



EVALUATION OF EFFICACY OF DIFFERENT MODALITIES IN TREATMENT OF FRACTURE METATARSAL

Orthopaedics

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ABSTRACT

Aim: to evaluate the efficacy of three different modalities in treatment of fracture metatarsal.

Materials and methods: A Hospital based prospective comparative study was conducted in Mahatma Gandhi Medical College, Jaipur from December 2018 to June 2020 involving 50 patients above 16 years of age presented with isolated metatarsal fractures and grade I open fractures were included. Patients fulfilling the inclusion criteria were then allocated to one of three groups. Group A-Conservative management, Group B-K-wire fixation and Group C-External Fixator. Outcome measurement was done using AOFAS MID FOOT SCALE (100 points total).

Results: Majority 29 patients belong to 35-60 years of age group followed by 18 patients in 26-35 years. Maximum number of cases is reported in male category that is 45 cases. Majority of the cases; falls under the category of Road Traffic Accidents that is 28 cases which is about 56% of total cases. In 37 cases right foot is involved whereas 13 cases are of left side suggesting right is the dominant side. 48% of second metatarsal and 30% of third metatarsal showed the maximum involvement. Maximum number of cases are designated as excellent having score between 90 and 100 that is about 38 cases which is 76% of total cases suggesting every treatment modality is good in its own right. There is significant difference between the different treatment modalities at final follow-up $p < 0.05$.

Conclusion: All treatment modalities equally good, achieving good fracture union, decreased incidence of pain and achieve good range of movements but complications rate is more in conservative group as compared to other groups.

KEYWORDS

Fracture metatarsal, Conservative management, K-wire fixation, External Fixator

INTRODUCTION

Foot is a great dynamic structure of the body; consists of 26 small bones, joints, multiple ligaments and tendons that provide a great stable structure which enable a person to walk, jump and run even on uneven surface without any difficulty.

The foot which is situated at the lower part of human anatomical hierarchy carry the whole body to its destination is still the one that is mostly neglected by patients and clinicians. Although the various traumas to the foot encountered out of that Fracture metatarsal is one of them.

Metatarsal fractures represent 5 to 6 percent of fractures encountered in primary care.¹ They range from easily managed fractures to more complicated fractures that require surgical intervention. With a basic knowledge of metatarsal injuries, primary care physicians can manage selected metatarsal fractures and further identify patients who need referral.

Contiguous metatarsal fractures were also common and occurred in 9% of all metatarsal fractures. A total of 60% of middle metatarsal fractures were associated with a neighboring metatarsal injury. Middle metatarsal fractures are generally neglected because that is secured on medial side by first metatarsal and lateral side by fifth metatarsal that prevents displacement of fracture fragments. Even then, this fracture creates lots of problems and disability during walking and long standing for example stress fracture being one of them. Stress fractures which occur in athletes and military personnel commonly affect the foot skeleton. The proximal shaft of thesecond, third, and fourth metatarsals are the most frequent sites of stress fractures in human adult bones.^{2,4} The fifth metatarsal remains the most common site of injury: such fractures are almost ten times more common in males and the mean age is 26 years.³ In high-level athletes, fracture through the base of the fifth metatarsal is the fourth most common foot and ankle injury.⁶

While we were dealing with foot injuries we came up with lot of problems such as patients arriving late after injury as a result of which there were lots of neglected foot injury cases present. Another problem

being the economic crunch that leads to mismanagement of patients and these patients were unable to receive the proper treatment. In case of compound fracture, infection is the main culprit which leads to modification of treatment. Hence the present study was conducted with the aim to evaluate the efficacy of three different modalities in treatment of fracture metatarsal.

MATERIALS AND METHODS

A Hospital based prospective comparative study was conducted in Mahatma Gandhi Medical College, Jaipur from December 2018 to June 2020 involving 50 numbers of patients. The study was done after taking due clearance from Clearance from Institute Ethics Committee. Also, Written and informed consent of all the patients was taken prior to their enrolment in the study.

