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Dr. Abhishek Khandelwal
Jahangir Hospital, Sassoon Road
Near Railway Station Pune,
Maharashtra, India

Dr. Devam Shah
Jahangir Hospital, Sassoon Road
Near Railway Station Pune,
Maharashtra, India

Dr. Jimit Mirani
Jahangir Hospital, Sassoon Road
Near Railway Station Pune,
Maharashtra, India

A prospective non randomized observational study of functional and radiological outcome of open reduction and internal fixation in bimalleolar and trimalleolar ankle fracture

Dr. Abhishek Khandelwal, Dr. Devam Shah and Dr. Jimit Mirani

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Abstract

Ankle fractures are the third most common orthopaedic injuries in geriatric patients and the most common intra-articular fractures of a weight bearing joint. Trimalleolar fracture can be tricky to manage and carry a high risk of long-term complication like osteoarthritis and joint stiffness. We conducted a prospective study of 35 patients who underwent surgical management for Bi/Trimalleolar fractures. We classified patients as per Lauge-Hansen classification. Our aim was to assess functional outcome using Karlsson's score and radiological outcome as well as to compare it with existing literature. Complications were noted. Results were comparable to other series. There was significant improvement of subjective scores from 3 months to 6 months in stability, pain, swelling, sports and ADLs, running and support with P value <0.0001 (for all). Surgical treatment with stable fixation gives good results in terms of early mobilization, faster rehabilitation and more rapid return of function.

Keywords: Ankle fracture, trimalleolar, management, ORIF, classification

Introduction

Ankle fractures contribute to 9% of all fractures. Surgical correction is required otherwise it may lead to post traumatic painful restriction of movements and osteoarthritis^[1,2,3]. About 15-20% of patients with ankle fractures are clinically significant and vary from unimalleolar, Bimalleolar and Trimalleolar fractures^[4]. A more stable but least invasive osteosynthesis is required to enable early functional outcome. Both Bimalleolar and Trimalleolar fractures affect gait pattern and clinical symptoms to an equal extent in short-term studies^[6]. Malleolar fractures occur because of a rotatory force as opposed to an axial force. To date very few investigators have examined the functional recovery following operative treatment of ankle fractures or mentioned about the suitable period advisable for full weight bearing^[12].

Materials and Methods

This was a prospective observational study. A detailed case history was taken of all patients coming in emergency with ankle fracture. Thorough clinical (general and systemic) examination was done. The diagnosis was confirmed by XRAY and injuries were further evaluated by CT scan. Patients were classified as per Lauge-Hansen classification. Patients were given immediate management in form of splinting, elevation and analgesics. 35 patients of ankle fracture, between 18 to 65 years with close injuries were included in this study. Patients outside this age limit and having open fractures were excluded from study. Informed consent was taken before enrolling in the study. Patients undergoing surgery were underwent routine preoperative investigations. Experienced trauma surgeon in our institute operated all patients. During surgery fracture reduction and fixation was done in accordance with AO principles. Specific physiotherapy protocol was followed. Follow ups were taken on 6week, 3rd month, 6th month. On each follow up, patients were evaluated radiologically by Kristenson criteria and functionally using Karlsson's scoring system.

Corresponding Author:
Dr. Devam Shah
Jahangir Hospital, Sassoon Road
Near Railway Station Pune,
Maharashtra, India

Table 1: Kristen son's criteria ^[75].

S. N	GOOD
1.	Talus- Correctly placed
2.	Medial malleolus - No displacement or fracture gap of less than 2mm
3.	Lateral malleolus- negligible lateral displacement and up to 2mm of posterior displacement
4.	Posterior malleolus -upward displacement of less than 2mm
FAIR	
1.	Talus- Correctly placed
2.	Medial malleolus- No displacement or fracture gap of less than 2mm
3.	Lateral malleolus- negligible lateral displacement and up to 2mm of posterior displacement
4.	Posterior malleolus -upward displacement of less than 2mm
POOR	
1.	Talus- Correctly placed
2.	Medial malleolus - No displacement or fracture gap of less than 2mm
3.	Lateral malleolus - negligible lateral displacement and up to 2mm of posterior displacement
4.	Posterior malleolus -upward displacement of less than 2mm

Table 2: Karlsson's scoring system:

