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## Outcome analysis of closed ankle fractures treated by ORIF

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### Abstract

Though malleolar fractures are discussed extensively, the opinions in the treatment of these fractures varies widely because of differences in classification reduction techniques and subjective symptoms at follow up studies. The primary goal of treatment should be full restoration of anatomy and function of the ankle joint. In this study we report clinically and radiologically the outcome of various types of ankle injury and to analyze the results of closed bimalleolar ankle fractures treated with open reduction and internal fixation.

**Keywords:** Ankle fractures, open reduction and internal fixation

### Introduction

The ankle injuries gained importance because body weight is transmitted through it and the locomotion depends upon the stability of this joint. It must be realized that ankle injuries are mixed ones, ligamentous and body failures due to deforming forces. Bohler in 1929 discussed the importance of accurate reduction and possible joint motion. Many of these fractures were managed by manipulative reduction and conservative treatment and have yielded satisfactory results. Injuries like unstable syndesmotic diastasis, tri or bimalleolar fractures required open reduction and fixation. In this study we evaluated clinically and radiologically the type of injury and to analyze the results of closed bimalleolar ankle fractures treated with open reduction and internal fixation.

### AIM of the Study

To evaluate clinically and radiologically the type of injury and to analyze the results of closed bimalleolar ankle fractures treated with open reduction and internal fixation.

### Materials and Methods

This is prospective study done at Sri Ramachandra University, Chennai between April 2012-October 2013 to assess the functional and radiological outcome of closed bimalleolar ankle fractures treated by open reduction and internal fixation. The duration of study was 18 months with a minimum follow up of 3 months to a maximum of 18 months. (Avg-12 months)  
Total number of Patients assessed and evaluated in this study-30

### Method of Selection

#### Inclusion Criteria

- i) Closed ankle fractures in adults.
- ii) Associated with subluxation & dislocation of the ankle joint.

#### Exclusion Criteria

- i) Open fractures.
- ii) Talar fractures.
- iii) Associated fractures of ipsilateral limb.
- iv) Pilon fractures.
- v) Children below 18 yrs.

vi) Pathological fractures.

All patients were evaluated pre-operatively by clinical examination of the fracture site and radiologically using the Lauge-Hansen classification.

### Preoperative Protocol

Displaced, malleolar fractures often involve significant subluxation or dislocation of the tibiotalar joint. To minimize pain, swelling and local trauma, such injuries were treated initially with analgesics, closed reduction and immobilization using a below knee slab. This was followed by limb elevation using pillows to reduce swelling. Prompt closed reduction of the ankle mortise decreases articular damage and in turn decreases soft tissue swelling.

Operative treatment was usually delayed for a few days till the initial swelling had subsided.

If soft tissue injury like abrasions and lacerations or blisters were present, surgery was delayed until the skin had healed. This was to minimize risk of infection post operatively.

Patients were operated immediately only if the patient presented immediately after injury and if skin over fracture site was healthy, provided general condition of the patient was stable.

### Operative Protocol

All Patients were operated under spinal or general anesthesia in a supine position with tourniquet control and using image intensifier.

The implants used were 3, 5mm reconstruction plate, one third tubular plate, kirschner wire, 3.5mm DCP, LCP and tension band wiring for the fibula. Tension band wiring, locked compression plates and 4mm partially threaded cancellous screws were used for the medial malleolus. And for the posterior malleolus, a 4mm cannulated partially threaded cancellous screw with or without washer was used. A single 3.5mm cortical screw was used in fixing of syndesmotom joint. Implants were selected based on the fracture pattern, quality of the bone and surrounding soft tissue.

### Post-operative Protocol

- IV antibiotics for 3 days.
- This was followed with oral antibiotics till suture removal.
- 1<sup>st</sup> wound inspection on second post- operative day.
- Check x-ray taken.
- Suture removal on 12<sup>th</sup> day.
- Non-Weight bearing mobilization started from 3<sup>rd</sup> post-operative day and active ankle mobilization exercises started.
- Non-Weight bearing mobilization continued for 6 weeks.
- Partial weight bearing after 6 weeks till 12 weeks, depending on fracture pattern and comorbidities.
- Full weight bearing walking started after 8 or 12 weeks, depending on fracture pattern, fixation and patient tolerance.
- Patient with syndesmotom injuries were generally kept non-weight bearing for 6 to 8 weeks.
- Syndesmotom screws were not removed before the start of weight bearing.

### Post-operative Evaluation

Patients were followed clinically and radiologically evaluated at 6 weeks, 12 weeks, 24 weeks and thereafter, every year. Post-Operative evaluation of function and radiological

outcome was done using the Baird and Jackson scoring system. This score is based on the criteria of pain, stability of ankle, ability to walk, run and do work, ankle movements and radiological analysis.

### Results

Based on the Baird and Jackson scoring system, we graded our results as Excellent, Good, Fair and Poor. Our results were,

- Excellent** - 9 Cases (30%)
- Good** - 11 Cases (37%)
- Fair** - 4 Cases (13%)
- Poor** - 6 Cases (20%)

The study shows excellent and good results of 67% (20 cases), with a poor result in 20% (6cases)

As per this study, my results showed the following

**Gender:** This study shows a male predominance of 64% (19) over a female percentage of 36(11).

**Age:** In our study, the mean age group falls in the middle age (43yrs), with more number of patients between 30 and 50 yrs of age.

