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Outcomes of Fifth Metatarsal Base Fractures Treated Through Conservative Measures

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ABSTRACT

Introduction: A constant change in biomechanics from the proximal to distal part in the fifth metatarsal makes it vulnerable to different pattern of fractures at different locations. Both conservative and surgical options are practised for the treatment of base of 5th metatarsal fractures. Appropriate and adequate treatment of the base of 5th metatarsal fracture, depending upon the zones involved has always been a matter of confusion and debate.

Objectives: The objectives of this study is to evaluate the outcomes of fifth metatarsal base fractures treated through conservative measures.

Methodology: This study is a prospective, observational, cohort, cross sectional study conducted among the patients visiting orthopaedics out-patient department (OPD)/ Emergency with base of 5th metatarsal fractures. The sample size was calculated to be 45 and samples are collected using non probability purposive sampling technique. After data collection, All reports are entered in a predetermined Performa and analysed using SPSS version 21.

Results: Out of 45 patients, 40 (88.9%) patients had zone 1 injury, 4 (8.9%) has Zone 2 injury and only 1 (2.2%) had zone 3 injury. The average VAS score was 7.88 ± 0.61 at presentation, 5.46 ± 0.62 at 6 weeks and 2.31 ± 0.73 at 12 weeks from the date of trauma. The average AOFAS midfoot score was 25.08 ± 12.89 at presentation, 51 ± 6.08 at 6 weeks and 89 ± 4.83 at 12 weeks from the date of trauma. None had paster related complications, non-union, secondary fracture displacement requiring manipulation or fracture fixation.

Conclusion: Conservative approaches for treatment of base of 5th metatarsal fractures yield favourable results in the majority of cases. It also mitigates the risks associated with surgical intervention such as infection and hardware complications. The cost-effectiveness and accessibility of conservative management make it an attractive option for patients across diverse healthcare settings.

INTRODUCTION

Fractures of the fifth metatarsal base have gathered significant attention in both clinical and research realms due to their diverse presentations and treatment challenges.[1-3] The fifth metatarsal, situated at the lateral edge of the foot, plays a crucial role in weight distribution and propulsion during walking, making its fractures a subject of substantial interest.[4,5] There is a constant change in biomechanics from the proximal to distal part in the fifth metatarsal which makes it vulnerable to different pattern of fractures at different locations.[6] Lawrence and Bottle thus classified the proximal part of the fifth metatarsal into three anatomical zones: zone 1, the tuberosity; zone 2, the meta-diaphyseal junction; and zone 3, the diaphyseal area within 1.5 cm of the tuberosity.[7]

Fractures of the fifth metatarsal base encompass a spectrum of injuries, ranging from avulsion fractures at the proximal end to Jones fractures in the metaphyseal-diaphyseal junction, and stress fractures along the diaphysis.[7] Being in the vascular watershed area, Jones fractures has always been favoured for surgical intervention.[6,8-10] The conservative approaches are increasingly being explored and given potential advantages such as reduced morbidity and avoidance of surgical complications.[11-14] This study addresses a significant gap in understanding the outcomes associated with non-surgical treatments, shedding light on their viability, limitations, and implications for clinical practice.

The primary aim of this research is to comprehensively assess the functional and radiological outcomes of fifth metatarsal base fractures treated conservatively. There is a plethora of conservative modalities for treatment of fifth metatarsal fractures which includes elastic bandage support, immobilization through a hard-soled shoe, short-leg walking casts, or a cam walker boot cast, protected weight-bearing/ non weight bearing, activity modification, with or without bone stimulation.[2,11,15-18] Various surgical treatments has also been practiced for the fractures of the fifth metatarsal like open reduction internal fixation with intramedullary cannulated cancellous screw, tension band wiring, low profile plate fixation with/without bone grafting.[1, 19-33]

The increasing recognition of the complex anatomical and biomechanical significance of the fifth metatarsal in weight-bearing and propulsion during gait cycle has underscored the importance of developing optimal treatment strategies for these fractures. This study emanates the outcomes associated with conservative measures in treating fifth metatarsal base fractures, thus contributing to evidence-based decision-making and refining current clinical practices.

Surgical intervention has been favored for fifth metatarsal base fractures, being arterial watershed areas, particularly for Jones fractures, owing to their tendency for delayed healing and non-union. However, recent trends have witnessed a surge of interest in non-surgical approaches due to their potential advantages, including reduced surgical morbidity and avoidance of surgical complications, thereby providing a holistic perspective on the effectiveness of non-surgical interventions.

In conclusion, the rationale for this study rests on the imperative to address the gap in knowledge regarding the outcomes of fifth metatarsal base fractures treated through conservative measures. By systematically evaluating functional and radiological outcomes, as well as patient-reported experiences, the research seeks to provide valuable insights that can guide clinical decision-making, enhance patient care, and contribute to the ongoing refinement of treatment protocols for this intricate class of fractures.