Characteristic	Score
Instability	
No instability	25
1 or 2 sprains each year (during exercise)	20
1 or 2 sprains each month (during exercise)	15
Walking on uneven ground	10
Walking on even ground	5
Constant (severe), using ankle support	0
Pain	
None	20
During exercise	15
Walking on uneven surface	10
Walking on even surface	5
Constant (severe)	0
Swelling	
None	10
After exercise	5
Constant	0
None	5
Moderate	2
Marked (constant, severe)	0
Stiffness	
None	5
Moderate	2
Marked (constant, severe)	0
Work, sports activities, and activities of daily living	
Same as preinjury	15
Same work, less sports, normal leisure activities	10
Light work, less sports, normal leisure activities	5
Severe impaired working capacity	0
Stair climbing	
No difficulty	10
Impaired	5
Not possible	0
Running	
No difficulty	10
Impaired	5
Not possible	0
Support	
No support	5
Ankle support while exercise	2
Ankle support while daily activity	0

The functional assessments at final follow-up will be graded according to the criteria of Okuda *et al.* ^[75] (good, 90-100; fair, 75-89; poor, <75). We will consider good (> 90 points) as satisfactory improvement and fair and poor (< 90) as unsatisfactory improvement.

The data on categorical variables will be presented as n (Percentage of cases) and the values on continuous variables

will be presented as Mean \pm Standard deviation (SD). The significance of difference of distribution of incidence of

outcome measures across various groups of interest (such as age, sex groups etc.) will be tested using Chi-Square test. Independent Sample 't' test or analysis of variance (ANOVA) will be used to test the significance of difference in the continuous variables across two or more groups. The underlying assumption of normality will be tested before subjecting the study variables to t test or ANOVA. P-values less than 0.05 will be considered statistically significant. All the hypotheses will be formulated using two tailed alternatives against each null hypothesis (hypothesis of no difference). The entire data will be statistically analysed using Statistical Package for Social Sciences (SPSS ver 21.0, IBM Corporation; NY, USA) for MS Windows.study.

Results

In our series, most of the patient affected by the fracture belongs to age group of 41- 50 years, which was 14(40%). The commonest mode of injury is road traffic accident (34.3%) and fall (45.7%). 20 were male patients (57.9%) and 15 were female patients (42.9%). 20 cases involved the right ankle and 15 cases involved the left ankle. In our study, 94.2% of cases did not have any associated injury. The most common injury pattern seen was supination external rotation 13 patients (37.1%). In the present study group, 5 cases (85.71%) had a stay of more than 5 days while 30 cases (14.29%) had a stay of less than or equal to 5 days. The mean duration of stay was 4.5 days. Surgical technique used were open reduction and internal fixation of the lateral malleolus with semi tubular plate; medial malleolus with cancellous screws or tension band wiring; posterior malleolus with cancellous screws.

In the present study out of 35 patients, 5 patients presented with persistent swelling, 8 patients presented with residual pain while 9 patients presented with both of the complaints. In our study of 35 cases, 29 cases (82.85%) achieved excellent results and 5 cases (14.28%) achieved good results at 6 months follow up. No significant wound complications were noted. Operative treatment for ankle fractures results in good functional outcome post- operatively. Anatomical reduction of the fracture was associated with better functional and radiological outcomes. Early management with guided weight bearing ensure good functional outcome.

Table 3: Total Karlsson Functional Score

Total Karlsson functional Score	At 3 months (%)	At 6 months (%)
Poor	3 (8.57%)	1(2.85)
Fair	27 (77.14%)	5(14.28%)
Good	5 (14.28%)	29 (82.85%)
Total	35 (100.0%)	35 (100.0%)

Table 4: Radiological Outcome

Kristenson's radiological criteria	Number of patients	percentage
Good	29	82.85%
Fair	5	14.28%
Poor	1	2.85%
Total	35	100.0%

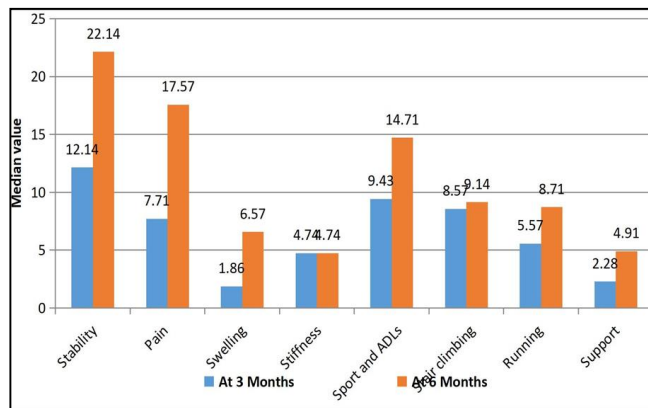


Fig 1: Comparison of The Karlsson functional Scoring System at 3 and 6 months in study group