INCLUSION CRITERIA:

1. Isolated metatarsal fractures
2. Open fractures grade I
3. Age above 16 yrs

EXCLUSION CRITERIA:

1. Grade II and III open fractures
2. Associated lower limb long bone fractures
3. Age Below 16 yrs

Protocol

The management of patient was started in emergency room as soon as possible. Early management of these patients was done according to standard ATLS protocol. After primary stabilization the patient underwent a complete survey which included radiographs of cervical spine, chest-abdomen, dorso-lumbar spine, pelvis and the injured limb with proximal – distal joint. Open injuries were thoroughly irrigated and debrided to remove any foreign body, contamination, grass, dirt or any devitalized tissue.

After primary management, the patient was checked if he fits in inclusion criteria or not. Written consent was taken in patient's native language. Patients fulfilling the inclusion criteria were then allocated to one of three groups.

Routine Investigation:

CBC, ESR, Serum electrolyte
Random blood sugar, blood urea, serum creatinine
Blood grouping and cross matching
Other investigations depending on patient's pre-morbid condition.

Groups

GROUP A – Conservative management
GROUP B – K-wire fixation
GROUP C – External fixator

Outcome Measurement

AOFAS MID FOOT SCALE (100 points total)
(AMERICAN ORTHOPAEDIC FOOT AND ANKLE SCORE)
The surveys include a mixture of questions that are both subjective and objective in nature. The pain category which asks patients a single question about their level of pain is subjective, while the alignment category (to be answered by the physician) is objective.

RESULTS

Table 1: Majority 29 patients belong to 35-60 years of age group followed by 18 patients in 26-35 years. Maximum number of cases is reported in male category that is 45 cases; which is about 90% of total cases and only 5 cases of female are reported; which is only 10% of total cases. There is hardly any difference, as cases from urban and rural areas are nearly equal consists of 52% cases from urban areas and 48% cases from rural areas.

Table 2: Maximum number of cases; falls under the category of Road Traffic Accidents that is 28 cases which is about 56% of total cases followed by 15 cases belongs to Fall of heavy object that is 30% of cases and Remaining modes of injury that is twisting get 5 cases which is 10% of total cases while assault got only 2 cases which 4% of total cases. Side of injury does not have much significance but still in 37 cases right foot is involved which is 74% of cases whereas 13 cases are of left side which is 26% of total cases suggesting right is the dominant side.

Table 3: Total percentage that is 48% of second metatarsal and 30% of third metatarsal showed the maximum involvement. While the fourth and fifth metatarsal consists of 20% and 18% respectively and remaining first metatarsal with only 6% involvement.

Table 4: Every patient is given a set of questionnaires according to it patient is assigned to a score between 0 to 100. It is been calculated at the time of injury, at 2 weeks, 2 months and 6 months. As expected patients that are receiving treatment has increment in mean score being lowest at the time of injury that is 42.68 which increases at follow up that is 69.82 at 2 weeks, 78.24 at 2 months and 87.88 at 6 months. Maximum number of cases are designated as excellent having score between 90 and 100 that is about 38 cases which is 76% of total cases suggesting every treatment modality is good in its own right. But excellent cases do complains of pain causing limping during walking and are not fully satisfied. Rest 7 cases are designated as good consisting of 14% of total cases and 5 cases are designated as fair consisting of 10% of total cases.

Table 5: Comparison between conservative management and k-wire was done. Statistical significance been calculated at follow up that is at 2 weeks, 2 months and 6 months which is 0.002, 0.006 and 0.014. Similarly, comparison between conservative management and external fixation been done. Statistical significance been calculated at follow up that is at 2 weeks, 2 months and 6 months which is 0.027, 0.045 and 0.035. Comparison between k-wire and external fixation been done. Statistical significance been calculated at follow up that is at 2 weeks, 2 months and 6 months which is 0.04, 0.12 and 0.006. Suggesting there is significant difference between the different treatment modalities at final follow up.

