

## Original Research Article

# Functional outcomes of early versus delayed fixation of closed ankle fractures assessed by objective and subjective criteria using the Olerud-Molander ankle score

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## ABSTRACT

**Background:** The incidence of ankle fractures is approximately 0.01% per year. Indications for surgical fixation include severe displacement and unstable fracture pattern. Ankle fracture is one of the most common injuries treated by an orthopaedic surgeon. Ankle injuries are usually caused by simple twisting injury to high energy injuries.

**Methods:** This study included patients attending the OPD, emergency of Orthopaedics Department, Govt. Medical College Jammu from October 2014 to October 2016 diagnosed with closed ankle fractures. Both male and female patients between the age group of 18-60 years were treated by open reduction and internal fixation. 50 patients were divided into two equal groups (25 each) as per the timing of surgery. Group 1-cases of early internal fixation within 5 days Group 2-cases of delayed internal fixation after 5 days.

**Results:** In subjective results, in Group I 92% of the patients had good subjective results and 8% had fair results whereas in Group II 84% had good and 16% had fair subjective result. In objective results, in group I 96% patients' good results were obtained and 4 % patients had fair results whereas in group II 88% patients had good results and 12% patients had fair results.

**Conclusions:** In this study the overall functional outcome was good in both the groups. Thus, we felt when immediate fixation is not possible, delayed fixation of displaced ankle fracture is a reasonable option.

**Keywords:** Closed ankle fractures, Subjective criteria, Olerud-Molander ankle score

## INTRODUCTION

Ankle fractures are one of the most common lower limb fractures which account for 9% of all fractures, representing a significant portion of the trauma workload. Ankle fractures usually affect young men and older women, however, below the age of 50; ankle fractures are more common in men.

The incidence of ankle fractures is approximately 0.01% per year.<sup>1,2</sup> Indications for surgical fixation include severe displacement and unstable fracture pattern.<sup>3</sup>

Ankle fracture is one of the most common injuries treated by an Orthopaedic Surgeon. Ankle injuries are usually caused by simple twisting injury to high energy injuries.<sup>4,6</sup> Ankle fractures are common among young adults especially involved in RTA and extreme or contact sports. Isolated malleolar fractures are most common accounting for 2/3 of fractures, with bimalleolar fractures represent one fourth of patients and trimalleolar fractures occurring in the remaining 7%. Open fractures are rare injuries accounting for just 2% of all ankle.<sup>7</sup>

The objective of the study was to compare the functional outcomes of early versus delayed closed ankle fractures fixation using objective and subjective score by Olerud-Molander ankle score (OMAS).

## METHODS

This study included patients attending the OPD, emergency of Orthopaedics Department, Govt. Medical College Jammu from October 2014 to October 2016 diagnosed with closed ankle fractures. Both male and female patients between the age group of 18-60 years were treated by open reduction and internal fixation. 50 patients were divided into two equal groups (25 each) as per the timing of surgery.

*Group 1:* cases of early internal fixation within 5 days.

*Group 2:* cases of delayed internal fixation after 5 days. This group included those who presented after 5 days of injury, those could not be operated because of unavailability of operation theatre, cost and social circumstances.

### *Ethics committee*

This study was approved by institutional ethics committee.

### *Inclusion criteria*

Inclusion criteria were all displaced fractures, age-skeletally mature patients (>18 years), gender both males and females, entire definite treatment done in our institution and patients who complied with regular follow-up for a period of at least 6 months.

### *Exclusion criteria*

Exclusion criteria were skeletally immature patient, open fractures, fracture associated with neurovascular injury, severe peripheral vascular diseases, uncontrolled diabetes mellitus, patient with underlying medical contraindication to surgery, undisplaced fracture, bad condition of soft tissue (excessive swelling with blister formation, ecchymosis) at the time of presentation and fractures older than 3 weeks.

After complete evaluation, the patients were treated by operative management, as per the guidelines of AO and a protocol was followed to open or closed reduction and internal fixation of the fractures at the earliest possible opportunity over allocated period of study.

