

To Study the Outcome of Conservative Management of Closed Fracture of Base of Fifth Metatarsal in Adults

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Abstract: ***Introduction:** Metatarsal fractures are amongst the most common foot injuries with an incidence of 67 per 100,000 inhabitants and year¹. Of all metatarsal fractures, those of the fifth metatarsal are the most common, contributing to upto 70%¹, among them 80% involves the proximal part of 5th metatarsal¹. The majority of fifth metatarsal fractures are managed conservatively. **Material and Methods:** It was a cross-sectional, Hospital based study conducted in the Orthopaedics Department of Agartala Government Medical College And Govind Ballabh Pant hospital, Agartala from november 2017 to november 2019 in 115 patients of fracture base of fifth metatarsal, which were treated conservatively and evaluated using foot function index. **Results:** In this study total 115 cases were included who matched inclusion and exclusion criteria. They were treated by conservative method and observed and follow up done till 6 months. Among this 47.8 % were male & 52.2 % were female patients. **Conclusion:** conservative treatment leads to excellent clinical results for both, Lawrence and botte type I and type II acute fractures. As both fracture locations did not differ for outcome, they should not be delineated, but rather be summarized as epi-metaphyseal. Fracture displacement greater 2mm, intra-articular involvement did not affect the outcome. Diabetes Mellitus has significant effect in the functional outcome in this type of fracture compared to non-diabetic patients who were treated in similar fashion. Therefore, conservative treatment should be applied to all epi-metaphyseal fractures, even when displaced, intra-articular or comminuted.*

Keywords: Closed Fracture, Base of 5th metatarsal in adult, Epi-metaphyseal fracture, Conservative treatment, Foot function index

1. Introduction

Metatarsal fractures are amongst the most common foot injuries with an incidence of 67 per 100,000 inhabitants and year¹. Of all metatarsal fractures, those of the fifth metatarsal are the most common, contributing to upto 70%¹. Among them 80% involves the proximal part of 5th metatarsal¹. The majority of fifth metatarsal fractures are managed conservatively, The treatment in accident and emergency departments is varied and can involve the use of supportive shoes, elastic tubular bandaging or casting. Mobilisation protocols vary markedly and range from non-weight bearing, to full weight bearing as able. Follow-up radiographs are usually taken to identify fracture displacement at the early stages, and then to assess fracture healing in the later stages of treatment.

Proximal fifth metatarsal fractures are divided by the location of the fracture and the most commonly used classification system is Lawrence & Botte.

They are- Zone 1: cancellous tuberosity [Where insertion of the peroneal brevis and plantar fascia occurs & involvement of the metatarsocuboid joint] This results from avulsion from lateral plantar aponeurosis. Treatment is symptomatic, with a hard-soled shoe. Healing is usually uneventful.

Zone 2: distal to the tuberosity. They are true Jones Fracture. They result from adduction or inversion of the forefoot. The fracture is caused by tensile stress along the lateral border of the metatarsal. Treatment is controversial: advocates recommend both weight bearing and non weight bearing in a short leg cast as well as ORIF.

Zone 3: distal to the proximal ligaments. They are known as proximal diaphyseal stress fracture. These are relatively rare and seen mainly in athletes. They occur in the proximal 1.5 cm of the diaphyseal shaft of the metatarsal. Patients usually present with prodromal symptoms before complete fracture. This particular entity poses problems because of its tendency to nonunion. Initial treatment is non weight bearing for up to 3 months². Fractures of the fifth metatarsal typically show pain, swelling, and tenderness on the outside of the foot. Patients usually complain about difficulties with walking. Bruising may occur following direct trauma. To delineate those injuries which require further radiologic investigation, the Ottawa Foot Rules as an extension of the Ottawa Ankle Rules should be followed. They have been found to be 100% sensitive and 79% specific for the identification of fifth metatarsal fractures. Radiographic evaluation is critical to assess fifth metatarsal fractures for consideration of treatment options. Three views (AP, lateral, and oblique) are mandatory to judge shortening, deviation, angulation, and displacement. If clinical findings are

suggestive of a fracture at the base of the fifth metatarsal but radiographs of the foot appear normal, an AP radiograph of the ankle that includes the proximal fifth metatarsal is recommended to rule out a tuberosity avulsion fracture located at the tip of the tuberosity proximal to its expanded portion.

