



# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2019; 5(4): 1076-1081  
© 2019 IJOS  
www.orthopaper.com  
Received: 10-08-2019  
Accepted: 12-09-2019

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## A study of functional outcome of closed ankle fractures treated by open reduction and internal fixation

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**DOI:** <https://doi.org/10.22271/ortho.2019.v5.i4r.1837>

### Abstract

**Background:** Ankle fractures are one of the most common injuries of the lower limb 3 treated by orthopaedic surgeons, with an incidence of 107 fractures per 100000 person- years. 4 Up to 12% of emergency presentations involve an ankle injury. There has been an increase in the prevalence of ankle fractures over the past two decades both in the young, active patients and in the elderly [5, 6]. Injuries around the ankle joint cause destruction of not only the bony architecture, but also often the ligamentous and soft tissue components [7]. The anatomy of the joint makes it very unstable in cases of fractures or ligamentous injuries around the ankle. Open anatomic reduction and internal fixation are routinely advocated for displaced, unstable ankle fractures [10, 11, 12]. Functional and radiological results were analyzed using the ankle scoring system of Baird and Jackson [16]. The objective of this study is to analyse the patterns and causes of ankle fractures as well as to assess the functional outcome and results of surgically treated ankle fractures performed at our institution.

**Keywords:** Ankle, closed fractures, Biard and Jackson's, cancellous screws, kirschner wires

### Introduction

**Aims and Objectives:** To know the functional outcome of closed ankle fractures treated with open reduction and internal fixation. To know the incidence of post-operative complications.

**Methods:** A prospective study of 30 cases of fractures of in adults, managed surgically by various techniques in During the period from December 2014 to May 2016 were studied, satisfying the inclusion and exclusion criteria were studied. The functional outcome was evaluated using the Biard and Jackson's ankle scoring system.

**Results:** In our study we achieved 86.6% excellent to good results, 6.6% fair results, 6.6% poor results. The results were comparable to other studies.

**Interpretation & Conclusion:** The operative results were satisfactory in 86.6% cases, with good to excellent functional outcome. Excellent results are obtained with stable fixation of fracture. Cancellous screws or Malleolar screws are far better in internal fixation of medial malleolus compared to Kirschner - wire fixation and lateral plating was the best for fibular fractures. Good functional results are obtained by surgical management of bimalleolar ankle fractures.

**Introduction:** Sir Robert Jones said, "Ankle is the most injured joint of the body but the least well treated" [1]. Ankle injuries gain importance because body weight is transmitted through the joint and locomotion depends upon the stability of it. They are usually mixed injuries. Ligamentous and bony; and each injury is an end result of the sequence of ligamentous and bony failure due to deforming forces. Malleolar fracture have varied presentations which have given rise to a wide variety of classification systems, of which two are in vogue: Lauge-Hansens and Danis-Weber classification. Malleolar fractures are one of the most common fractures in orthopaedic traumatology.

As with all intra articular fractures, malleolar fractures necessitate accurate reduction and stable internal fixation. When malleolar fractures are not reduced accurately they may lead to post traumatic painful restriction of motion or osteoarthritis or both [2]. As for the treatment of malleolar fractures, many of them which are stable are reduced by conservative treatment and have given good result.

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The other unstable displaced and open fractures require open reduction internal fixation. The superiority of ORIF over closed treatment have been thoroughly demonstrated in literature [3]. The operative method restores the anatomy and contact-loading characteristic of the ankle. Additional advantages include easier rehabilitation without a cast, early mobilization and earlier weight bearing [4]. However all studies have not obtained good results in cases of bimalleolar fractures. The purpose of this study is to assess the functional outcome and results of surgical treatment of malleolar fracture especially in elderly. Methodology Patients admitted from December 2014 to May 2016 to the department of orthopaedics with bimalleolar fractures satisfying the inclusion criteria will be included in the study and with follow up from the time of admission to a minimum of 6 months of postoperative period will be done (minimum of 30 cases will be studied).

### Inclusion Criteria

1. Closed ankle fractures in adults
2. Associated with subluxation & dislocation of the ankle joint.

### Exclusion Criteria

1. Open fractures.
2. Talar fractures.
3. Associated fractures of ipsilateral limb.
4. Children below 18 yrs.
5. Pathological fractures.

### Operative Technique

The patient was placed in supine position after administration of spinal and/or epidural anaesthesia. A sandbag was placed under the ipsilateral buttock. Pneumatic tourniquet with a pressure of 300mm of Hg was used in all the cases. Standard surgical steps were followed in all the cases. Fibula was operated first in all the cases. In our study tension band wiring, malleolar screw, K wires, cancellous screws were used for fixation of medial malleolus. One third tubular plate and rush pin were used to fix lateral malleolus.