Tables**Table 1: Demographic details of the study population**

Variables	No. of Cases	Percentage
Age in Years		
18-25	3	6.00
26-35	18	36.00
36-60	29	58.00
Sex		

Male	45	90
Female	5	10
Area of Residence		
Rural	24	48.00
Urban	26	52.00
Total	50	100

Table 2: distribution according to mode of injury and laterality

Variables	No. of Cases	Percentage
Mode of Injury		
RTA	28	56.00
Fall of object	15	30.00
Twist	5	10.00
Assault	2	4.00
Side involved		
Right	37	74.00
Left	13	26.00
Total	50	100.00

Table 3: distribution according to metatarsals involved

Metatarsals Involved	No. of Cases	Percentage
1	3	6.00
2	24	48.00
3	15	30.00
4	10	20.00
5	9	18.00

Table 4: mean AOFAS score and outcome in the study population

AOFAS SCORE	Interval	Mean±SD
	Before treatment	42.68±14.43
	2 Week	69.82±8.10
	2 Month	78.24±8.69
	6 Month	87.88±10.11
Outcome		N (%)
	Good	7 (14.0)
	Fair	5 (10.0)
	Excellent	38 (76.0)

Table 5: comparison of treatment outcome between the groups at different time intervals

Treatment	No. of Cases	2 Week		2 Months		6 Months	
		Mean	SD	Mean	SD	Mean	SD
Conservative	27	72.19	2.75	81.92	3.32	91.59	3.99
K wire	19	66.84	12.14	75.53	11.91	84.26	14.14
External Fixator	04	68.00	3.27	75.75	3.86	80.00	6.32
(Conservative vs K-wire) p-value		0.002*		0.006*		0.014*	
(Conservative vs external fixator) p-value		0.027*		0.045*		0.035*	
(K-wire vs external fixator) p-value		0.040*		0.120		0.006*	

Test applied: unpaired t-test. * indicates statistical significance

DISCUSSION

Patients with metatarsal fractures often present to primary care settings and present with a variety of situations. Ranging from the relatively benign, isolated central metatarsal fracture to the crush injury leading to extensive damage of the soft tissue and osseous component, these fractures can cause a significant inconvenience to the patient. With the exception of the fifth metatarsal fractures, little standardization is available for the treatment of metatarsal fractures.

The importance of the first metatarsal with regard to overall foot function makes anatomic alignment paramount. Attention to detail can help prevent long- term sequelae & deformities. Central metatarsal fractures have a high chance of union, with little known about extensive complications. However, disruption in the metatarsal parabola can cause undue discomfort. The fifth metatarsal is by far the most common metatarsal that is fractured. A large percentage of this fracture is amenable to conservative treatment. When surgical intervention is implemented, the patient and surgeon can expect a good outcome.

This sample size is very small as well as duration of study is not too long. Looking with this scenario in our study also has same condition more and less. This comes out with overall observation even. Better results can be achieved after a long study and a larger sample size.

In this study, a total number of 50 cases have been taken out of which, 27 patients underwent conservative management and 19 underwent K-wire fixation and 4 patients underwent external fixation.

Our case series, we considered age from 18 to 60 years and divided into 3 groups. First group has age between 18-25 Consist of only 3 cases that are 6% of total cases. Second group has age between 26-35 Consist of 18 cases that are 36% of total cases. And the third group has age between 36-60 Consist of 29 cases that are 58% of total cases. It indicates maximum number of cases falls in second and third group that is 94% of total cases; pointing towards the working class that sustains this type of injury. Chandran P et al.⁷ and Thompson P et al.⁸ also documented a similar incidence.

In sex distribution, maximum number of cases is reported in male category that is 45 cases; which is about 90% of total cases and only 5 cases of female are reported; which is only 10% of total cases. This suggests in Indian scenario, males are dominantly working class and sustains more traumas.

Chandran P et al.⁷ also have incidence similar to our study with male 90% and female 10%. Incidence of female patient was significantly higher in Thompson P et al.⁸ study, which is due to similar working class of male and female in foreign countries.

In area distribution, there is hardly any difference, as cases from urban and rural areas are nearly equal consists of 52% cases from urban areas and 48% cases from rural areas. As road traffic accident and industrial machine injury were more common in urban areas.