METHODOLOGY

This study is a prospective, observational, cohort, cross sectional study conducted among the patients visiting orthopaedics out-patient department (OPD)/ Emergency with base of 5th metatarsal fractures. This study was conducted after ethical clearance from Institutional Review Committee (IRC) at Birat Medical College teaching hospital (ref no. 357) from November 2023 till the sample size was achieved. The sample size was calculated to be 45 and samples are collected using non probability purposive sampling technique. The inclusion and exclusion criteria are as follows:

Inclusion Criteria:

- Age more than 15 years
- Closed fracture
- Base of 5th Metatarsal fracture within anatomical Zone 1-3
- Acute injury

Exclusion Criteria:

- Previous history of similar fracture in same foot
- Other associated fracture in the same limb
- Multiple metatarsal fracture
- Pathological fracture
- Open fractures
- Displaced more than 3 mm
- Neglected injuries
- Lost to follow up
- Refusal to participate in the study

Patients visiting the orthopaedics outpatient department/ BMCTH emergency with fractures of fifth metatarsal meeting the inclusion criteria will be taken into the study. Patients will be informed about the research and written consent will be taken. After taking meticulous history, a clinical examination will be done and anteroposterior and oblique view radiographs of the injured foot are obtained. In presence of prominent swelling at the fracture site/ foot, below Knee posterior slab will be applied for immobilization in the same setting (OPD/ Emergency) by one of the investigators, using thin layer of cotton, 6 inch plaster of Paris folded into 18-20 layers and roller bandages. In absence of prominent swelling, below knee cast will be applied for immobilization, using either a thin layer of cotton and 6 inch plaster of Paris or stocky net, cotton padding and 5 inch fibre cast. All the patients with below knee posterior slab or cast are counselled about the plaster complications; to return to the hospital immediately in case of increasing swelling distal to the plaster, disproportionately increasing pain/ pain out of proportion, numbness and discoloration in any of the toes. Patients will be asked for strict non weight bearing mobilization with adjustable axillary crutches. Also, limb elevation and active toes movement will be advised for the duration of plaster application. Patients will be discharged after about 30 minutes of observation after application of a posterior slab or a cast.

At 1 week, check x-rays (anteroposterior and oblique view radiographs of the injured foot) will be done to see for the alignment/ displacements of the fracture fragments and any complications relating to the plaster application. Those patients with below knee posterior slab at first visit will now be converted to below knee cast after 1 week in second hospital visit in

orthopaedics OPD after the swelling has substantially decreased.

Patients will be then called for follow up at 6 weeks and 12 weeks, clinically and radiologically evaluated (anteroposterior and oblique view radiographs of the injured foot will be obtained). Visual Analogue Scale (VAS) score and American Orthopaedic Foot and Ankle Society (AOFAS) Midfoot score will be taken. Cast will be removed after 6 weeks of immobilization. Partial weight bearing mobilization will be initiated after 6 weeks of immobilization, for next 2 weeks with axillary crutches and then full weight bearing mobilization will be allowed.

All the data are entered in predetermined proforma and analysed using SPSS version 21.

RESEARCH FINDINGS

Out of 45 participants, 30 (66.67%) were males and 15 (33.33%) were females. The mean age of the participants was 31.71 ± 7.13 years, median age was 31 years; minimum being 20 years and maximum being 45 years. Among the females, the minimum age was 26 years and maximum 45 years. Similarly, among the males, the minimum age was 20 years and maximum 45 years.

On observing the pattern of injuries, 40 (88.9%) patients had zone 1 injury, 4 (8.9%) has Zone 2 injury and only 1 (2.2%) had zone 3 injury. Among 40 patients having zone 1 injury 25 (62.5%) were males and 15 (37.5%) were females. Similarly, all 4 patients with zone 2 injury were males and the single patient having zone 3 injury was also male (P value 0.245).

The average VAS score was 7.88 ± 0.61 at presentation, 5.46 ± 0·62 at 6 weeks and 2·31 ± 0·73 at 12 weeks from the date of trauma· Among the male patients, mean VAS score was 7·9 ± 0·66 at presentation, 5·5 ± 0·62 at 6 weeks and 2·5 ± 0·74 at 12 weeks· Similarly among females, mean VAS score was 7·8 ± 0·51 at presentation, 5·4 ± 0·63 at 6 weeks, 2·5 ± 0·74 at 12 weeks· Assessing the 40 patients with only zone 1 injuries, the mean VAS score was 7·9 ± 0·59 at presentation, 5·45 ± 0·63 at 6 weeks and 2·32 ± 0·69 at 12 weeks· Similarly among the patients with zone 2 injuries, mean VAS score was 7·5 ± 0·57 at presentation, 5·5 ± 0·57 at 6 weeks, 1·75 ± 0·5 at 12 weeks· For patient with zone 3 injury, mean VAS score was 9 at presentation, 6 at 6 weeks and 4 at 12 weeks·