### Medial approach

The standard medial incision runs posterior to the medial malleolus. The saphenous vein and nerve must be protected. Fracture fragment was reduced and the articular surface was visualized for any soft tissue interposition. Modified tension band wiring was done for type 1 lauge hansen cases, In a vertical fracture, provided the fragment is large enough and the bone quality is good enough, two or even three lag screws on their own may be sufficient. If in doubt, a buttress plate may be more secure

### Intraoperative pictures

**Intraoperative image showing TBW application for right medial malleolus fracture**



Fig 1: Incision

Fig 2: Exposure



Fig 3: Medial approach

### Lateral Approach

The longitudinal lateral incision is the standard approach for most lateral fractures. If a lateral plate is required for the lateral malleolus, the incision should be placed either slightly anteriorly or posteriorly, so that the plate does not come to lie directly beneath the incision. If a posterior plate is planned, place the incision slightly posteriorly, so that the soft-tissue dissection can be minimized. The dissection plane is between the peroneus tertius anteriorly and the peroneus longus and brevis posteriorly. Free the periosteum at the fracture site. In order to minimize devascularisation, the fracture site is now exposed. Fracture reduction was done by reversing the force that caused the fracture. Preliminary fixation of the fragments was done using the inter fragmentary lag screws which was later followed by application of 3.5mm Low contact dynamic compression plate/ distal fibula anatomical LCP or a reconstruction plate was applied on the lateral or posterior surface of the fibula as appropriate. The reduction was visualized at every crucial step under fluoroscopy in both the orthogonal views. Meticulous closure was done in all the cases,



Fig 4: lateral approach

### Post - Operative Protocol

Non-weight bearing gait was started from first or the second postoperative day. Partial weight bearing was started after the removal of the cast (after clinical and radiological signs of union become evident). Active exercises of the ankle was advised. In patients with syndesmotomic screw fixation, weight bearing was delayed till screw removal. Follow up of cases was done at 2nd weeks, 6th week and later they were

followed up to 6 months period. Using Baird and Jackson’s ankle scoring system.

**Duration Follow-Up Of**

- Patients follow up was done in outpatient department at 2 weeks, 6 weeks and 6 months. X-rays were made to see for the union.

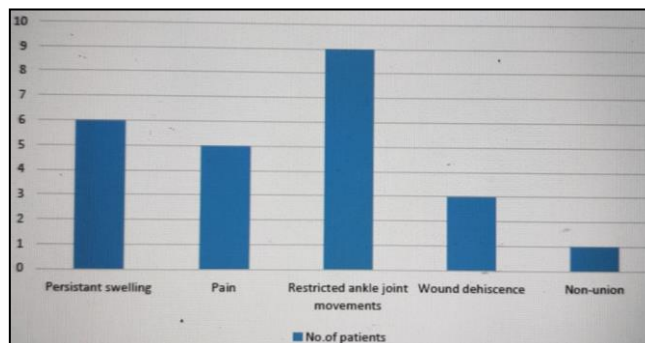
**Results**

The study consisted of 30 patients aged more than 19 years, of which 10 were females and 20 were males. The most common mode of injury was road traffic accidents, 13 patients had left ankle fracture, 15 patients had right ankle fracture, where as 2 patient had bilateral involvement, among them 9 patients had bimalleolar fracture, 10 patients had medial malleolus fracture, while 8 patients had their lateral malleolus fractured, 3 patients had associated posterior malleolus fractured, that is the Trimalleolar fracture. Patient with bad skin conditions, like abrasions, lacerations and open ankle fractures were excluded from the study. Out of 30 patients, most of the patients had supination external rotation type of injury, followed by supination adduction and pronation external rotation type of injury, rarely pronation abduction type of injury was seen. The most common modality of fixation for lateral malleolus was one third tubular plate, locking plate and rush pin and for medial malleolus was 4mm cannulated cancellous screw with washer/ k wire and for posterior malleolus fixation is done with lag screw from anterior to posterior or posterior to anterior. The average duration of hospital stay for above patients was 2 weeks approximately. On follow up at 2 weeks 11 patients out of 30 had persistent swelling and pain at the operative site, 9 out of 30 patients had restricted ankle movements, 2 out of 30 patients had wound dehiscence at the suture site, 1 case out of 30 developed non-union at the medial malleolar fracture site because of early weight bearing for which revision surgery was done with bone graft at non-union site, There was a significant improvement statistically in the subjective assessment of pain, walking, activity levels, ankle and subtalar joint functions from 6th week to 6 months post operatively, even the radiographic assessment showed subjective statistical improvement from 6th week to 6th month post operatively. The mean Baird and Jackson score has resulted significant improvement statistically in the score from 2 nd postop week to 6th post op month.

followup, There was a significant improvement statistically in the subjective assessment of pain, walking, activity levels, ankle and subtalar joint functions from 6th week to 6 months post operatively

**Table 3:** Shows complications and no. of patients

Complications	No. of patients
Persistent Swelling	6
Pain	5
Restricted ankle joint movements	9
Wound dehiscence	3
Non-union	1



**Fig 5:** Shows Complications

**Table 1:** Shows Type of fracture no of patients and Treatment

Type of fracture	No. of patients		Treatment
Medial malleolus fractures	10	TBW	Malleolar Screw
	3	2	Cancellous Screw