**Side:** In our study, there is a right sided predominance of the fracture.

**Mode of Injury:** Our study shows that slip and fall, accounting to 53% of the total number of cases, is the most common cause for injury, followed by road traffic accidents

### Mechanism of Injury/Fracture Pattern

In our study, Supination External Rotation (SER) mode of injury is the commonest fracture pattern with 33% of total cases and Supination Adduction as the rarer presentation in 17% of the cases.

### Duration between injury and presentation

Most of the cases in this study presented to the hospital almost immediately following trauma, accounting to 83%, with 10% of the cases presenting late.

### Time interval between injury and surgery

In our study, there is a delay of 2-7 days for surgical treatment for most cases. Depending on various criteria like patients general condition, comorbidities, soft tissue condition at fracture site, etc. surgery was done within 48 hours of trauma or delayed.

### Effect of delay

We attempted to analyze the relationship between the time period between time of injury and time of surgery and its influences on the end result.

- Within 48 hours of trauma

**Table 1:** Surgery Within 48 hrs of trauma and outcome

Results	No. Of Patients	Percentage
Excellent	4	13%
Good	2	7%
Fair	1	3%
Poor	2	7%

ii) Between 2 to 7 days

**Table 2:** Surgery between 2 to 7 days of trauma and outcome

Results	No. Of Patients	Percentage
Excellent	4	13%
Good	6	20%
Fair	2	7%
Poor	1	3%

iii) More than 7 days

**Table 3:** Surgery after 7 days of trauma and outcome

Results	No. of Patients	Percentage
Excellent	1	3%
Good	2	7%
Fair	2	7%
Poor	3	10%

This clearly showed that when surgery was done within the first week following trauma, patients had a superior end functional and radiological result when compared with patients who were operated after 1 week.

**1. Tourniquet**

A tourniquet was always used to prevent blood loss and for a clear blood less field of surgery.

**2. Method of fixation of medial malleolar fractures**

**Associated fracture fixation**

**Table 6:** Associated fracture fixation

Other fractures	Number of patients	Method of fixation	Percentage
Syndesmotic disruption	3	3.5mm cortical screw	10%
Posterior malleolus	2	4mm partially threaded cannulated cancellous screw	6%

A syndesmotic screw was needed to stabilize the syndesmotic joint for 3 cases. Posterior malleolus needed operative fixation in 2 cases.

**4. Complications**

The complications seen post operatively are listed here

**Table 7:** Complications

Complication	Number of Cases	Percentage
Infection	1	3%
Malunion	2	6%
Wound dehiscence	1	3%
Delayed union	1	3%
Nonunion	1	3%
No complications	24	82%

After open reduction, the medial malleolus was fixed using an implant based on type of fracture and the soft tissue condition.

**Table 4:** Method of fixation of medial malleolar fractures

Method of fixation	Number of patients	Percentage
Cancellous screws alone	17	57%
Tension band wiring	8	27%
K-Wire +cancellous screw	1	3%
Plating	3	10%
POP stabilization post op	1	3%

Maximum medial malleoli fixations done using cancellous screws alone (57%) and tension band wiring (27%).

**3. Method of fixation of lateral malleolar fractures**

After open reduction, the Lateral malleolus was fixed using an implant based on type of fracture and the soft tissue condition.

**Table 5:** Method of fixation of lateral malleolar fractures

Method Of Fixation	Number Of Patients	Percentage
Plating	25	84%
Tension band wiring	3	10%
K-Wire	1	3%
POP Stabilization Post Op	1	3%

Maximum lateral malleoli fracture fixations done using plate fixation (84%). Fewer cases were fixed with tension band wiring and K-Wire. One case was left unfixed and was immobilized using a below knee POP slab for 3 weeks.

We had our fair share of complications with 1 case of infection, 2 cases of malunion, 1 nonunion, 1 case with delayed union and 1 case with wound dehiscence with infection.

**Case reference**

Type - Supination External Rotation Fracture  
Baird and Jackson Score- 91

**ROM**

Dorsiflexion - 25 Degrees  
Plantar flexion - 45 degrees  
Result - Good  
Duration Btw trauma and surgery - 3 Days  
Comorbidities - None



**Pre OP**

**Post OP**



**6 Months post op**

**1 year post op**



**Neutral position**



**Bilateral Plantar Flexion**



**Bilateral Dorsiflexion**



**Standing**

**Fig: Case Reference**

**Discussion**

Ankle fractures are the most common fractures of the lower extremity. They usually occur following a twisting injury following a fall (53%) or a road traffic accident (37). This is a

prospective study done to evaluate the functional and radiological outcome of closed Ankle fractures treated by Open Reduction and Internal Fixation and were analyzed results based on the BAIRD AND JACKSON SCORING

