



# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2020; 6(1): 1182-1186  
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[www.orthopaper.com](http://www.orthopaper.com)  
Received: 13-11-2019  
Accepted: 17-12-2019

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## Operative outcome of ankle fractures: a prospective and retrospective study of 142 cases

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i1p.1981>

### Abstract

**Introduction:** Fractures and fracture dislocation of the ankle joint are common and operative treatment is a well-recognised treatment method. Open reduction and internal fixation have advantage of accurate reduction, restoration of ankle biomechanics, early mobilization and weight bearing, better patient satisfaction and ultimately good radiological and functional results

**Materials and methods:** The study included clinical and radiological results of 109 prospective and 33 retrospective patients of displaced malleolar fractures treated by open reduction and internal fixation. Various implants were used like locking plate, recon plate, partially threaded cancellous screws, tension band wiring and k wires. Functional scoring was done as per Olerud Molander ankle score and was compared with previous score and the final results were categorized into excellent, good, fair, poor

**Observations and results:** Age of the patients ranged between 18 to 80 years with average age of 44 ±6years. Majority of our patients were farmers and house hold workers which constituted 88 (61.9%) patients. In present study 63 patients with supination external rotation injury form largest type of ankle injuries, out of which 22 (35%) had excellent OMAS, 29 (46%) had good OMAS, 8 (7.6%) patient had fair OMAS. Only 4 (3.4%) patients had poor OMAS.

**Conclusion:** Ankle fractures are common in all age groups but results in elderly patients are poor as compared to young patients. Open reduction internal fixation is a preferred method for displaced ankle fractures with favourable results. Present study shows complications were not much of concern if patients are followed regularly with crutch walking properly and gradual weight bearing.

**Keywords:** ankle fracture, lauge hansen, malleolus, Olerud Molander ankle score

### Introduction

The talocrural or ankle joint is a uniaxial modified-hinge joint formed by the talus, distal ends of the tibia and fibula. Ankle joint is a stable diarthrodial joint in which stability is provided by medial and lateral ligament complexes, inferior tibiofibular ligament, tendon crossing the joint, bony contour and capsular attachments<sup>[1, 2]</sup>. Malleoli of tibia and fibula constrain the talus such that the joint function as a hinge joint and primarily contribute to the dorsiflexion and plantar flexion. Fractures and fracture dislocation of the ankle joint are common and often occur with little apparent force. These are the fractures of one or more of the malleoli associated with varying degrees of subluxation or dislocation and can be stable or unstable. Stable fractures are those that cannot be displaced by physiological force while unstable fractures easily displace when physiological forces are applied<sup>[3]</sup>. These fractures are associated with considerable morbidity and symptoms like pain, joint stiffness and limitation in lower limb fractures that may present for long time<sup>[4]</sup>. These are one of the most common lower limb fractures and account for 9-10% of all fractures<sup>[5]</sup>. Annual incidence of ankle fractures is between 107-184 per 100,000 persons. Most of the ankle fractures are closed and around 2% are open<sup>[6, 7]</sup>. 60-70% of these fractures are unimalleolar, 15-20% are bimalleolar and 7-12% are trimalleolar<sup>[8]</sup>.

Anatomical classification, Danis Weber/ AO classification and Lauge Hansen classification are the commonly used systems to classify the ankle fractures. Lauge Hansen-devised what has been termed the 'genetic classification'. It is based upon the concept that each of the various patterns of fracture-dislocation of the ankle is the end product of a sequence of bony and

ligamentous failures which results from a deforming force and that for any given deforming force the failure sequence usually occurs in the same order to produce the complete injury pattern which is pathognomonic of that deforming force. The most common mechanism of these fractures is supination external rotation with pronation external injury being next most common<sup>[9]</sup>.

As conservative treatment of displaced fractures with unstable ankle is associated with a number of complications and poor results hence open reduction and internal fixation is recommended for these fractures. Open reduction is the treatment of choice for treatment of these fractures which involves open reduction and fixation by various devices such as plates, screws, tension band wiring and K-wires. Open reduction and internal fixation have advantage of accurate reduction, restoration of ankle biomechanics, early mobilization and weight bearing, better patient satisfaction and ultimately good radiological and functional results<sup>[10]</sup>.