**Table 2:** Shows Lateral malleolus fractures Lateral Plate and Rush Pin

Lateral malleolus fractures	8	Lateral Plate	Rush Pin
		4 4	
Posterior malleolar fixation	3	Anterio-Posterior Screw	
Bimalleolar fracture	9	Tbw+Lateral Plate	Malleolar/Cancellous Screw/Rush Pin
		3 6	

**Complications**

Most of the complications were observed during the first



**Fig 6:** case 1

Functional outcome by braid and jacksons score at 6months:

SUB-CATEGORIES	SCORE
1.Pain	A(15)
2.Stability of ankle	A(15)
3.Able to walk	A(15)
4.Able to run	B(8)
5.Ability to work	A(10)
6.Motion of the ankle	A(10)
7.Radiographic results	A(25)

The composite score is 98, which indicates EXCELLENT in braid and Jackson scoring system.

Fig 7: functional score

Functional outcome by braid and jacksons score:

SUB-CATEGORIES	SCORES
1.Pain	B(12)
2.Stability of ankle	A(15)
3.Able to walk	A(15)
4.Able to run	B(8)
5.Ability to work	A(10)
6.Motion of the ankle	A(10)
7. Radiographic results	A(25)

The composite score is 95, which indicates GOOD in braid and Jackson scoring system.

Fig 9: functional score



Fig 8: case 2

**Discussion**

The aim of our study is to determine the the functional outcome of closed ankle fractures treated with open reduction and internal fixation, and To know the incidence of post operative complications. Most of the ankle fractures are managed operatively by stable internal fixation devices, which has resulted in excellent/good functional outcome. The study consisted of 30 patients aged more than 19 years, of which 10 were females and 20 were males. The most common mode of injury was road traffic accidents, thirteen patients had left ankle fracture, fifteen patients had right ankle fracture, where as two patient had bilateral involvement. Most common mechanism of injury as per lauge Hansen classification was supination external rotation type of injury, followed by supination adduction and pronation external rotation type of injury, rarely pronation abduction and pronation dorsiflexion type of injury. Unstable malleolar fracture of ankle, managed conservatively has resulted in inadequate restoration of the anatomy and biomechanics of ankle. Conversely, open reduction with internal fixation is an excellent method for restoration of normal anatomy and biomechanics of the joint. The most common modality of fixation for medial malleolus is 4mm cannulated cancellous screw with washer, and for lateral malleolus is 1/3rd tubular plate and rush pin.

**Conclusion**

In this study of 30 patients with closed ankle fractures who were managed surgically with different modalities, and later they all were assessed by Baird and Jackson scoring system for their functional outcome, the following are some of the salient findings noted

1. In the Indian scenario, where a major group of people belong to the lower socioeconomic ladder, as a result, are entirely dependent on a pain-free and stable, early mobility of the ankle to carry on their work and day-to-day activities without any hurdles and also where most people are time-bound for various reasons – economic or

social - it is important to make sure that such patients of malleolar fractures of the ankle are appropriately treated via open reduction and internal fixation in order to avoid complications.

2. The ankle fractures are commonly seen in the young adult population, with Road traffic accidents and twisting injuries being the common causes.
3. Right side ankles were commonly involved than the left side.
4. Understanding the mechanism of injury is essential for anatomical reduction and fixation.
5. Early treatment without delay, anatomical reduction and fracture fixation, stringent postoperative mobilization and rehabilitation should help improve outcome in an operated ankle fracture, After a year of surgery, most patients experience little or mild pain and have certain restrictions of functional activities.
6. Open reduction and stable internal fixation using AO principles was found to give an excellent and good results.
7. During surgery, the soft tissues dissection was kept minimal to avoid further vascular compromise in an already tense, swollen ankle.
8. In the post-operative period, splintage of the ankle and precaution to prevent swelling of the ankle is necessary. The swelling may lead to delayed wound healing. Patients are ambulated with crutches or walker without bearing weight on the injured limb from the first post-operative day if there are no associated injuries
9. A significant improvement was noted in the ankle function from 2nd week to 6th month post-operatively, which was assessed using Baird and Jackson scoring system
10. Outcome was better for young and middle aged patients than the older patients.
11. Regarding complications: The most common late complications reported were persistent swelling and residual pain, some of our patients also developed reduced ankle range of movements.

Several studies indicated that, internal fixation of displaced malleolar fractures of ankle provides better results 105-107. The goal of operative management of ankle fractures is to provide painless full range of motion of ankle, union at the fracture site and anatomical restoration of the injured ankle. All the patients were clinically evaluated for improvement in pain, walking, activity levels, ankle and subtalar joint functions using the functional outcome scoring system i.e; the Baird and Jackson scoring system. Functional Outcome was measured at 2nd weeks, 6th weeks and lastly at 6th month. Paired t- test was used to analyse these results. These results are similar to several other systematic reviews performed recently, whereas they have some similarities to others and are in contradiction to other systematic reviews.

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