The average AOFAS midfoot score was 25.08 ± 12.89 at presentation, 51 ± 6·08 at 6 weeks and 89 ± 4·83 at 12 weeks from the date of trauma· Among the male patients, mean AOFAS midfoot score was 25.96 ± 12.45 at presentation, 51.26 ± 6.61 at 6 weeks and 90.16 ± 4.99 at 12 weeks. Similarly among females, mean AOFAS midfoot score was 23.33 ± 14.01 at presentation, 50.46 ± 5.02 at 6 weeks, 86.67 ± 3.61 at 12 weeks. Assessing the 40 patients with only zone 1 injuries, the mean AOFAS midfoot score was 24.62 ± 13.09 at presentation, 50.7 ± 5.85 at 6 weeks and 88.5 ± 4.69 at 12 weeks. Similarly among the patients with zone 2 injuries, mean AOFAS midfoot score was 34 ± 2.30 at presentation, 57 at 6 weeks, 95 at 12 weeks. For patient with zone 3 injury, mean AOFAS midfoot score was 8 at presentation, 39 at 6 weeks and 85 at 12 weeks.

Also, while comparing the mean value of VAS score and AOFAS midfoot score at presentation, at 6 weeks and at 12 weeks by gender the test was not statistically significant using T test.

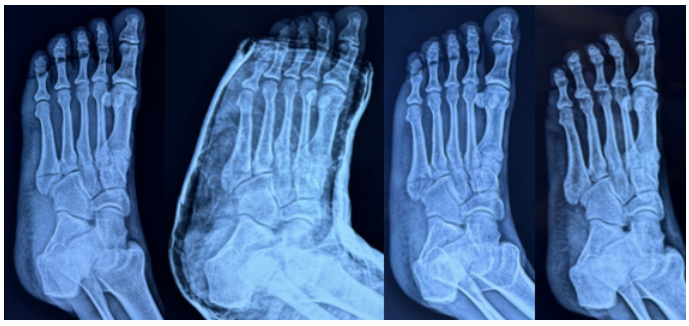
Among the 45 patients of the study, none had paster related complications, non-union, secondary fracture displacement requiring manipulation or fracture fixation.

Table 1: Baseline characteristics of study participants

	Total participants	Mean ± SD	Median (IQR)
Age	45	31.71 ± 7.13	31 (26-31)
Male			
Age	30	30.4 ± 7.26	30.5 (24-30.5)
Female			
Age	15	34.33 ± 6.30	33 (31-33)

Table 2:

Gender	Zone involved			Total
	1	2	3	
Male	25, 62.50%	4, 100%	1, 100%	30, 66.67%
Female	15, 37.50%	0, 0%	0, 0%	15, 33.33%
Total	40, 100%	4, 100%	1, 100%	45, 100%



A B C D

Fig 1: Jones fracture at presentation before (A) and after below knee cast application (B), at 6 weeks (C) and at 12 weeks (D)

A B C D

Fig 2: Pseudo Jones fracture at presentation before (A) and after below knee posterior slab application (B), at 6 weeks (C) and at 12 weeks (D)

DISCUSSIONS

In our study among 45 patients, majority of the base of 5th Metatarsals fracture, 40 (88.89%) were zone 1 injuries. This was in accordance to the study conducted by Chloros et al in 2021.[6]

The average VAS score was 7.88 ± 0.61 at presentation, 5.46 ± 0.62 at 6 weeks and 2.31 ± 0.73 at 12 weeks from the date of trauma. This is in accordance to the study conducted by lee et al in 2016.[34]

The average AOFAS midfoot score was 25.08 ± 12.89 at presentation, 51 ± 6.08 at 6 weeks and 89 ± 4.83 at 12 weeks from the date of trauma. This was in accordance to the study conducted by Piyapittayanun et al in 2019.[35] Similar was the result in the study conducted by Baumbach et al in 2017.[16]

In our study the average time of patients to return to normal daily activities was 3.26 weeks which was in accordance to the study conducted by Wu et al. in 2017.[36]

In our study none of the patients had paster related complications, non-union, secondary fracture displacement requiring surgery. All patient showed radiological and symptomatic improvement with plaster immobilization for 6 weeks. This is also in accordance to the similar study conducted by Bumbach et al in 2017[11] and Piyapittayaun et al in 2019.[35]

CONCLUSION

Through a comprehensive review of existing literature and clinical studies, it becomes evident that conservative approaches, including immobilization, protected weight-bearing, and gradual rehabilitation, yield favorable results in the majority of cases.

Not only does conservative management often lead to successful fracture healing and restoration of function, but it also mitigates the risks associated with surgical intervention, such as infection, hardware complications, and prolonged recovery times. Furthermore, by avoiding surgery, patients can experience quicker return to activities of daily living and sports participation, with minimal disruption to their lifestyle.

Moreover, the cost-effectiveness and accessibility of conservative management make it an attractive option for patients across diverse healthcare settings.

In essence, the evidence overwhelmingly supports the efficacy, safety, and practicality of conservative management in the treatment of base of fifth metatarsal fractures. By incorporating this approach into clinical practice, healthcare professionals can contribute to improved patient outcomes, enhanced quality of life, and greater overall satisfaction for individuals navigating this common orthopaedic injury.

CONFLICT OF INTEREST None

FINALCIAL DISCLOSURE None

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