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The outcome of minimally invasive distal tibia plating in a case of an extra articular distal tibia fracture

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Abstract
Background: Aim was to delineate the functional and radiological outcome of minimally invasive distal tibia plating in a case of extra-articular distal tibia fracture using contoured 4.5 DCP plate and long periosteal elevators.
Methods: The study was conducted on patients who were diagnosed with extra-articular distal tibia fractures and underwent minimally invasive distal tibia plating in the Department of Orthopaedics, KEM hospital Parel Mumbai from March 2020 till June 2021. Participants were evaluated for functional outcome using the AOFAS score at minimum of 6 months postop, time to full radiological union and time to partial and full unaided weight-bearing was calculated based on follow up OPD visits at 6 weeks, 3 months, and 6 months.
Results: Of the 30 participants involved in the study the average period of follow up was 8.47 months, the mean AOFAS score was 89.67, mean time to partial weight bearing was 6.13 weeks. And the mean time to full unaided weight bearing was 10.17 weeks, and the average time to complete radiological union was 17.03 weeks. One patient developed superficial wound complication which was managed with antibiotics and dressing. No patient developed deep infection osteomyelitis and non-union.
Conclusions: minimal invasive plate osteosynthesis with contoured 4.5 dynamic compression plate can be successfully used for fixation of extra articular distal tibia fractures with minimal soft tissue compromise and wound complications and excellent results.

Keywords: Extra-articular fractures of distal tibia, contoured 4.5 dynamic compression plate, minimal incision plate osteosynthesis

Introduction

Tibia is one of the most commonly fractured bones, with distal tibia fractures comprising of up to 10 percent of all lower limb injuries [1]. Distal tibia fractures pose a significant challenge to the treating physician due to the associated soft tissue injuries and swelling which can further complicate the process of fixation of these fractures. Schatzker and Tile [2] first made a distinction between the soft tissue envelope that is suitable for an immediate major operative procedure and the soft tissue envelope that is not appropriate for emergent surgery due to Prescence of marked swelling or blisters. In the latter group a minimum delay of 1week was advised before definitive fixation surgery was decided upon, to allow for the soft tissue envelope to heal and return to a “reasonable state”. Until then closed reduction and plaster slab application or skeletal traction was advised. Authors recommended Length stable injuries to be immobilised in plaster slabs where as in fractures with shortening calcaneal traction was put as temporary stabilisation device. Thus, leading to popularisation of staged treatment of distal tibia fractures which the author of this study also advices. Modern plating techniques [3, 4, 5, 6] rely on minimal invasive approaches using smaller incisions, the plate is slid through the incisions and screws being passed through stab incisions. Care is taken to preserve soft tissue attachments and avoid periosteal stripping whenever possible thus minimising the incidence of infection and non-union which plagues formal open reduction and internal fixation techniques used for distal tibia fractures. Complications of distal tibia plating [7, 8, 9, 10, 11, 12] include superficial and deep wound infection, osteomyelitis, non-union, post traumatic arthritis. In the present study an analysis of patients sustaining extra-articular distal tibia fracture was done to outline the functional and radiological outcome of minimally invasive distal tibia plating. Also, the complications associated with the procedure were reported.

Materials and Methods

A descriptive observational study was conducted in the premises of KEM hospital Mumbai after taking approval from the institution ethics committee.

Inclusion criteria for study

- Adult with age 18-70 year.
- Both male and female patients who have undergone distal tibia plating with 4.5 DCP.
- Patients with AO classification Type 43A1, 43A2 and 43A3 fractures.
- Patients with CLOSED, extra-articular distal tibia fractures.
- Distal tibia fractures presenting within 3 weeks of injury
- Closed distal tibia fractures • Patients who are medically fit for operative management.

Exclusion criteria

- Patients with AO classification Type 43B and 43C fractures.
- Patients with ipsilateral limb fractures that may affect clinical outcome of the patient.
- Patients with open fractures and intra-articular fractures.
- Patients with severe systemic illnesses.
- Children below age of 18 years and adult age >70years
- Patients non-compliant to physiotherapy or follow up.
- Severe osteoporosis
- Previous surgery involving distal tibia, talus or calcaneum prior to the surgery under study
- Evidence of active infection, sepsis.
- Chronic degenerative arthritis like osteoarthritis or rheumatoid arthritis.

Patients who are suffering from distal tibia extra-articular fractures and who have been treated with minimal invasive plate osteosynthesis with contoured 4.5 DCP plate were selected from previous hospital records and followed up. Patients were explained in detail regarding the American Orthopaedic Foot and Ankle Scoring system and the survey. Patients were seen in the outpatient department as a part of routine follow up at 6 weeks, 3 months and 6 months post op. Clinical evaluation was done by AOFAS score at minimum 6 months postop, also time to partial and full weight bearing was calculated on examination at OPD basis, according to history given by patient and patient records containing mobilisation protocol. Time to radiological union was calculated on OPD basis by using x ray(dated) or already done previous x ray records.