Case 1



Fig1: Pre Op X-rays



Fig2: Immediate Post Op



Fig3: Final Functional Outcome



Fig 7: Functional outcome

Case 2



Fig 4: Pre Op X-rays



Fig5: Immediate Post Op

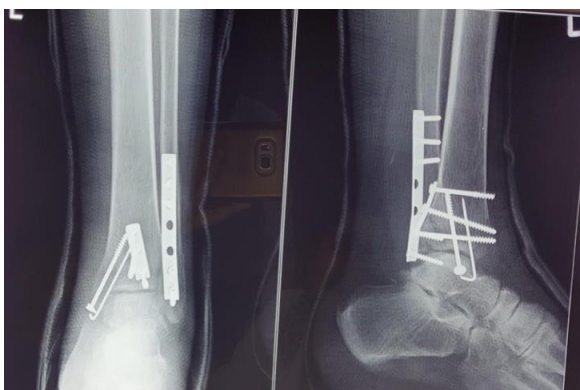


Fig6: Functional Outcome

Discussion

In the present study, the most common fracture pattern seen was supination-external rotation type of injury 13 cases (37.1%) followed by pronation external rotation type of injury 9 cases (25.7%). This is in concordance with observations given by Stufkens *et al.*^[24] in 2009, with good functional outcome. Studies by weening *et al.*^[23] in 2005, of about 425 ankle fractures demonstrated 30% of fractures to be due to supination external rotation type of injury. The least common being pronation dorsiflexion type of injury. The most common modality of fixation for the lateral malleolus was 1/3rd tubular plate, and for the medial malleolus was with 4 mm cannulated cancellous screws with washers. Fixation of the lateral malleolus with one third tubular plates showed good functional outcome and similar results have been reported by sanders *et al.*,^[31] in 2012. Syndesmotic screws were used in 3 of the cases. Weening *et al.*,^[23] conducted study in 2005 on the predictors of functional outcome following trans-syndesmotic screw fixation of ankle fractures. Of the 425 ankle fractures that were studied 30% were supination external rotation injuries. On follow up at 6 weeks, 9 out of 35 patients had persistent swelling and residual pain, 8

patients had only residual pain and 5 patients had only persistent swelling. This is in concordance with a similar study done by Hong *et al.*^[40] in 2014 in which he reported residual pain, swelling and ankle stiffness as the most common complications at 1 year follow up. Studies by Reagan *et al.*,^[48] showed good functional outcome despite patients evaluated to have residual pain and restricted movements. The mean Karlsson functional score at 3rd month post op was 47.50 and at 6th month post op was 88.37. There was a statistically significant improvement in the scores from 3rd month to 6th month post-op (p value 0.0001). In our study total 26 patients had total score between 90- 100, 6 patients had score between 75-89 and only 3 patient had score less than 75 which is comparable to previous study. Comparison of present study to other previous study has been given below in tabulated form. According to Kristenson's Radiological criteria out of 35; 29 (82.85%) patients have good result, 5 (14.28%) patients have fair result and 1 (2.85%) patient has poor result. Similarly khandelwal h. *et al.*^[79] in their study recorded Good result in 85% patients & Fair result in 15% patients who were treated operatively.

There are several limitations of our study. The results of this

study may be limited by measurement error. The physical measurements may be subject to both, observer's errors and patient variability. Observer's errors can arise from inconsistencies during the recording and reporting of measurements, including; variations in the placement of equipment. The study was conducted by a single observer hence there was no inter-observer bias. Patient variations however, may arise from the patient altering their effort or position when performing the physical assessments, or by reporting a better or worse functional score in response to external influences unrelated to their ankle at the time of completing the score.

The study is also limited to patients having surgical fixation for their fracture. These results therefore, cannot necessarily be compared to the outcome achieved with non-operative Management or other modalities of treatment.

Conclusion

By this study, we conclude that Understanding of mechanism of injury is essential for good reduction and internal fixation. Anatomical reduction is essential in all trimalleolar fracture to achieve good functional outcome and to avoid complications like arthritis and loss of range of movements. Immobilization for 6 weeks does not reduce the final functional outcome. Good physiotherapy is recommended for adequate range. Understanding of mechanism of injury is essential for good reduction and internal fixation.

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