A recent systematic literature review evaluated the validity of the classification system and treatment recommendations by Lawrence and Botte. Overall the level of evidence available was moderate. Based on this evidence a treatment-oriented adaptation of the L&B classification was concluded. In summary, L&B type I and II fractures should not be differentiated but be summarized as epi-metaphyseal fractures, as both apparently heal well when treated functionally. Although these recommendations are based on strong evidence for L&B type I fractures, only little evidence is available for L&B type II fractures. In contrast, strong evidence is available in favour of surgical treatment for L&B type III fractures (meta-diaphyseal fractures). Furthermore, it remains largely unknown, whether fracture characteristics, i.e. displacement, articular involvement, number of fragments, negatively influence the outcome of functional treatment and therefore require surgery

Considering the variable outcome of base of 5th metatarsal fracture when managed conservatively according to the location of the fracture (zone 1, zone 2, or zone 3) and characteristic of fracture & lack of such kind of study in Tripura this study is undertaken.

2. Methodology

Study Place: Department of Orthopaedics. Agartala Government Medical College, Agartala, West, Tripura.

Study Duration: November 2017 to November 2019.
STUDY DESIGN: Cross-sectional study.

Study Type: Observational study.

Study Population: All patients with isolated base of 5th metatarsal fractures in adults which are recent injuries (7 days or less than that) attending department of Orthopaedics in Agartala Government Medical college and G.B pant Hospital, Agartala, West Tripura.

Sampling Method: Census sampling by fulfilling inclusion and exclusion criteria

Data Collection: Patients attending orthopaedics outdoor of Agartala Government Medical College and fulfilling inclusion and exclusion criteria were included in the study and informed consent were taken from each patient.

Inclusion Criteria: All patients with isolated closed fracture of base of 5th Metatarsal in adults (>18 years) which are recent injuries (7 days or less than that)

Exclusion Criteria: Patients <18 years, Patients with polytrauma, Patients with open fracture of base of 5th metatarsal, Patients not willing to participate in the study, patients who lost to follow, Patients with irregular follow up.

Method of Study: Demographic information will be collected. Clinical evaluation was done by taking detailed history and physical examination of the affected site (inspection, palpation, active and passive range of movement were recorded) to achieve clinical diagnosis. Patients were assessed for pain in subjective manner (mild, moderate, severe) and Foot Function Index was used to assess functional outcome. After obtaining a clinical diagnosis patients were advised X-rays of Foot (A P, Oblique, lateral). For the purpose of documentation, a standard proforma was maintained.

Selection of patients: During one and half year of study duration only 132 patients attending Orthopaedics OPD fulfilled all inclusion criteria. They were managed conservatively as mentioned in study but later on 115 patients came for regular follow up and were included in study.

3. Results

In this study total 115 cases were included who matched inclusion and exclusion criteria. They were treated by conservative method and observed and follow up done till 6 months. Among this 47.8 % were male & 52.2 % were female patients.

Most of the cases occurred due to accidental fall from stairs by twisting injury. Sex and distribution according to religion are shown below.

Table 1: Distribution of patients according to gender-

Gender	No of cases	Percentage
Male	55	47.8%
Female	60	52.2%
Total	115	100%

Table 2: Patient distribution according to the time of first visit in OPD after injury

Days	Number	Percentage
0	65	56.5%
1	19	16.5%
2	13	11.3%
3	6	5.2%
4	5	4.3%
5	5	4.3%
7	2	1.7%
Total	115	100%

Table 3: Severity of pain around foot during first visit in OPD

Severity of pain	No of cases	Percentage
Mild	3	2.6 %
Moderate	25	21.7 %
Severe	87	75.7 %
Total cases	115	100%

Table 4: Swelling around Foot during first visit in OPD

Swelling around foot	No of cases	Percentage
Present	113	98.3 %
Absent	2	1.7 %
Total cases	115	100 %

Table 5: Movement of joints around Foot & Ankle during first visit in OPD

Movement	No of cases	Percentage
Minimally restricted	34	29.6 %
Grosslyrestricted or absent	81	70.4 %
Total cases	115	100 %