In our study, the commonest mode of injury was high velocity road traffic accidents accounts for 56% followed by fall of heavy object (30%). The incidence of injury due to RTA was almost similar to series of Gotha HE et al.⁹ and Chandran P et al.⁷ The reason of high incidence of RTA can be attributed to better road facilities and technological advancements with increase number of vehicles and ignorance of traffic rules. Assault and fall of heavy object are other causes.

Incidence of right side metatarsal involvement was significantly higher (74%) than left side (26%) in our series as observed by Gotha HE et al.⁹ that right foot commonly involve that left foot further supporting the evidence. As right is the dominant side.

In our series, most common metatarsal involved was second (48%) followed by third (30%). While the fourth and fifth metatarsal involvement was 20% and 18% respectively. Remaining first metatarsal with only 6% involvement. Baumfeld D et al.¹⁰ 29 study was almost similar involvement of second metatarsal fracture (57%). Incidence of fifth metatarsal fracture significantly higher in Sarpong NO et al.¹¹ 33.

As the study progresses we encountered various complications such as infection, malunion and deformity. Of these malunion and deformity are mostly present in conservative management group as these patients often remove cast of their own and loss of follow up leading to mismanagement and leads to complications. 6 cases have suffered from malunion and in 5 cases persistence of deformity been seen. Kim HN et al.¹² stated that more than 10 degree of displacement in the sagittal plane and 3-4 mm of translation in any plane should be treated surgically as due to presence of angulations and these cases opted for conservative management, as a result of which leads to malunion and deformities.

Infection rates are higher in operative cases, in which 3 cases of external fixation got infected and 2 cases of k-wire fixation got infected and persistence of deformity is seen in only one case of k-wire fixation. Baumfeld D et al.¹⁰ concluded that Percutaneous antegrade k-wire surgical treatment is an effective alternative to other types of treatment for lateral metatarsal fractures, with a lower incidence of complications. In our study also, the overall complication rate was found to be lower in K-wire group.

In our series, final outcome was based on AOFAS score. Patients that

were treated as conservatively AOFAS score excellent (91.59 out of 100). Patient treated with k-wire fixation and external fixator AOFAS score was good (84.26 and 80.00 respectively). Similar study was conducted by CakirH et al.¹³ reported that general outcome of metatarsal fracture were satisfactory. Moreover, Spector FC et al.¹⁴ treated 12 patients; 3 with a non displaced proximal metatarsal fracture, 1 with a displaced proximal metatarsal fracture, 7 with a distal metatarsal fracture, and 1 with a mid shaft metatarsal fracture. Five of these patients were treated conservatively without reduction, 2 by anatomic open reduction with internal fixation, and 5 by non anatomic open reduction with internal fixation. Good to excellent results were obtained in 8 (67%) and fair results in 4 (33%).

In case study of Kim HN, MD et al.¹² conducted study on k-wire fixation done on 35 patient and result found excellent with average AOFAS score of 96.7.

While we were going through literature it was found most of the authors are treated conservative only or operative only. There are few studies who tried to compare between different modalities but they were not satisfied as conditions were not equal in both the treatment.

Various factors are considered before assigning the patient into a certain group such as low socio economic conditions of the patients, social dogma in society regarding operative procedures, simply not willing for surgical correction irrespective of severity of injury and lastly those who are not fit for surgery underwent conservative management. While the educated people who are from good socio economic background who understood the situation underwent fixation via k-wire fixation and external fixation on the basis of severity of injury. AOFAS score was excellent in conservative group in compare with operative group due to larger sample size and have less severe type of injury.

CONCLUSION

In our study metatarsal fractures treated with conservative management with casting, kirschner wire stabilization and external fixation. AOFAS score was used to assess the functional outcome in our study. At the end of study AOFAS score was maximum in conservative groups pointing towards the fact that maximum cases opted for conservative management and least for external fixation. All treatment modalities equally good, achieving good fracture union, decreased incidence of pain and achieve good range of movements but complications rate is more in conservative group as compared to other groups. Even though we have maximum complications in conservative group, we have achieved good union and excellent functional outcome at end of follow up.

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