### Material and Methods

The present study was conducted in the Department of Orthopaedic Surgery, Indira Gandhi Medical College, Shimla. The study included clinical and radiological results of 109 prospective and 33 retrospective patients of displaced malleolar fractures treated by open reduction and internal fixation. Prospective cases included those who were operated from 1<sup>st</sup> August 2015 to 31<sup>st</sup> December 2016 while retrospective cases included those who were operated before 1<sup>st</sup> August 2015. Patients aged 18 years and above with displaced malleolar fractures were included, open, undisplaced and fractures associated with other fractures in ipsilateral lower limb were excluded. Standard approach was used according to the fracture type and level. A variety of implants were used like k wires, cerclage wires, one-third tubular plate, recon plate and locking compression plate etc. Deltoid injury if suspected was probed and repaired accordingly. Fixation of syndesmosis was considered in patient having pronation external rotation and pronation abduction (Denis Weber type C) injuries or other injuries associated with disruption of syndesmosis. Patients were immediately started on ankle range of motion exercises and typically kept non weight bearing for about 4 weeks and then partial weight bearing for 8-12 weeks and gradually allowed full weight bearing. There after every patient was advised to come for follow up at six weeks interval. Functional scoring was done as per Olerud Molander ankle score<sup>[11]</sup> and was compared with previous score and the final results were categorized into excellent, good, fair, poor.

### Observation and Results

This study was conducted in the Department of Orthopaedic Surgery, Indira Gandhi Medical College Shimla H.P. Total of 142 patients were included in the study out of which 109 patients were prospective and 33 patients were retrospective. Age of the patients ranged between 18 to 80 years with average age of 44 ±6 years. Most of patients were in younger age group. Left side ankle fractures were more common in our study which was seen in 80 i.e 56.5% of all patients. Majority of our patients were farmers and house hold workers which constituted 88 (61.9%) patients. Twisting injury in 71 (50%) was the commonest mode of trauma followed by fall from height in 59 (41.6%) and road side accident in 12 (8.4%). Supination external rotation injuries were most common in our study which constituted 44.1% of patients and majority of these injuries were stage 2 i.e isolated fracture of

lateral malleolus with antero inferior tibio fibular ligament injury. Pronation abduction was next common constituting 40 (28.0%) patients followed by pronation external rotation having 8 (19.6%) patients and supination adduction was seen in 11 (7.7%) patients only. Majority of our patients 44.1% had type B (Transyndesmotoc) injury followed by type C 26% and least common was infrasyndesmotoc i.e type A fracture which was seen in 7.7% patients.

**Table 1:** Distribution of patient according to complication present

Type of complication	Number of patients	Percent
Pain	8	4.9
Superficial infection	7	4.9
Deep Infection	6	4.2
Stiffness	5	3.5
Non union	1	0.7
Osteoarthritis	2	1.4
Total	29	

In present study 8 (5.6%) patients had pain during post operative follow up. 13 (9.1%) patients had infection out of which 7 (4.9%) had superficial and 6 (4.2%) had deep infection; stiffness was present in 5 (3.5%) patients and 2 patients had early osteoarthritis. One (0.7%) female diabetic patient had non-union medial malleolus (Table 1).

**Table 2:** Distribution of patients according to Olerud Molander ankle score at 3 months and final follow up

Functional results	Number of patients	
	OMAS at 3 months	OMAS at final follow up
Excellent (91-100)	4 (2.8%)	40 (28%)
Good (61-90)	48 (33.6%)	72 (50.4%)
Fair (31-60)	58 (40.6%)	24 (16.8%)
Poor (0-30)	32 (22.4%)	6 (4.2%)

In present study 63 patients with supination external rotation injury form largest type of ankle injuries, out of which 22 (35%) had excellent OMAS, 29 (46%) had good OMAS, 8 (7.6%) patient had fair OMAS. Only 4 (3.4%) patients had poor OMAS. 2<sup>nd</sup> most common type of injury was pronation abduction. 40 patients were of pronation abduction type of fracture out of which 6 (15%) had excellent OMAS, 31 (64.5%) had good OMAS, 2 (5%) patient had fair OMAS and 1 (2.5%) patient had poor score. The least common group forms supination adduction type of ankle injuries which had total 11 patients out of which none had poor score. Majority of our patients 63 had transyndesmotoc type of injury. Out of which 22 (36%) patients had excellent OMAS, 29 (42%) patients had good OMAS. 8 (14.3%) patients had fair score and 4 (2.1%) patients had poor score. Least common variety of ankle injuries were of infra syndesmotoc type 11 (7.7%) patients only. Out of which 4 (36.3%) patients had excellent score. 5 (45.4%) patients had good OMAS. 2 (18.1%) patients had fair OMAS. 31 patients unclassified injury type of fractures only 1 (3.2%) patient had poor score.