Table 6: Distribution of patients according to Diabetic or not

Diabetes	No of cases	Percentage
Present	26	22.6 %
Absent	89	77.4 %
Total	115	100 %

Table 7: Distribution of patients according to Type of Fracture by Lawrence & Bette classification

Type of fracture	No of patients	Percentage
Type 1	43	37.4 %
Type 2	72	62.6 %
Type 3	0	0 %
Total	115	100 %

Table 8: Distribution of patients according to displacement of fracture in Xray

Fracture displacement	No of cases	Percentage
Undisplaced	50	43.5 %
Displaced	65	56.5 %
Total	115	100 %

Table 9: Distribution of patients according to fracture characteristic (articular involvement)

Articular involvement	Number	Percentage
Extra articular	93	80.9%
Intra articular	22	19.1%
Total	115	100%

Table 10: Distribution of patients according to treatment given on first visit-

Treatment options	No of patients	Percentage
BK pop slab/cast	89	77.4 %
Leucocrepe bandage	26	22.6 %
Total	115	100 %

Table 11: Distribution of patients according to pain around foot during 2nd visit after 10 days-

Pain	No of cases	Percentage
Mild	68	59.1 %
Moderate	38	33 %
severe	9	7.8 %
Total	115	100 %

Table 12: Distribution of patients according to pain around foot during follow up visits

Pain	3 rd visit (after 1 month)		4 th visit (after 3 month)		5 th visit (after 6 month)	
	No of cases	percentage	No of cases	percentage	No of cases	Percentage
Present	15	13 %	1	0.9 %	0	0 %
Absent	100	87 %	114	99.1 %	115	100 %
Total	115	100 %	115	100 %	115	100 %

Table 13: Distribution of patients according to presence of swelling around foot during follow up visits-

Swelling	2 nd visit (after 10 days)		3 rd visit (after 1 month)		4 th visit (after 3 month)		5 th visit (after 6 month)	
	No of cases	percentage	No of cases	percentage	No of cases	percentage	No of cases	Percentage
Present	45	39.1 %	12	10.4 %	0	0 %	0	0 %
Absent	70	60.9 %	103	89.6 %	115	100 %	115	100 %
Total	115	100 %	115	100 %	115	100 %	115	100 %

Table 14: Distribution of patients according to movement of joints around foot & ankle during follow up visits-

Movement	2 nd visit		3 rd visit		4 th visit		5 th visit	
	No of cases	percentage	No of cases	percentage	No of cases	percentage	No of cases	Percentage
Normal	25	21.7 %	83	72.2 %	106	92.2 %	112	97.4 %
Midly restricted	80	69.6 %	30	26.1 %	09	7.8 %	03	2.6 %
Grossly restricted or absent	10	8.7 %	02	1.7 %	00	0 %	00	0 %
Total	115	100 %	115	100 %	115	100 %	115	100 %

Table 15: Distribution of patients according to union of fracture during follow up-

Follow up	Union		Non-union	
	No.	percentage	No.	percentage
After 1 month	96	83.5 %	19	16.5 %
After 3 month	113	98.3 %	2	1.7 %
After 6 month	115	0 %	0	0 %

Table 17: Relation of fracture location and functional outcome based on Foot Function Index after 3 months follow up

Foot function index after 3 month	Fracture location	Mean	Standard deviation	P value
	Type 1 fracture	5.4330	2.14896	0.619
	Type 2 fracture	5.6218	1.84259	

Table 16: Distribution of patients according to return to daily activities during follow up

Return to daily activity	After 1 month		After 3 month		After 6 month	
	number	percentage	number	percentage	number	percentage
Yes	36	31.3%	107	93%	113	98.3%
No	79	68.7%	8	7%	2	1.7%

Table 18: Relation of fracture location and final outcome based on Foot Function Index after 6 months follow up-

Foot function index after 6 month	Fracture location	Mean	Standard deviation	P value
	Type 1 fracture	1.5088	0.88891	0.982
	Type 2 fracture	1.5047	0.95677	

Table 19: Relation of fracture characteristic (displacement) and functional outcome based on foot function index after 3 months

