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ORIGINAL RESEARCH

Outcome of MIPO in Distal Tibial Metaphyseal fractures - comparative analysis in terms of fibular fixation

S. Abdul Hameed Ansari[1], S. Arularasan[2], S. Basheer Ahamed[3]

[1]Professor of Orthopaedics, Government Thiruvarur Medical College, Thiruvarur, Tamilnadu, India.
[2]Senior Assistant Professor, Department of Orthopaedics, Government Thiruvarur Medical College, India.
[3]Assistant Professor, Department of Orthopaedics, Government Thiruvarur Medical College, India.

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ABSTRACT

Objectives: To compare the clinical and radiological outcomes of distal tibial Metaphyseal fractures fixed with distal tibial locking plates with or without lateral malleolus fixation.

Methods: Among 40 patients fixed with distal tibia locking plate from 2016 to 2021, 22 cases were fixed with lateral malloelus and 18 cases without fixing the lateral malleolus. The AOFAS was analysed to know about the clinical outcome and Lateral distal tibial plafond angle(LDTA) was measured after 6 months after fixation and compared.

Results: The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-hind foot score average was slightly reduced in lateral malleolus not fixed group, but significant reduction was noticed in lateral malleolus not fixed group.

Key Words: Tibial lower Metaphyseal fracture, AOFAS score, Lateral distal tibial plafond angle, MIPO

Corresponding Author: Dr. S. Abdul Hameed Ansari, Professor of Orthopaedics, Government Thiruvarur Medical College, Thiruvarur, Tamilnadu, India.
Email: bansarinas@yahoo.com

INTRODUCTION

Lower tibial Metaphyseal fractures are high velocity injuries and commonly occur in younger and middle year individuals. While they need fixations for better rehabilitation and outcome, they pose a dilemma in view of selection of implants. In the recent years, the comminuted AO 43 type A fractures with less than 5cms from tibial plafond have been treated successfully with Distal medial locking plate fixation. Since they are Metaphyseal region fractures, they unite well, but complications are many in view of infection, flap necrosis and late collapse of fracture site with increase in deformity of ankle and hind foot. The resultant deformity is the cause for pain in many individuals. According to Ruedi and Allgower 1969,(2) the restoration of fibular length remains one of the four principles of restoration of anatomy in distal Metaphyseal fracture of tibia. We studied the clinical and radiological outcome of distal tibial Metaphyseal fractures, and compared the outcomes of distal tibial Metaphyseal fractures of tibia with fibular fixation done with those in which fibular fixation not done.

Objectives

To compare the clinical and radiological outcome of the distal tibial Metaphyseal fractures operated with medial locking plates with fibula fractures fixed and without fibula fractures fixed.

MATERIALS AND METHODS

This is a amphispective study of the patients with AO43 A1/A2/A3 fractures of distal Metaphyseal fractures admitted at Department of Orthopaedics, Government Thiruvarur medical college from 2016 to 2021.The exclusion criteria were 1) Compound fractures 2) Age group less than 18 and more than 60. 3) Associated with other fractures in lower limbs. 4) Post operative infection in the fixation. To have a uniform comparison we excluded the poorly fixed tibial plafond fractures in both groups according to Ovadia & Beals criteria for fracture fixation in tibial plafond fractures. The decision of Fibula fixation was per operatively decided by Assistant Professors and Residents who were designated as Primary Surgeon. Usually the skin conditions which prevented the fixations of fibula.

Totally 40 patients were studied. 22 patients were fixed with Medial tibial locking plate and fibular fixation was done with either 3.5mm locking recon plate or one third tubular plate. 18 cases were fixed with medial tibial locking plate and fibula fracture was left alone.

Figure 1: LDTA Measurement

Average age was 43.8 years in Fibula fixed group and range was 27-60. Average age was 37.5 years and range was 29 to 57 in fibula left alone group. Male female ratio in fibula fixed group and fibula left group was 15:7 and 14:4 respectively.

AO type 43 A1/A2/A3 was 6/4/12 in Fibula fixed type and 1/8/9 in fibula left alone group. All the cases were well resuscitated and temporary AK slab applied. Radiographs were taken both Anteroposterior and Lateral views with ankle joint were taken. They were typed with AO classification by the duty resident. CT scan with 3D reconstruction was done in A2and A3 type cases. All necessary investigations were done for assessment and timing of surgery was decided after subsidence of oedema. The time gap interval between injury and surgery averaged 8 days in Fibula fixed group and the range being 6 to 10 days. In the fibula left alone group it was 6.7 days and range was 6 to 9 days.