### Discussion

In the present study; 109 prospective and 33 retrospective patients with ankle fractures who were treated operatively were analysed. The main objectives of the study were to analyse the patterns of the ankle fractures, radiological results as well as functional outcome and complications of surgically treated displaced ankle fractures.

Ankle fractures are seen most commonly in young active patients sustaining high energy trauma and the mean age

reported in literature varies between 32.3 years to 64 year<sup>[12]</sup> Majority of studies in literature revealed twisting injury, falls and road side accidents as commonest cause of malleolar fractures. Sometimes they occur with sports injuries, assault or industrial accidents. We observed the twisting injury in 50%, falls in 41.6% and road side accidents in 8.4% of the patients. In our study majority of the patients (91.6%) were injured either due to twisting injury or fall from height which were most likely due to hilly terrain and tough geographic area as patients have frequent falls from height and slips on uneven surfaces. Also rural background, when people have to climb up trees for fodder.

Lauge Hansen classification is genetic classification based on cadaveric experimental studies. According to this classification; supination external rotation have been universally reported as commonest injury pattern. Motwani *et al* 2015<sup>[13]</sup> in a study of 68 patients reported that 42% of their patients had supination external rotation, 34% had pronation abduction, 17% had pronation external rotation and 7% supination adduction fractures. Many authors in their studies observed the same findings although some differences exist<sup>[14]</sup>. Danis Weber / AO classification system organises the fractures based upon the level of fibular fractures in relation to the distal tibiofibular syndesmosis. Majority of the studies reported type B fractures to be the commonest type of operatively managed ankle fractures followed by type C while type A being the least common<sup>[15]</sup>. The distribution of fractures according to Lauge Hansen and Danis Weber classification in our study was in accordance with the majority of studies.

Malleolar fractures usually occur in isolated ankle injuries but sometimes there can be injury to other parts of body especially in high energy trauma. Incidence of these associated injuries have been reported between 2% to 33% in various studies while some studies have not mentioned such association<sup>[14, 15]</sup>. In our study the associated injuries were present in 7 (4.9%) patients; 3 patients had blunt trauma chest with fracture ribs out of which 2 required intercostal drain, 2 had spine fracture both were operated; 1 had ipsilateral fracture shaft of femur which was fixed with interlocking nail; 1 had contralateral intertrochanteric fracture in whom fixation was done with dynamic hip screw.

The open reduction and internal fixation restores the normal anatomy, provide sufficient stability to allow movements, early weight bearing and decreases the risk of subsequent osteoarthritis due to incongruence of the joint. Various devices such as plates, screws, k wires and tension band wiring are used for fixation of these fractures. Lateral malleolus is the key structure to the anatomical reduction and its reduction establishes stability of joint<sup>[16]</sup>. ORIF by using one or other types of plates with or without a lag screw is the most common method for fixation of fibular fracture. Other methods of fixation of fibular fractures include lag screw only fixation in long oblique fracture, malleolar screws from tip of lateral malleolus, TBW for low transverse fractures, intra medullary devices especially for committed diaphyseal fractures and rarely by multiple k wires only<sup>[17, 18]</sup>. Fractures of the medial malleolus, whether isolated or part of a bimalleolar or trimalleolar fractures warrant consideration for optimum fixation method and these fractures should be treated surgically because persistent displacement allows the talus to tilt into varus. The operative fixation of medial malleolus with PTCS or tension band wiring has become widely accepted. TBW is more technically advantageous over other types of fixation of small fragment fractures as well as

large fracture fragments of medial malleolus but it is not recommended for fixation of vertical fractures. We also fixed the majority of medial malleolar fractures (71, 49.7%) with tension band wiring while malleolar screws with additional screws or k-wire was used in 7 (4.9%), 11 (7.7%) patients had vertical fracture which was fixed with multiple lag screw and 7.7% patients had very small or comminuted fracture which were fixed with multiple k wires with or without ethibond.

Posterior malleolus need to be fixed if > 25% of the articular surface is involved<sup>[19]</sup>. In our study 8 patients had posterior malleolus fractures, all of them all of them were part of trimalleolar fracture pattern. Size of posterior malleolus fragment was >25% in 3 patients which were fixed by 2 anterior to posteriorly directed screw and size of fragment was <25% in 5 patients in which no fixation of posterior malleoli was done.