Foot function index after 3month	Fracture characteristics	Mean	Standard deviation	P value
	Undisplaced	5.4392	1.99436	
displaced	5.6347	1.93636		

Table 20: Relation of fracture characteristic (displacement) and final outcome based on foot function index after 6 months

Foot function index after 6 month	Fracture characteristics	Mean	Standard deviation	P value
	Undisplaced	1.5058	0.94669	0.996
Displaced	1.5066	0.92082		

Table 21: Relation of fracture characteristic (articular involvement) and final outcome based on foot function index after 6 months

Foot function index after 6 month	Fracture characteristics	Mean	Standard deviation	P value
	Extraarticular	1.5378	0.94822	
intra articular	1.3727	0.84453		

Table 22: Relation of diabetes and functional outcome based on foot function index after 3 month follow up

Foot function index after 3 month		Mean	Standard deviation	P value
	Diabetic	6.6777	2.28281	
Non diabetic	5.2221	1.72897		

Table 23: Relation of diabetes and final outcome based on foot function index after 6 month follow up

Foot function index after 6 month		Mean	Standard deviation	P value
	Diabetic	1.9369	1.13055	
Non diabetic	1.3804	0.82570		

Table 24: Relation of treatment methods and functional outcome after 6 months

Foot Function Index after 6 month	Treatment method	Mean	P value
	Bk pop slab	1.54	
Leucocrepe bandage	1.39		

4. Discussion

Whereas there is a broad consensus on conservative treatment for L&B type I fractures, limited evidence is available for the best treatment for L&B type II fractures^{12,14,20,27,31,33,35,36,38}. Today, few studies report promising results following functional treatment while other authors argue for operative treatment^{21,29,28,34}. A major reason for these conflicting recommendations is the inconsistent use of the term “Jones fracture” for both L&B type II and III fractures^{7,8,11}. An example for the confusion resulting from this lack of definition is the systematic review by Roche et al²⁸, analysing the outcome of “Jones fractures” in 26 studies. When looking at these studies in detail, the great majority analysed L&B type III fractures. Some did not clearly define the fracture types and only one study clearly included L&B type II fractures. In consequence, the actual treatment recommendation for type II fractures remains unclear.

In the herein presented study, conservative treatment of all L&B type I and II fractures lead to excellent results (Table

14). The comparison between 2 methods of conservative treatment used (below knee pop slab and leucocrepe bandage) had no significant difference in outcome. Return to Daily activities (93% patients returned to their daily activities within 3months) were comparable to previous studies including L&B type I fractures only^{14,15, 20, 27}. The mean foot function index score (FFI) for Type 1 fracture was 5.43 and for Type 2 fracture was 5.63 respectively after 3 months of follow up. After 6 month of follow up the mean FFI score for Type1 fracture was 1.5088 and for Type 2 fracture was 1.5047 respectively (Table 16 & 17). Finally, our treatment regimen did not result in any complications or conversion of treatment except in 3 cases who had mild restriction of movement of joints around foot and ankle after 6 months and 2 patients could not return to their daily activities even after 6 months. When comparing L&B type I and II fractures no significant differences could be detected for any outcome parameter (fracture location & fracture characteristic) within a follow-up of 6 months. Except in case of Diabetic patients final functional outcome was poor when compared to non-diabetic patients (Table 20 & 21).

The few studies available for type II fractures demonstrated comparable results to the herein presented findings. Still they are inherent of shortcomings that need to be discussed.

Biggs et al²⁹ reported on the outcome of 62 type I and 26 type II fractures. No differences were found for the Foot Function Index (FFI) and the Short Form 36 between type I and II fractures. Unfortunately, no standardized treatment regimen was applied.

Konkel et al.¹⁹ treated 35 type I and 10 type II fractures nonoperatively. Treatment varied from no treatment to immobilization in a short leg cast. In average patients required 3.5 months to resume full duty. The orthosis, cast or shoe was applied for a minimum of 6 weeks. This long immobilization might have contributed to the prolonged time of recovery. Nevertheless, 100% of the patients were satisfied with the result.

