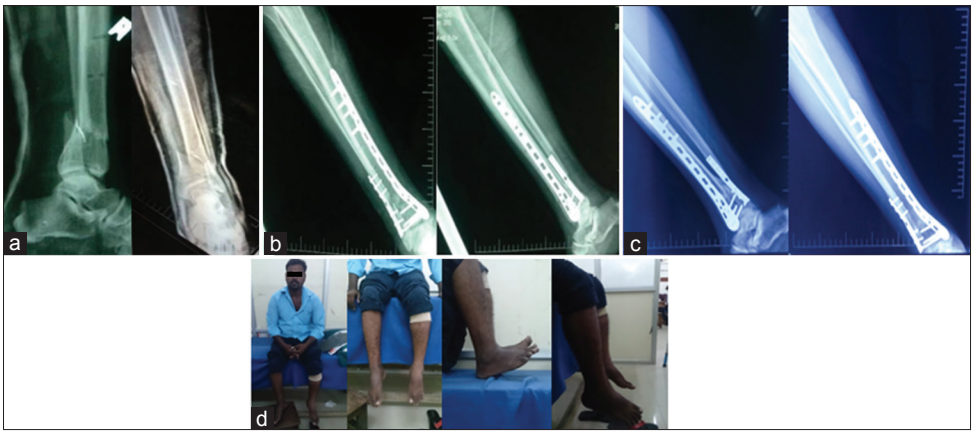

Figure 1: 27 years old male patient with history of renal tubular acidosis with AO type 2 distal tibial fracture treated with open reduction and internal fixation with locking compression plate using minimally invasive plate osteosynthesis technique for tibia and 1/3 tubular plate for fibule. (a) pre-operative X-ray (b) post-operative X-ray (c) 6 month follow-up (d) clinical photos

outcome was evaluated [Figure 1]. Minimally invasive percutaneous plating allows to reduce soft tissue problems and prevents devascularization of the fracture fragments. Anatomic reduction of the fracture site with minimally invasive plating is technically demanding. Fibular plating was done in patients with varus/valgus malalignment, fracture within 5 cm of syndesmosis, and all implant failure patients. Malunion is noted in one patient with acceptable varus/valgus deformity; the patient deferred further treatment. Non-union in one patient managed with bone grafting at 6th month. Bone grafting was done in 6 cases as secondary procedure for three implant loosening cases, two osteoporotic comminuted fractures, and one non-union case. Hence, 30% of cases required augmentation with bone grafting. Wound-related problems (10%) were noted in our study; all of them were treated non-operatively. Open methods of fixation carry a higher rate of infection and soft tissue problems. Old age, osteoporosis, and ankle ligament injuries associated with a delay in post-operative rehabilitation, joint mobilization, and weight bearing. These patients were managed with calcium and Vitamin D supplementation to augment fracture union.

In a prospective randomized trial, Im and Tae concluded recently that ORIF could restore alignment better than IM nailing.[8] They treated 64 consecutive distal tibial fractures with ORIF or IM nailing. They found an average angulation of 0.9 after ORIF versus 2.8 after IM nailing ($P = 0.01$). Unfortunately, there is no description of the angulation measurements. Varus and valgus malalignment are usually determined by measuring the angle between the center of the knee down the middle of the proximal shaft and proximally from the center of the ankle up the middle of the distal shaft. The slightly S-shaped tibial shaft in many normal individuals means that the mechanical axis of the tibia rarely passes down the middle of the medullary canal; this makes the conventional method of measuring the angulation of malunion potentially unreliable. Vallier and Bedi showed that angular malalignment is more with nail ,varus of more than 5º in 29% and 5.4% with plating.[9]

Distal tibia fractures are complex cases and need appropriate treatment to limit the incidence of complications. For acute fractures without skin injury, we prefer a stable and rigid internal fixation in a one-stage procedure. Limited internal fixation can be used for fractures without important comminution and easily reducible by traction or external manipulation. However, with this technique, a non weight-bearing cast is recommended. ORIF with conventional or locking plates should be used for comminuted cases to reduce the articular surface perfectly. Surgical approaches must preserve the soft tissue and can be anteromedial or anterolateral according to surgeon preference and fracture localization. One advantage of the locking plate is to permit faster full weight bearing and stronger fracture stabilization as an internal fixator. Despite the advantages of closed reduction and slight disturbance of soft tissue, MIPO has the disadvantages of non-accurate reduction. The fragments may be not tightly compressed which could increase the risks of delayed union and nonunion, especially for simple fractures (i.e., type A3). Several studies have reported the rate of delayed union or non-union to be 5–17%.[10,6] Admittedly, malreduction is also inevitable in the MIPO group; however, careful management under an image intensifier and post-operative guidance should effectively prevent unacceptable deformity. Cadaver research suggests that the MIPO technique may carry a higher risk of injury for saphenous nerve and long saphenous vein.[11]

CONCLUSION

Distal tibial fractures stabilized with MIPPO technique had earlier fracture healing and good soft tissue healing

comparative to patients operated with open surgical technique. MIPPO technique after good articular reduction gives superior results in good surgical hands. Fibular fracture stabilization offers stability to the MIPPO construct, prevents malalignment, and promotes bony union in osteoporotic fractures.

REFERENCES

1. Müller ME, Nazarian S, Koch P, Schatzker J. The Comprehensive Classification of Fractures of Long Bones. New York: Springer-Verlag; 1990.
2. Singer BR, McLauchlan GJ, Robinson CM, Christie J. Epidemiology of fractures in 15,000 adults: The influence of age and gender. J Bone Joint Surg Br 1998;80:243-8.
3. Havemann D, Busse FW. Accident mechanisms and classifications in distal radius fractures. Langenbecks Arch Chir Suppl II Verh Dtsch Ges Chir 1990:639-42.
4. Koval KJ, Zuckerman JD, Kenneth E. Handbook of Fractures. 2nd ed. Philadelphia PA, USA: Lippincott Williams and Wilkins; 2002. p. 133-8.
5. Li Y, Jiang X, Guo Q, Zhu L, YT, Chen A. Treatment of distal tibial shaft fractures by three different surgical methods: A randomized, prospective study. Int Orthop 2014;38:1261-7.
6. Hasenboehler E, Rikli D, Babst R. Locking compression plate with minimally invasive plate osteosynthesis in diaphyseal and distal tibial fracture: A retrospective study of 32 patients. Injury 2007;38:365-70.
7. Hooper GJ, Keddell RG, Penny ID. Conservative management or closed nailing for tibial shaft fractures. A randomised prospective trial. J Bone Joint Surg Br 1991;73:83-5.
8. Im GI, Tae SK. Distal metaphyseal fractures of tibia: A prospective randomized trial of closed reduction and intramedullary nail versus open reduction and plate and screws fixation. J Trauma 2005;59:1219-23.
9. Vallier HA, Bedi A. Radiographic and clinical comparison of distal tibia fracture(4-11 cm from plofond)nailing versus platng. J Orthop Trauma 2008;22:307-11.
10. Hazarika S, Chakravarthy J, Cooper J. Minimally invasive locking plate osteosynthesis for fractures of the distal tibia results in 20 patients. Injury 2006;37:877-87.
11. Ozsoy MH, Tuccar E, Demiryurek D, Bayramoglu A, Hayran M, Cavusoglu AT, *et al.* Minimally invasive plating of the distal tibia: Do we really sacrifice saphenous vein and nerve? A cadaver study. J Orthop Trauma 2009;23:132-8.

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