



## Study of Outcome of Extra-Articular Metaphyseal Lower Third Tibia-Fibula Fractures Treated Using Fibula Rush-Pin and Cast

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### Introduction :

Lower third Tibia and Fibula fractures are common in adult population. Tibial pilon fractures encompass a spectrum of skeletal injury ranging from fractures caused by low-energy rotational forces to those precipitated by high-energy axial compression forces usually resulting from motor vehicle accidents or falls from a height. Rotational variants typically have a more favorable prognosis, whereas high-energy fractures frequently are associated with open wounds or severe, closed, soft tissue trauma. The fracture may have significant metaphyseal or articular comminution or diaphyseal extension. The fibula is fractured in 85% of these patients.

Defining appropriate treatment protocols for purely extra-articular metaphyseal fracture is further complicated by poor reproducibility and reliability of the commonly used classification system devised by Rüedi and Allgöwer, which divides plafond fractures into three categories. AO/Association for the Study of Internal Fixation (AO/ASIF) classification system also has been shown to be insufficiently reproducible.

Classification : Extra-articular distal tibial metaphyseal fracture classification	
AO-OTA Type A	1. Metaphyseal simple
	2. Metaphyseal wedge
	3. Metaphyseal complex

In our institute, Fibula rush pin and conservative management for tibia is quite frequent operative modality opted for Lower third Tibia and Fibula fractures in adult population with quite acceptable results. While Several studies insist on plating and anatomical reduction for such fractures for acceptable functional results, we have obtained good results with fibula rushpin and cast for these fractures. Open reduction and plating of these fractures is fraught with complications like skin and wound healing problems, hardware related problems, infections, peri-implant fractures, soft tissue and tendon adhesions and refractures following implant removal. We measured the malalignment of the fractures in AP and Lat view, Rotational deformity, Limb shortening of operated extremity and compared it to the uninjured side. We also correlated the loss of ankle range of motion, delayed union and complications due to prolonged immobilization and functional outcome as measured by Heflet and Hooper Criteria, American Foot and ankle score.

### Materials and Methods :

A prospective study was performed from May 2012 to February 2014 at the Orthopaedic Department, PDU Medical College, Rajkot, Gujarat, India. Consecutive 30 adult patients with Lower third Tibia and Fibula fractures that consented for participation and met the exclusion/inclusion criteria, treated with fibula rush pin at our institute were enrolled in the study.

### Inclusion Criteria:

>18 yrs of age  
Closed Fracture  
Extra-Articular Metaphyseal fracture  
Either Gender

### Exclusion Criteria:

<18yrs of age  
Compound Fracture  
Intra-Articular fracture  
Patient with any fracture of Same Limb  
Pt. Not willing to participate in study

All patients were treated with appropriate size, appropriately bent fibula rushpin for their tibia fibula fractures under appropriate anesthesia, open reduction for fibula fracture was resorted to where close nailing was not possible. All patients were put in an above knee slab initially for 10 days and then an above knee cast for further 10-12 weeks followed by physiotherapy. All patients were followed up with serial xrays till radiological union was achieved when malalignment in AP and lateral view was measured and rotational deformity and limb shortening compared with opposite side. Functional Outcome was measured by Modified Functional Evaluation System of **Heflet Hooper Criteria, American Foot and ankle score** at radiological union and at 6 months following union.

### Radiographic Outcome:

Radiographs taken immediately postoperatively were reviewed for adequacy of fracture reduction in all 30 patients. Anteroposterior alignment was determined by measuring the angle between a line parallel to the proximal fragment and a line parallel the distal fragment on lateral radiographs. Varus-valgus alignment was determined by measuring the angle between the lines drawn perpendicular to and bisecting the tibial plateau and proximal medullary canal with a line bisecting the distal medullary canal and tibial plafond on anteroposterior radiographs.

**Lee et al.** described radiological criteria for fracture reduction as follows :

Criteria	Fracture Gap	Angular Deformity in any Plane
Excellent	<2 mm and	≤5°
Good	2 to 5 mm and	≤5°
Poor	>5 mm or	>5°

Adequate reduction included excellent and good reductions.

Bony union was defined as evidence of bridging callus across the fracture sites or the obliteration of the fracture lines based on radiographic findings. Malunion was defined as fractured healing >5° of angulatory deformity in any plane, or internal rotation of ≥10°, external rotation of >15°, or shortening of ≥2 cm. Nonunion was defined as no evidence of healing after 6 months.

Statistical analysis was done with both parametric and non-parametric tests for comparing Radiological Malalignment and non-union for Lee.et al criteria.**Heflet Hooper Criteria, American Foot and ankle score satisfaction criteria were used** at radiological union and at 6 months following union. Finally, Chi square test was used to assess correlation between nonunion and patient satisfaction.