### *Internal fixation of the lateral malleolus*

The lateral malleolus was approached through a posterolateral incision. The fibula was exposed subperiosteally by deepening the incision through subcutaneous tissue and deep fascia. Full thickness skin

flaps were retracted anteriorly and posteriorly. Fixation of the fracture was done using 1/3 tubular plate with or without a lag screw, with lag screws alone or with an intramedullary device namely a Rush pin.

### *Fixation of the medial malleolus*

A medial longitudinal incision was put over the medial malleolus between its anterior and posterior borders with the lower end curving anteriorly at the tip of medial malleolus. The fracture was fixed with one or two 4 mm cannulated cancellous screws or malleolar screw with washer, or by tension band wiring depending on buttress plating depending on the configuration and size of the fracture fragment.

### *Posterior lip fractures*

Reduction of posterior lip fragments was done indirectly through either posteromedial or posterolateral incisions. The choice was made by the location of the fragment on the AP radiograph. Posterior lip fragments were reattached with one or two lag screws, occasionally supplemented with K-wires, washers. The most secure fixation was provided by interfragmentary fixation with lag screws, which glide through the fragment adjacent to their head and be threaded only into the opposite fragment. Such screws were placed from posterior to anterior if the fragment is exposed using a posterolateral incision.

### *Syndesmotic injury*

The syndesmosis must be anatomically reduced and held with provisional Kirschner wires or a reduction clamp before the syndesmotic screws are inserted. The screw should be positioned 2 to 3 cm proximal to the tibial plafond, directed parallel to the joint surface, and angled 30 degrees anteriorly so that it is perpendicular to the tibiofibular joint. The AO group recommended a fully threaded syndesmotic screw in a neutralization mode or position; however, others have suggested that a lag screw provides more secure fixation.

After open reduction and internal fixation, check x-ray was taken in antero-posterior lateral views and mortise view. A well-padded plaster slab was applied for 3-5 days. Patients were instructed to keep the limb elevated for prevention of edema for 3-5 days.

### *Statistical analysis*

Statistical analysis was carried out according to the complete sample analysis. Data were analyzed by use of the SPSS 19 (SPSS Inc., Chicago, IL, USA).

### *Functional assesment*

Criteria for grading results are those of Magnusson (1944), Vasli (1957) and Klossner (1962).

**Table 1: Objective criteria.**

<b>Good</b>	Ankle and foot movements atleast three quarters normal trivial swelling normal gait.
<b>Fair</b>	Ankle and foot movements atleast half normal small amount of swelling normal gate.
<b>Poor</b>	Ankle and foot movements less than half normal marked swelling any visible deformity of ankle or foot limp.

**Table 2: The modified subjective ankle score of Olreud and Molander (1984).**

	Score
<b>Pain</b>	
None	25
Minor (whether Dependent)	20
During Sports	15
During walking on smooth surface	5
Constant and severe	0
<b>Stiffness</b>	
None	10
In the morning	5
Constant	0
<b>Swelling</b>	
None	10
Only in the evening	5
Constant	0
<b>Stair climbing</b>	
No problem	10
Impaired	5
Impossible	0
<b>Sports</b>	
Normal	10
Impaired	5
Impossible	0
<b>Supports</b>	
None	10
Tape or wrap	5
Stick or crutch	0
<b>Daily activity and work</b>	
Unchanged level	25
Loss of tempo	20
Change of easier job or part time job	10
Severely impaired work capacity or disability at work	0
Total	100

Good: 80% to 100%, fair: 60% to 80%, poor: <60%.

## RESULTS

Distribution of patients according to age in both Group 1 and Group 2 were comparable. Mean age of patients in Group 1 was 36.24 with a range of 21 to 60 years. Similarly, mean age of patients in Group 2 was 36.04 with a range of 21 to 60 years. Statistically, there was no significant mean age difference between the two groups ( $p>0.05$ ).

**Table 3: Distribution and comparison of patients of Group 1 and Group 2 according to age.**

Age group (in years)	Group 1		Group 2	
	No.	%	No.	%
<b>20-25</b>	6	24.00	7	28.00
<b>26-30</b>	4	16.00	3	12.00
<b>31-35</b>	2	8.00	4	16.00
<b>36-40</b>	6	24.00	2	8.00
<b>41-45</b>	2	8.00	3	12.00
<b>46-50</b>	2	8.00	1	4.00
<b>≥51</b>	3	12.00	5	20.00
<b>Total</b>	25	100.00	25	100.00

Group 1=Mean age  $\pm$  SD (range) = 36.24 $\pm$ 11.15 (21-60) years;

Group 2 = Mean age  $\pm$  SD (range) = 36.04 $\pm$ 12.59 (21-60) years.