Van Aaken et al.²¹ applied functional treatment for 15 type I and 8 type II fractures with an elastic dressing. The mean time to return to work was 21 days for patients with type I fractures compared to surprisingly 4 days for patients with type II fractures. Taken together, type II fractures can be treated functionally with an excellent clinical outcome, comparable to L&B type I fractures.

Further, many authors postulate that displaced (>2 mm), multifragmentary, or intra-articular fractures necessitate operative treatment. Almost all of these recommendations are solely based on the authors’ opinion, but not on evidence²⁹⁻³⁴. Therefore, the second aim of this study was to evaluate the influence of these aspects on the outcome of conservatively treated L&B type I and II fractures. None of the fracture characteristics analysed, namely fracture displacement greater 2 mm, articular involvement, or comminution, affected any of the outcome parameters assessed.

Only two studies report data regarding the impact of intra-articular involvement and displacement on the clinical outcome^{20, 31}

Egol et al.²⁰ treated L&B type I fractures by immediate weight bearing as tolerated. Out of these, 50% were intra-articular and 32% displaced (>2 mm). The average time to return to work was 22 days. Comparing intra- to extra-articular fractures and non-displaced to displaced fractures, no significant differences could be observed for any of the outcome parameters (SMFA pain, VAS).

Tahririan et al.³¹ treated 143 patients with a fracture to the base of the fifth metatarsal (L&B type I, II, III) with a short leg cast for 6 weeks. The average AOFAS score after 20 weeks for all fractures was 93 with a 95% confidence interval of 92–94. The multivariate analysis revealed that displacement, patient weight, type III fractures, diabetes and female gender were associated with a poorer AOFAS. One should keep in mind, that the AOFAS score, the only outcome parameter assessed, has been proven to be poorly valid and the minimal important clinical difference of this score is unknown³⁹. Moreover, the average AOFAS in this study was extremely high with a remarkably narrow CI suggesting an excellent outcome for all fractures. Finally, the results of the statistical analysis are not comprehensible, as the authors did not present any data in detail.

All in all, the data presented in our study argue for conservative treatment for 4 weeks and immediate weight bearing after that of all L&B type I and II fractures, independent of displacement, articular involvement, or comminution.

Several limitations and strengths have to be discussed. First it is a prospective cross-sectional study with follow up of 6 months. The follow up rate is also high among 132 cases 115 patients came for follow up. But it is unclear what happened to the patients lost to follow up, whether they received surgery elsewhere, suffered inferior clinical results or were in line with the patients included in this study. Still, this follow-up rate is compare to previous studies^{16,32,40}.

Second, despite follow-up of almost 6 months, refractures have been reported to occur even upto 2 years and even after that time range³². Still, most recent studies report low re-fracture rates in operatively treated patients initially suffering a stress fracture (L&B type III) 26 or athletes^{30, 32, 34}. The risk for re-fracture after conservative treatment for L&B type I and II fractures remains unknown.

Third the number of follow up visits and radiological evaluation every time is not cost effective and also difficult to maintain in this poor socio-economic set up.

Fourth, during follow up visit only subjective improvement of pain, swelling & movement around foot and ankle was checked, no valid scoring system was available to follow the improvement or deterioration of this factors.

Strengths of this study were the use of one validated patient rated outcome measures, specific for foot and ankle disorders i.e., Foot Function Index^{5,6}. Furthermore, the

fracture characteristics were assessed by mean, P value and prospective follow up of 6 months was reached. Patient specific factors such as metabolic disorders (Diabetes Mellitus) was assessed and relation with final functional outcome was established. Relation between two different methods of conservative treatment and functional outcome was assessed; although no significant result was found. Finally, a detailed workup of various factors possibly influencing the results

5. Conclusion

Conservative treatment leads to excellent clinical results for both, L&B type I and type II acute fractures. As both fracture locations did not differ for outcome, they should not be delineated, but rather be summarized as epi-metaphyseal. Fracture displacement greater 2 mm, intra-articular involvement did not affect the outcome. Diabetes Mellitus has significant effect in the functional outcome in this type of fracture compared to non-diabetic patients who were treated in similar fashion. Therefore, conservative treatment should be applied to all epi-metaphyseal fractures, even when displaced, intra-articular or comminuted.

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