Surgical procedure: After the soft tissue envelope has been given adequate time for recovery surgery is planned. The procedure starts in the preoperative period with preoperative planning, an appropriately sized plate is chosen considering patient's fracture anatomy allowing 3 to 4 screws to be placed in proximal fragment. The plate is then contoured according to the distal tibia anatomy using plate benders. A contoured plate will look as follows. (Figure 1) On the operating table after adequate anaesthesia has been given an unsterile pneumatic tourniquet is applied to the thigh region of the limb to be operated. The limb is scrubbed with a chlorhexidine surgical scrub and routine painting and draping done for lower limb. A sterile glove is applied to foot. Fracture site localised and marked under fluoroscopic guidance using skin marker. Using direct medial approach 2 incisions 3-4 cm each are taken on the medial subcutaneous surface of tibia. The first incision is taken from medial malleolus and extended proximally 3 to 4 cm. The second incision is taken where the proximal end of plate is anticipated to be. (Figure 2). Both incisions are taken down to the bone. Now a long periosteal elevator is taken and passed from the distal incision towards proximal incision separating bone form skin and soft tissues and making space for plate. (Figure 3) Now the plate is inserted from distal incision towards the proximal incision until it is seen to exit from proximal incision, an assistant gives traction to reduce fracture and obtain adequate limb length, once achieved further reduction can be achieved indirectly by passing cortical screws in the distal fragment near the fracture site, at least 2 to 3 screws are passed in the distal fragment all these screws are 4.5mm each and bicortical, one 4mm unicortical screw is passed from medial malleolus diagonally upwards to augment the fixation.(Figure 4) An interfragmentary screw can be passed diagonally through the plate after taking stab incision to augment fixation and reduction. At this stage screws are passed in the proximal fragment, 3-4 4.5mm bicortical screws are passed in proximal fragment. Drain is inserted and routine closure is done in layers. Figure 5), (Figure 6) Post operatively patient is put in a slab for 2-3 weeks and strict anti-oedema measures followed to keep the post-operative swelling in check, Wound check and drain removal done after 3 days and sutures removed at 2 weeks after the procedure. Ankle ROM and assisted weight bearing started after 2-3 weeks as tolerated by the patient.

Results

In our study, the mean age of the patient was 43.47 years with the range being 21to 65 years. This study was conducted with 30 patients out of which 13 were female and 17 were male. The average period between the date of trauma and date of the surgery was 9.6 days with the minimum duration being 4 days and the maximum duration being 20 days. The minimum period of follow-up was 6 months and the maximum period of follow-up was 12 months with the average period of follow-up being 8.47 months. The minimum AOFAS score was 85 and the maximum AOFAS score was 95 with the average AOFAS score being 89.67. The average time to full weight-bearing was 10.17 weeks with minimum time to full weight-bearing being 6 weeks and maximum time to full weight-bearing being 16 weeks. The average time to complete radiological union was 17.03 weeks and minimum time to radiological union was 14 weeks and the maximum time was 20 weeks.

Fig 1: contoured tibia plates

Fig 2: showing the incision markings of distal tibia MIPO plating, the 2 blue lines demonstrate the proximal and distal incision with the green hemisphere showing the skin marking of medial malleolus.

Fig 3: Specially designed long periosteal elevators to elevate skin and soft tissue off the distal tibia and to make room for the plate.

Fig 4: Intraoperative fluoroscopy showing distal fragment being fixed and indirectly reduced using 3*4.5 mm cortical screws and one 4 mm malleolar screws

Fig 5: Post op x ray of another patient showing interfragmentary screw being passes through stab incision and proximal fragment being fixed subsequently with 4 * 4.5mm cortical screws.

Fig 6: Final closure picture of distal and proximal incision respectively

Table 1: Distribution of Study Subjects according to the Age (Years) (N = 30)

Age (Years)	No.	Percent
≤ 30	6	20.0
31-40	6	20.0
41-50	8	26.7
51-60	7	23.3
>60	3	10.0
Mean (SD)	43.47 (12.73)	
Range	21-65	

Table 2: Distribution of Study Subjects according to the Gender (N=30)

Gender	No.	Percent
Female	13	43.3
Male	17	56.7

Table 3: Various result parameters:

S. No.	Parameter	Range	Mean
1	Period of follow up	6-12 months	8.47 months
2	Duration from trauma till surgery	4-20 days	9.6 days
3	AOFAS score	85-95	89.67
4	Time to partial weight bearing	3-12 weeks	6.13 weeks
5	Time to Unaided full weight bearing	6-16 weeks	10.17 weeks
6	Time to radiological union	14-20 weeks	17.03 weeks

Discussion

Distal tibia fractures are notorious to treat as there is very limited soft tissue cover over the bones and there is high risk of wound complication, implant prominence and deep sepsis. To further compound the problem the skin and soft tissue cover are significantly damaged during the trauma. So, a significant amount of time must be given to the skin and soft tissue to return back to a reasonable state so as to reduce these complications.