**Table 4: Distribution and comparison of patients of Group 1 and Group 2 according to sex.**

Sex	Group 1		Group 2	
	No.	%	No.	%
<b>Male</b>	18	72.00	16	64.00
<b>Female</b>	7	28.00	9	36.00
<b>Total</b>	25	100.00	25	100.00

Group 1 = Male to female ratio = 2.57:1, Group 2 = Male to female ratio = 1.78:1.

Distribution of patients according to sex in both Group 1 and Group 2 were comparable. Male to female ratio in Group 1 was 2.57:1, while in Group 2 it was 1.78:1. Statistically, there was no significant sex difference between the two groups ( $p>0.05$ ).

**Table 5: Distribution and comparison of patients of Group 1 and Group 2 according to mode of injury.**

Mode of injury	Group 1		Group 2	
	No.	%	No.	%
<b>Fall from height</b>	5	20.00	6	24.00
<b>Road traffic accident</b>	15	60.00	13	52.00
<b>Slip</b>	5	20.00	6	24.00
<b>Total</b>	25	100.00	25	100.00

Distribution of patients according to mode of injury in both Group 1 and Group 2 were comparable. More patients (60%) in Group 1 had RTA as mode of injury. Similarly, more patients (52%) in Group 2 had RTA as mode of injury. Statistically, there was no significant difference between the two groups ( $p>0.05$ ).

More patients in Group 1 had bimalleolar closed ankle injury (56%), followed by unimalleolar (36%) and trimalleolar (8%). Similarly, more patients in Group 2 had bimalleolar closed ankle injury (72%), followed by unimalleolar (16%) and trimalleolar (12%). Statistically, there was no significant difference between the two groups ( $p>0.05$ ).

**Table 6: Distribution and comparison of patients of Group 1 and Group 2 according to anatomic type of closed ankle injury.**

Anatomic type of closed ankle injury	Group 1		Group 2	
	No.	%	No.	%
<b>Bimalleolar</b>	14	56.00	18	72.00
<b>Trimalleolar</b>	2	8.00	3	12.00
<b>Unimalleolar</b>	9	36.00	4	16.00
<b>Total</b>	25	100.00	25	100.00

**Table 7: Distribution and comparison of patients of Group 1 and Group 2 according to subjective criteria at 6 months.**

Subjective criteria at 6 months	Group 1		Group 2	
	No.	%	No.	%
<b>Fair</b>	2	8.00	4	16.00
<b>Good</b>	23	92.00	21	84.00
<b>Total</b>	25	100.00	25	100.00

p=0.04 (Fisher's exact test); Significant.

In Group 1, more patients (92%) had subjective criteria of "good" at 6 months as compared to patients in Group 2 (84%). The difference between the two groups was statistically significant (p=0.04).

In Group I, 92% of the patients had good subjective results and 8% had fair results whereas in Group II 84% had good and 16% had fair subjective result.

**Table 8: Distribution and comparison of patients of Group 1 and Group 2 according to objective criteria at 6 months.**

Objective criteria at 6 months	Group 1		Group 2	
	No.	%	No.	%
<b>Fair</b>	1	4.00	3	12.00
<b>Good</b>	24	96.00	22	88.00
<b>Total</b>	25	100.00	25	100.00

p=0.60 (Fisher's exact test); Not significant.

In Group 1, more patients (96%) had objective criteria of "good" at 6 months as compared to patients in Group 2 (88%). However, the difference between the two groups was statistically not significant (p=0.60).

### Objective results

In Group I, 96% patients' good results were obtained and 4 % patients had fair results whereas in Group II 88% patients had good results and 12% patients had fair results.

When all these three results were compared between the two groups, difference was not statistically not significant.

Authors are of the opinion that both the operative timing used in our study provide excellent functional results in terms of functional outcome.