All cases are operated under Carm control. In Fibula fixation group, first the fibula was fixed and then Medial tibial locking plate was applied in MIPO technique. 3 cms horizontal incision was made at the level above Medial malleolus and Saphenous vein was dissected. Reduction was done using in closed manner with pointed reduction forceps. Plate itself was used to create space subcutaneously and negotiated to the position in retrograde manner. In proximal part, vertical incision was made. Fixation of screws done with both these incisions

checked by Carm image intensifier. Postoperative care given according to universal guidelines.

Post operative X-ray of leg with ankle is taken. Limb position was done in mortise view in all patients to standardise the X-rays.

Lateral distal tibial plafond angle (LDTA) is measured in X-ray leg with ankle Mortise Anteroposterior view. It is the angle between tibial axial line and tangential line drawn along the tibial plafond. Tibial axis line is drawn through intersection of 2 horizontal points at the level of distal Metaphyseal diaphysial junction(B) and 2 horizontal points 5 cms proximal to the above mentioned points(C) (12) Fig . 1

Figure 2: Steps of MIPO

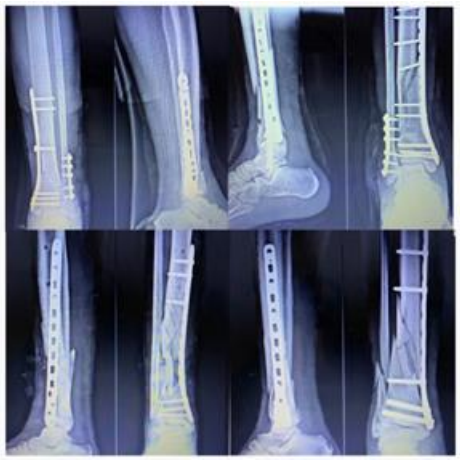


Figure 3: Sample cases

After discharge to home, patients were reviewed every 15 days and radiological union date was noted. Clinical assessment after union was done with AOFAS score. The parameters read in patients include pain, function, maximum walking distance, walking surfaces, Gait abnormality, Sagittal motion, Hind foot motion, Ankle-hind-foot stability, and alignment of the foot To minimise the inter observer variation, score was independently calculated by 2 Residents and if there was variation , average score was taken. To have a uniform comparison, AOFAS and LDTA angles were taken 42 weeks after fixation.

Comparison table between 2 groups

	Distal Metaphyseal fracture tibia fixed with fixation of fibular fracture n=22	Distal Metaphyseal fracture tibia fixed without fixation of fibular fracture n=18
Age average and range	Average 43.8 yrs Range = 27 to 60	Average 37.5 yrs Range =29 to 57
Sex	M/F = 15/7	M/F= 14/4
AO Type	43 A1/A2/A3= 6/4/12	43 A1/A2/A3= 1/8/9
Timing of Surgery in days	Average-8 days Range = 6 to 10	Average - 6.7 days Range = 4 to 9
Union weeks	Average- 35.9 weeks Range = 28 to 41 weeks	Average- 37.3 weeks Range = 34 to 41 weeks
AOFAS score after 42 weeks	Average -74.68 Range = 69 to 78	Average - 71.67 Range = 64 to 76
Lateral Distal tibial plafond angle (immediate Postop) & After 42 weeks	Postop- Average - 85.18 degrees 42 weeks -Average- 84.77 degrees	Postop- Average - 84.6 degrees 42 weeks -Average- 78.6 degrees
Reduction in LDTA angle in 42 weeks	Average - 0.4 degrees	Average - 6 degrees

Figure 5: Comparison table

The statistical analysis was done with SPSS software and the *p* value is taken as 0.05

RESULTS

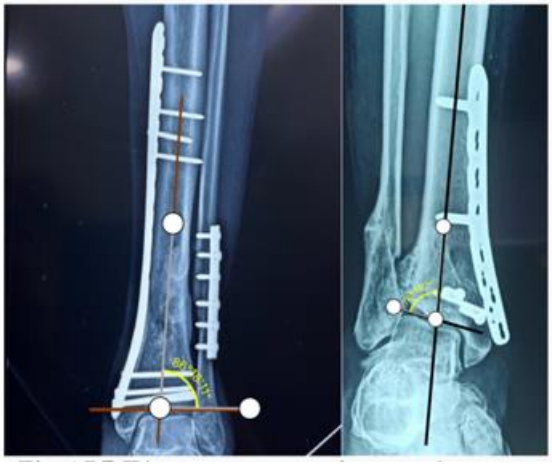


Figure 1: LDTA measurement in sample cases

Out of 40 cases, 36cases(20 in Fibula fixed group & 16in Fibula left alone group)fit in the fair group according to Ovadia and Beals criteria and 4 cases were good.