Minimally invasive plate osteosynthesis using contoured 4.5 DCP achieves excellent reduction and strong fixation while minimizing the chances of wound complications as incision length is small and there is minimal dissection and handling of soft tissues and no disturbance to fracture hematoma.

In our study out of the 30 patients, the minimum period of follow-up was 6 months and the maximum period of follow-up was 12 months with the average period of follow-up being 8.47 months. In the study conducted by Paul Shonnard [13] *et al*. the Follow-up period of the twenty patients was from 6-27 months (average 9 months). Supe AC *et al*. [14] operated on 32 patients with distal tibia pilon fractures. The average period to follow up was 11.2 months (range 4-25 months).

In our study out of the 30 patients the the average AOFAS score being 89.67. Supe AC *et al*. [14] operated on 32 patients with distal tibia Pilon fractures, average AOFAS score was 94.4. Mudgal A *et al*. [15] treated 21 patients with distal tibia

fractures, the mean Functional outcome according to AOFAS score was 96.52 ± 4.16.

In our study, out of the 30 patients the average time to full weight bearing was 10.17 weeks. In the study conducted by Paul Shonnard [13] *et al*. Full weight-bearing average time was 10.7 weeks (range 8-16 weeks). Supe AC *et al*. [14] operated on 32 patients with distal tibia Pilon fractures, the Mean time for full weight bearing was 20 weeks (17-22 weeks).

The average time to complete radiological union was 17.03 weeks. Mudgal A *et al*. [15] treated 21 patients with distal tibia fractures the mean time to union was found out to be 21.70 ± 2.67 weeks.

Conclusion

Thus the results of our study are comparable to various international and national articles thus demonstrating that minimally invasive plate osteosynthesis using a contoured 4.5mm Dynamic compression plate is an excellent method of fixing extra-articular distal tibia fractures with low rate of complications like superficial and deep wound infection, non-union and delayed union, the condition being that skin and soft tissue envelope have been given adequate time to recover after the initial trauma. However a larger study with larger sample size and longer period of follow up is needed to find out the long term outcome of the procedure.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee.

References

1. Sirkin MS. Plating of tibial pilon fractures. American Journal of Orthopedics (Belle Mead, NJ) 36. 2007;12(2):13-17.
2. Tile M. Fractures of the distal tibial metaphysis involving the ankle joint: the pilon fracture. In: Schatzker J, Tile M, eds. The Rationale of Operative Fracture Care. 2nd ed. New York: Springer-Verlag, 1996.
3. Bonnier P. Les fractures du pilon tibial. Lyon: These, 1961.
4. Collinge C, Kuper M, Larson K, *et al*. Minimally invasive plating of high-energy metaphyseal distal tibia fractures. J Orthop Trauma. 2007;21(6):355-361.
5. Collinge CA, Sanders RW. Percutaneous plating in the lower extremity. J Am Acad Orthop Surg. 2000;8(4):211-216.
6. Helfet DL, Suk M. Minimally invasive percutaneous plate osteosynthesis of fractures of the distal tibia. Instr Course Lect. 2004;53:471-475.
7. Bourne RB. Pylon fractures of the distal tibia. Clin Orthop Relat Res. 1989;240:42-46.
8. Bourne RB, Rorabeck CH, Macnab J. Intra-articular fractures of the distal tibia: the pilon fracture. J Trauma. 1983;23(7):591-596.
9. Dillin L, Slabaugh P. Delayed wound healing, infection, and nonunion following open reduction and internal fixation of tibial plafond fractures. J Trauma. 1986;26(12):1116-1119.
10. McFerran MA, Smith SW, Boulas HJ, *et al*. Complications encountered in the treatment of pilon fractures. J Orthop Trauma. 1992;6(2):195-200.
11. Teeny SM, Wiss DA. Open reduction and internal fixation of tibial plafond fractures: variables contributing to poor results and complications. Clin Orthop Relat Res. 1993;292:108-117.
12. Wyrsch B, McFerran MA, McAndrew M, *et al*. Operative treatment of fractures of the tibial plafond: a randomized, prospective study. J Bone Joint Surg Am. 1996;78(11):1646-1657.
13. Helfet DL, Shonnard PY, Levine D, Borrelli Jr J. Minimally invasive plate osteosynthesis of distal fractures of the tibia. Injury. 1997 Jan 1;28:A42-8. (Helfet DL, 1997)
14. Supe AC, Kinge KV, Badole CM, Wandile KN, Pafond KR. Minimally invasive percutaneous plate osteosynthesis in distal tibial fracture: A series of 32 cases. International Journal of Orthopaedics. 2016;2(1):06-9.
15. Mudgal A, Daolagupu AK, Agarwala V, Sinha AK. Management of fractures of the extra articular distal tibia by minimally invasive plate Osteosynthesis: A prospective series of 21 patients. International Journal of Medical Research & Health Sciences. 2016;5(6):276-82.