**Heflet & Hooper Series Criteria :**

Pain	ABSENT	0
	PRESENT	1
LIMP	ABSENT	0
	PRESENT	1
DEFORMITY	ABSENT	0
	ROTATIONAL	1
	ANGULATION	2
SHORTENING	ABSENT	0
	0-1cm	1
	0-2cm	2
INFECTION	ABSENT	0
	SUPERFICIAL	1
	DEEP(SEQUESTRA)	2
ANKLE MOVEMENT	DORSIFLEXION MORE THAN 15 DEGREE	0
	EQUINUS	1
WALKING CAPACITY	UNAIDED	0
	WITH STICK	1
	WITH CRUTCHES	2
SUBJECTIVE FEELING	BETTER	1
	GOOD	2
	FAIR	3
	POOR	4

Total Points 15  
 Excellent 0-5  
 Good 5-8  
 Fair 8-14  
 Poor 15

**Results:**

	Parameter	Our Study (30 patients)	Dickson, Montgomery & Field, 2013 (31 patients)	Rüedi TP, Allgöwer M (1969) : OTD Classic article review (84 patients)	Comparison of Medial and Lateral Plating : Lee et. Al , 2009 (88 patients)	
					L (39)	M (49)
1	Mean Age (in years)	39.16 (19-70)	41.81(21-60)		36.8	38.2
2	Male vs Female Ratio	73.3 : 26.7	20 / 11			
3	Side	66.7 : 33.3				
4	Mode : RTA vs Fall Down vs Miscellaneous	53.3 + 33.3 + 13.3	11 + 14 + 7		33	42
5	Partial Weight Bear(in weeks)	14.63 (9-24)		15(6-42)		
6	Full Weight Bear/Clinical or Radiological Union(in weeks)	26.73(18-44)	14(12-20)	23.5(10-78)	16.1(13-19)	18.2(15-22)
7	Ankle ROM : DF	18.8(10-30)			19(10-35)	16.9(7-30)
8	Ankle ROM : PF	34(20-45)			35.3(25-46)	31.1(21-45)
8	Radiological Non Union	20.00%	4.33%		2.60%	6.00%
9	Radiological Malunion	6.67%	6.45%		5.10%	2.00%
10	Radiological Fracture Gap(in mm)	2.93(1-7)				
10	Mean Malalignment AP(in degree)	3.33(2-6)			*1pt = 6	
11	Mean Malalignment VV	4.07(2-10)			*1 pt = 7	*1pt= 6
12	Mean Rotational Deformity	4.37(2-15)				
13	Mean Shortening	4.17(2-10)				
14	Radiological Reduction Criteria	Excellent = 20%; Good = 56.67%; Poor= 23.33%		*Ex + G = 55%	Ex = 74.4%; G = 20.5%; P = 5.1%	Ex = 81.6%; G = 16.3%; P = 2%
15	Heflet & Hooper Score	Excellent = 16.6%; Good = 43.3%; Fair = 40%; Poor = 0%	*Ex = 16; G = 10; F = 4 P = 1	*Ex = 74%		
16	American Foot & Ankle Score	53.5(15-80)			34.3	32.9
17	Complication	BG = 20%, Superficial Infection = 3.33%			Inf= 7.7%; H/w = 5.1%; ROI = 20.5%	Inf = 24.5%; H/w = 12.9; ROI = 75.5%

20.00% patients had non-union which required bone grafting later-on with mean fracture gap of 2.93mm @6 months, which is significantly high-

er as compared to all other standard studies. Mean malignment was 4-5mm which is also significantly higher. 23.33% had Radiological poor reduction according to Lee et-al criteria. However no patients developed any deep infection or had any hardware problem. American Foot and Ankle Subjective Score was 53.5 which is better than all other studies with better patient satisfaction.

**Discussion :**

In recent years, there has been a greater emphasis on functional outcome. Although there is no disagreement that anatomical reduction is desirable, the impact of anatomical reduction on overall outcome is less clear. DeCoster et al. analyzed the effect of severity of injury and fracture reduction on clinical outcome and found no correlation with clinical ankle score. In addition, no correlation has been found between radiographic arthrosis and clinical results. Williams et al. found that although radiographic arthrosis was related to injury severity and quality of reduction, there was non significant relationship between these variables and clinical ankle score, or return to work. Functional outcome was more closely related to socioeconomic factors. Patients with a higher level of education were more likely to return to work and had higher ankle scores. The predictors of clinical outcome seem to be multifactorial and are not fully understood.

Factors to consider in the formulation of a treatment plan include the fracture pattern, soft tissue injury, patient comorbidities, fixation resources, and surgical experience.

The goal should be to obtain the best possible fracture reduction and axial alignment while respecting the soft tissues. If the fracture does not reduce by ligamentotaxis, some form of open reduction usually is indicated after the soft tissues have recovered. Fracture union can be enhanced by bone grafting areas of impaction, bone loss, or extensive metaphyseal comminution. The frequency of wound healing problems and infection can be decreased by recognizing open and closed soft tissue injury and not operating through compromised soft tissue. In some cases, the surgeon must achieve a balance between the goals of anatomical reduction and prevention of wound complications. Anatomical reduction often is more difficult to achieve after

a delay of 2 to 3 weeks; however, surgical incisions through swollen, contused soft tissues can lead to disastrous results, which may require free tissue transfer or even amputation.

#### Conclusion :

It is believed that anatomical reduction plate is best treatment for distal tibial fractures. However, in the present study of extra-articular distal tibial metaphyseal fracture, we have found that fibula rush pin and cast although less satisfactory radiologically result in very good functional outcome while avoiding the complications of infection and hardware issues.

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