All our cases studied gone for radiological union in 5-6 months follow up time. There is no significant difference between two groups when compared to union time. In Fibula fixed group , the average union time was 35.9 weeks range was from 28 weeks to 41 weeks. In Fibula left alone group, the average union time was 37.3 weeks and range was from 34 to 41 weeks.

AOFAS average score after 42 weeks in Fibula fixed group was 74.68 and range was between 69 and 78. Average AOFAS score in fibula left alone group was 71.67 and range between 64 and 76. The decrease in outcome in Fibula left alone group was attributed to pain in lateral aspect of ankle in many cases and valgus foot.

Lateral distal tibial plafond angle(LDTA) average in immediate post operative period in fibula fixed group was 85.18 degrees . Average LDTA in the same group after 42 weeks was 84.77 degrees and the average reduction in LDTA was 0.4 degrees in this group after 42 weeks . Immediate post operative LDTA average in fibula left alone group was 84.6 degrees. After 42 weeks the average was 78.6 degrees and the average reduction of LDTA was around 6 degrees in this group after 42 weeks.

Mean dorsiflexion of 12 degrees and 25 degrees of plantar flexion was achieved in 42 weeks in our study.

DISCUSSION

According to AO principles, the A1,A2 and A3 AO 43 type fractures need anatomical reduction and rigid fixation, for a good outcome. Although Intramedullary nail fixation with additional screws or short arm nail have been successfully used in this type of fractures, there is possibility of implant loosening and malalignment according to authors who have studied this fractures(13). Since the medullary canal is wide in the distal tibial metaphysis, the stability of fixation is of question in this kind of fractures according to Dinko Vidovic et al (3) in his study. In his study he has concluded that MIPO technique minimises the complications that arise due to plating in high velocity fracture areas. In a meta analysis done by Zhong-Qin Lin et al(4) , nonunion rates were equal between,IMN and MIPO, but because of soft tissue complications recommended IMN slightly better than MIPO. The anatomically designed locking plates are the hardware we used which most of the surgeons use , which minimise the risk of soft tissue complication occur usually happen in these kind of fixations.

According to Michael Wagner et al (6)Locking plate used in bridging technique assured the results in fractures. Shan-Wei Yang(7) et al declared that lack of knee pain is one of advantage of plating in distal tibia. Tomas Borg (8) et al in his study postulated that using long plate with minimal screws both side of fracture give long lever arm which is advantageous and early pain regulated weight bearing gives early fracture union in this type of fractures.

Rushdi et al (9) supported ankle spanning external fixation before definitive fixation in closed distal tibial fractures reduce the later malalignment. In our series, we didn't apply any skeletal tractions or temporary external fixations, instead we closely watched the soft tissue around the lower leg and took for definitive fixations.

Restoring the fibular length is the key in success, according to Ruedi et al (2) and David.L.Helfet et al (14). Kumar et al (5) fibular plate fixation give more rotational stability, but the advantage was lost in high torque situations. R.Varsalona et al (15) researched the role of fibular fixation in distal tibial Metaphyseal fractures and concluded that additional trauma due to fibular fixation cause greater morbidity.

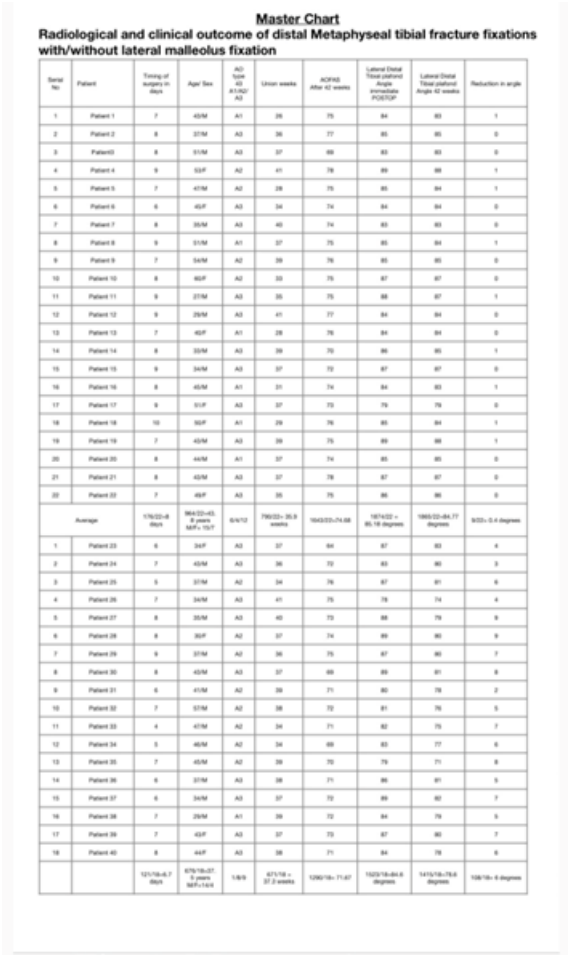
In another study (17)outcome of pilon fractures of distal tibia was studied with multiple radiological parameters like LDTA and also included talar shift as the predictor of increasing morbidity.