## DISCUSSION

Ankle fractures represent approximately 10% of all fractures and are among the most frequently encountered surgically treated fractures.<sup>5</sup> Surgical management for unstable ankle fractures is recommended for most patients. The degree of articular damage and anatomic reduction are determinants of satisfactory outcome. The optimal management for soft tissue is prompt reduction and stabilization. Nonetheless, immediate definitive fixation may not always be feasible. Soft tissue swelling is not a contraindication to early surgery (6-12 hours after injury); there is less danger of disturbing the micro-circulation in wound margins due to edema during surgery. In this study of 50 closed ankle fractures with age group ranging from 18-60 years, average being around 36 years in both the groups. Maximum numbers of patients were in third and fourth decade of their life. The mean age in our study was comparable to other studies (mean age 40 years) and (mean age 42 years). The predominance of the fractures in the younger and middle age group in this study was probably related to the fact that young people are more prone to road traffic accidents and other forms of trauma. In our series of 50 patients (25 in each group) it was found that ankle fractures were more common in males in both the groups. In this series, right side was seen to be involved more commonly compared to the left side (56%).

### Subjective results

Subjective results between the two groups were compared on the basis of modified subjective ankle score of Olerud-Molander ankle score (OMAS) (1984). All patients were questioned as to the presence of pain or aching or a sensation of stiffness/any disability/daily activity and work/swelling/stair climbing. In Group 1, more patients (92%) had subjective criteria of "good" at 6 months as compared to patients in Group 2 (84%). The difference between the two groups was statistically significant (p=0.04).

In Group I 92% of the patients had good subjective results and 8% had fair results whereas in Group II 84% had good and 16% had fair subjective result,

### Objective results

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Hong et al evaluated the clinical and functional outcome of trimalleolar fractures and the ability of patients to return to sporting activities. In their retrospective study of 31 patients, they found that 11 patients had residual pain, 13 patients had persistent ankle stiffness, 10 patients had swelling at 1 year follow-up. Only 4 patients were able to



return to sports. Increasing posterior malleolar fragment size was associated with poorer functional outcomes.<sup>8</sup>

Thakore et al in their study on ankle fracture and employment: a life-changing event for patients found that ankle fracture patients are likely to suffer high rates of unemployment or disability shortly after their injury. They suggested that improving patient compliance with attendance for rehabilitation may improve employment outcomes.<sup>9</sup>

Ponzer et al studied 53 patients with type B ankle fracture who were treated operatively. They found that about 60 percent of the patients had an excellent OMA score and a good clinical outcome. Only a few had radiographic postoperative dislocation or signs of arthritis.<sup>10</sup> Lash et al studied 74 patients operated for ankle fractures. At a 2-year follow-up, all fracture types averaged Olerud and Molander ankle scores of 71.1. Lifestyle outcomes were reflected in the patients' ankle function outcomes.<sup>11</sup>

Nilsson et al evaluated 54 patients, aged 17-64 years, 14 months post-operatively following ankle fractures. The median OMA score obtained was 75. Only 10 of the patients reported complete recovery and 16 scored > 90, indicating good function. They attributed poor results following surgery to insufficient rehabilitation.<sup>12</sup>

Syed et al studied 12 patients who had Weber type-C injury treated with syndesmosis only fixation. The treatment plan was followed only if the fibular length could be restored and if the syndesmosis could be anatomically reduced. Through a percutaneous or mini open reduction and clamp stabilisation of the syndesmosis, all but one patient had a single tricortical screw fixation across the syndesmosis. Excellent to good outcomes were noted in 83% of the patients assessed using Olerud and Molander scale.<sup>13</sup>

### **Limitation of the study**

The limitation of our study was small sample size in both groups and absence of long-term follow-up. A randomized control trial, preferably triple blinded even double blinded, involving a large number of patients with long term follow-up is clearly indicated to bring out significant differences between early and delayed operative treatment of ankle fractures.

### **CONCLUSION**

In conclusion, it was observed that the timing of surgery affected the recovery. Every effort should be made to operate closed ankle fractures as soon as reasonably possible to get better function outcome. In this study the overall functional outcome was good in both the groups. Thus, we felt when immediate fixation is not possible,

delayed fixation of displaced ankle fracture is a reasonable option.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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