SYSTEM. Patients with closed ankle fractures with or without subluxation were included in the study. Patients with Open fractures, Talar fractures, Pilon fractures, Non-unions and Malunions were not included in our study. All Patients were evaluated pre-operatively by clinical and radiological methods. The Fracture patterns were classified by the

mechanism of injury described by Lauge-Hansen. Our study showed a predominance of Supination-External Rotation injuries (33%) followed by Pronation-External Rotation (27%), Pronation-Abduction (23%) and 17% of supination-adduction injury. We had similar results comparing this study to those done by others,

**Table 8:** Distribution of fracture types in various studies

Fracture type	Lindsjo n:611	Lauge n:229	Kristensen n:232	Denham n:70	Our Study
Supination abduction	20	16	16	10	5
Pronation abduction	17	5	16	29	7
Supination external rotation	42	71	45	49	10
Pronation external rotation	13	7	22	9	8
Others	8	1	1	3	None

In our study we had a male predominance (64%) which was similar when compared to the Olerud-Molander study.

We had patients age group fall between 18-80 years with mean age group of 43 yrs, with ankle fractures seem more commonly in the middle age groups. Twelve out of 30 patients were operated (30%) within 48 hours and 13 cases (43%) between 2-7 days and 8 cases (27%) more than 7 days. The delay in surgery for 8 cases were late arrival, treated with native splinting initially, co-morbid conditions like Diabetes, Ischemic heart disease, and Swelling following native treatment and poor skin conditions. Carragee *et al.* recommended early operative intervention for high-energy ankle fractures as a higher soft tissue complication rate was seen even for a delay of greater than 24 hours [11].

Out of 30 patients, 25 cases of fibula were fixed with plating, 3 cases were fixed with tension band wiring, 1 case with K-wire and one left for conservative management. Nine cases of medial malleoli were fixed with Tension band wiring, 18 cases were fixed with cancellous screw fixation and 2 with plating. Two cases of posterior malleoli fractures were fixed with 4 mm partially threaded cancellous screws. Most authors agree that fixation of the posterior malleolus should be undertaken when 25% to 30% of the joint is involved. Syndesmotic screw fixation was needed in 3 cases done with 4 mm partially threaded cancellous screws.

Our patients were mobilized with syndesmotic screws insitu. Although screw removal at 6 to 8 weeks is advised by several authors, recent studies practice leaving it insitu. Ajay Manjoo *et al* and MD, David W. Sanders state that removal of syndesmotic screws after 6 months is advisable as it negates late syndesmotic displacement [37].

**Table 9:** Comparison of various study outcomes

Series	Number of cases	Excellent and good	Poor
Gallent Series	130 cases	78%	22%
Frieberg Series	105 cases	85%	15%
Listeal Series	212 cases	78%	22%
Our Series	30 cases	67%	33%

We assessed all the patients using the Baird and Jackson scoring system. Based on the score, we graded the patients into Excellent, Good, Fair and Poor results. Based on this score, we had 67% Excellent to Good results, 13% Fair results and 20% poor results. Comparing to other studies on the same fractures,

**Table 10:** Results using other Scoring systems

Study	Scoring	Result (Good/Excellent)
Day <i>et al</i>	Phillips scoring	52%
Lash N	Olerud-Molander score	77%

The study showed improved results in patients who underwent surgery within the first 48 hours (20%) and between 2 to 7 days (33%) as compared to those done after 2 days. This was comparable with published International literature. In the Mont Miller *et al* study, Journal Orthop trauma 1992, in a study of 80 cases they opined that those patients with a delay between injury and surgery greater than 7 days tended to have a poorer result [42].

**Complications**

We had 6 cases with complications which were followed up. Wound infection was seen in one case (3%), malunion in one case (6%), wound dehiscence in one case (3%) with 3% delayed union and 3% nonunion in this study, and this is related to the presence of comorbid conditions like diabetes mellitus, hypertension, etc. The study shows that there is a direct relationship between comorbidities and final scores in patients. Around 50% of the cases with comorbid conditions developed complications, whereas only 9% of the cases without any comorbidities developed complications. All cases with complications, developed a poor result.

This is similar to the results of Costigan *et al.* and Jones *et al.*, who identified neuropathy and hypertension as the most important predictors of postoperative complications in diabetic patients with ankle fractures [14].

The study had a malunion ratio of 6%, which shows that soft tissue condition at time of surgery, and delay in surgery result in poorer results. Fogel *et al.* showed a higher rate of malreduction when surgical delay exceeded 1 week for ankle fractures [22].

**Conclusions**

- Immediate open Reduction and Internal Fixation in ankle fractures yield good results in terms of anatomical reduction, stability and Post Op functional return.
- Supination External Rotation injury is the commonest mechanism of injury in our study.
- Patient operated early, only if soft tissue was good, in order to have good functional outcome in closed ankle fractures.
- Delay in surgery tended to give a poorer result.
- Good control of comorbidities decreased Post Op complications.
- Early return of ankle movements Post OP with proper rehabilitation improved functional outcome<sup>19</sup>.
- After a year of surgery, most patients experience little or mild pain and have certain restrictions of functional activities.
- Patients who needed syndesmotic joint operative stabilization, had poorer outcomes at the end of one year

as compared to those that needed fixation of only bimalleolar fractures.

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