In our study the reduction in Lateral distal tibial angle and slight decrease in the AOFAS score in fibula left alone group compared to fibula fixed group was statistically significant.

Comminution of the distal fragments, and type of fracture also influence the late collapse, but we didn't do the type wise comparison. The authors of this study also endorse the principles suggested by Ruedi and Allgower that prevention of malalignment and morbidity lies in restoring the fibular length.

The limitations of the study were lack of prospective design, bias in including the cases, omission of other radiological parameters of outcome and not including

the cases which were initially externally fixed and later converted to internal fixation since the second surgery was of later period than one month.



Master Chart

Radiological and clinical outcome of distal Metaphyseal tibial fracture fixations with/without lateral malleolus fixation

Serial No.	Patient	Timing of surgery in days	Age/ Sex	AO type 43 A1/A2/ A3	Union weeks	AOFAS After 42 weeks	Lateral Distal Tibial plafond Angle immediate POSTOP	Lateral Distal Tibial plafond Angle 42 weeks	Reduction in angle
1	Patient 1	7	45/M	A1	26	75	84	83	1
2	Patient 2	8	37/M	A3	36	77	85	85	0
3	Patient3	8	51/M	A3	37	68	83	83	0
4	Patient 4	9	53/F	A2	41	78	89	88	1
5	Patient 5	7	47/M	A2	28	75	85	84	1
6	Patient 6	6	45/F	A3	34	74	84	84	0
7	Patient 7	8	35/M	A3	40	74	83	83	0
8	Patient 8	9	51/M	A1	37	75	85	84	1
9	Patient 9	7	54/M	A2	39	76	85	85	0
10	Patient 10	8	46/F	A2	33	75	87	87	0
11	Patient 11	9	27/M	A3	35	75	88	87	1
12	Patient 12	9	29/M	A3	41	77	84	84	0
13	Patient 13	7	40/F	A1	28	76	84	84	0
14	Patient 14	8	33/M	A3	39	70	86	85	1
15	Patient 15	9	34/M	A3	37	72	87	87	0
16	Patient 16	8	45/M	A1	31	74	84	83	1
17	Patient 17	9	51/F	A3	37	73	79	79	0
18	Patient 18	10	50/F	A1	29	76	85	84	1
19	Patient 19	7	43/M	A3	39	75	89	88	1
20	Patient 20	8	44/M	A1	37	74	85	85	0
21	Patient 21	8	43/M	A3	37	78	87	87	0
22	Patient 22	7	49/F	A3	35	75	86	86	0
Average		176/22=8 days	964/22=43. 8 years M/F= 15/7	6/4/12	799/22= 35.9 weeks	1643/22=74.68	1874/22 = 85.18 degrees	1865/22=84.77 degrees	9/22= 0.4 degrees
1	Patient 23	6	34/F	A3	37	64	87	83	4
2	Patient 24	7	45/M	A3	36	72	83	80	3
3	Patient 25	5	37/M	A2	34	76	87	81	6
4	Patient 26	7	34/M	A3	41	75	78	74	4
5	Patient 27	8	35/M	A3	40	73	88	79	9
6	Patient 28	8	36/F	A2	37	74	89	80	9
7	Patient 29	9	37/M	A2	36	75	87	80	7
8	Patient 30	8	43/M	A3	37	68	89	81	8
9	Patient 31	6	41/M	A2	39	71	80	78	2
10	Patient 32	7	57/M	A2	38	72	81	76	5
11	Patient 33	4	47/M	A2	34	71	82	75	7
12	Patient 34	5	46/M	A2	34	69	83	77	6
13	Patient 35	7	45/M	A2	39	70	79	71	8
14	Patient 36	6	37/M	A3	38	71	86	81	5
15	Patient 37	6	34/M	A3	37	72	89	82	7
16	Patient 38	7	29/M	A1	39	72	84	79	5
17	Patient 39	7	43/F	A3	37	73	87	80	7
18	Patient 40	8	44/F	A3	38	71	84	78	6
		121/18=6.7 days	676/18=37. 5 years M/F=14/4	1/8/9	671/18 = 37.3 weeks	1290/18= 71.67	1522/18=84.6 degrees	1415/18=78.6 degrees	108/18= 6 degrees

Figure 6: Master chart

CONCLUSION

The restoration of fibular height prevents the complications of malalignment of ankle and foot, but to be judged against the soft tissue complication, and to be considered when treating the distal tibia plafond fractures. In addition to reduction criteria laid by Ovadia and Beals, the radiological assessment postoperatively gives good prediction in outcome of this kind of fractures.

REFERENCES

1. OvadiaDN, Beals RK. Fractures of the tibial Plafond.J Bone Joint Surg Am.1986;68:543-551.
2. Th.Ruedi. Fractures of the lower end of the tibia into the ankle joint: results 9 years after open reduction and internal fixation. Injury, 5,130-134.
3. Vidovic D, Alijosa Matejcic, Mihovil Ivica, Darko Jurisic, Esmat Elabjer, Bore Bakota. Minimally invasive plate osteosynthesis in distal tibial fractures: Results and complications. Injury (2015)
4. Kumar A, Charlebois SJ, Cain EL, et al. Effect of fibular plate fixation on rotational stability of simulated distal tibial fractures treated with intramedullary nailing. J Bone Jt Surg. 2003;85A:604e608
5. Michael Wagner. General principles for the clinical use of the LCP. Injury, Int.J.Care Injured 34(2003)S-B31-S-B42

6. Shan-Wei Yang, Huey-Ming Tzeng, Yi-Jiun Chou, Hsiu-Peng Teng, Hsin-Hua Liu, Chi Yin Wong.Treatment of distal tibial metaphyseal fractures: Plating versus shortened intra medullary nailing. Injury,Int.J.Care injured (2006) 37, 531-535
7. Tomas Borg, Sune Larsson, Ulf Lindsjo. Percutaneous plating of distal tibial fractures Preliminary results in 21 patients. Injury, Int.J.Care Injured (2004) 35,608-614
8. Rushdi I, Che-Ahmad A, Abdul-Ghani KAH, Mohd-Rus R. Surgical Management of Distal Tibial fracture: Towards An Outcome-based Treatment Algorithm. Malaysian Orthopaedic Journal 2020 Vol 14 No 3
9. Mudassar Abrar Ahmad, Alagappan Sivaraman, Ahmed Zia, Amarjit Rai, Amratlal D Patel. Percutaneous locking plates for fractures of the distal tibia: Our experience and a review of the literature. J Trauma,Volume 72,Number 2.
10. Kuo LT, Chi CC, Chuang CH. Surgical interventions for treating distal tibial metaphyseal fractures in adults (Protocol). The Cochrane Library 2012, Issue 12.
11. Christoph Sommer, Sean E. Nork, Matthew Graves, Michael Blauth, Mark Rudin. Quality of fracture reduction assessed by radiological parameters and its influence on functional results in patients with pilon fractures-A prospective multicentre study. Injury.Int J. Care Injured 48 (2017) 2853- 2863.
12. Dong- Il Chun, Tae-Hong Min, Eun Myeong Kang, Woojin Yu, Sung Hun Won , Jaeho Cho et al. Comparison of Radiological and Clinical Outcomes in Patients treated with standard plating versus intramedullary nailing in distal tibial fracture .Orthopaedic Surgery 2022 ;4:536-542
13. David L.Helfet, Paul Y. Shonnard, David Levine, Joseph Borrelli ,Jr. Minimally invasive plate osteosynthesis of distal fractures of the tibia. Injury Vol.28, Suppl. No. 1,pp. S.A42-S-A48,1997
14. R. Varsalona, G. T. Liu. Distal tibial metaphyseal fractures: the role in fibular fixation. Strat Traum Limb Recon (2006) 1:42-50.
15. Viswanath Yaligod, Girish H. Rudrappa, Srinivas Nagendra, Umesh M. Shivanna. Journal of Orthopaedics II (2014)10-18
16. Vishnu Sankar Appusamy, Karthik Ramachandran , Arvind Manoj Kumbakrishnakumar. International Journal of Research in Orthopaedics 2019 May;5(3):490-497.