Syndesmotic instability is seen in about 10% of ankle fractures and is identified by mechanism of injury, fracture pattern and preoperatively after fixation of malleoli. In patients with instability; fixation with screws is recommended. In our study 21 patients (14.7%) had syndesmotic injury which were fixed with syndesmotic screws through lateral plate most frequently (12.6%). In all the patients syndesmotic screw was removed after 2-3 months of surgery except one patient in which the syndesmotic screw was found broken at 3 months follow up.

Deltoid ligament along with medial malleolus is widely considered to be crucial for talar stability and its integrity is assessed by medial swelling, bruising and tenderness and radiologically by talar tilt or shift and by assessing joint space. We had 8 (5.6%) patients having complete rupture of deltoid ligament; 7(4.9%) patients were with lateral malleolus fracture and one patient had both of lateral malleolus and posterior malleolus indicating towards deltoid ligament rupture.

Many studies have investigated outcome after ankle fracture and a number of different measures are used to determine the different aspects of final results<sup>[20]</sup>. The OMAS is a disease specific questionnaire devised for patients with ankle problems and has been used most commonly in many studies to evaluate subjectively scored functions. We used the OMAS to assess the outcome after treatment of ankle fractures as its validity and test- retest reliability is very high and it has been frequently used to evaluate the functional results in many studies<sup>[21, 22]</sup>. It is generally perceived that there is progressive improvement in function and results over a period of time after ankle fractures. Nilsson *et al.*<sup>[23]</sup> found statistically significant (p value 0.002) improvement in subjective and objective scores from 6 months to 12 months post operatively. Mean OMAS at 6 months was 60±17.9 and at 12 months it was 70±16.2. In our study also there was statistically significant improvement in OMAS from 3 months to last follow up which was 7-38 months (p value .05). The mean OMAS at 3 months was 46.2 and on last follow up it was 76.8.

Treatment of malleolar fractures with accurate open reduction and stable fixation provide better results with high percentage of excellent and good results<sup>[24]</sup>. Excellent to good results after open reduction internal fixation have reported in 70% by Colton *et al.*<sup>[25]</sup>, in 74.3% by Beris *et al.*<sup>[26]</sup> and in 90% by De souza *et al.*<sup>[27]</sup> Most of the authors have reported fair results in around 14-17% and poor results in 4-6% of the operatively treated patients. Makwana *et al.*<sup>[28]</sup> in 2001 compared 22 cases of open reduction internal fixation and 21 cases of non-operatively treated patients and found that open

reduction internal fixation had higher functional scores and significantly better range of motion of ankle. Although we did not compare the outcome of patients treated conservatively and operatively; we were able to achieve excellent and good results in 78.7% of the patients. Burnwell and Charnley<sup>[29]</sup> in their series of 132 patients found that 77.3% patients had good results, 16% fair and 6% had poor results. Majority of the patients (78.7%) in the current study showed good and excellent results while fair results were observed in 16.8% of the patients and these findings were similar to the above mentioned studies and other studies in literature. We observed poor functional score in 6 (4.2%) patients as per OMAS which closely resemble the major series reported in literature. Most of these cases were severe bi/ trimalleolar fractures, operated in the second week after injury and had post-operative infections which lead to pain, stiffness and other functional limitation resulting into poor outcome. Most of the patients have satisfactory results after surgical treatment of malleolar fractures but there are a range of potential early and late complications. Early complications include infections, failure or loss of reduction, neurological or vascular complication and anaesthetic or medical problems. Late complications like persistent pain, swelling, stiffness, nonunion, malunion, symptomatic hardware and late osteoarthritis are also reported in literature<sup>[30, 31]</sup>. Complications rate varies widely and have been reported between 5 to 40% depending upon the population investigated<sup>[32]</sup>. Overall complication rate was 18.7% in patients in study by Ahmed Hafiz *et al.*<sup>[33]</sup>, 17.5% by Motwani *et al.*<sup>[13]</sup>. We observed complications in 16 (11.2%) patients out of which major complications were present in 10 (7%) patients which was close to these studies.

### Conclusion

Ankle fractures are common in all age groups but results in elderly patients are poor as compared to young patients. Open reduction internal fixation is a preferred method for displaced ankle fractures with favourable results. Age, sex and associated comorbid condition along with type of ankle injury is of prognostic value. Tension band wiring is the best method of fixation for medial malleolar fracture and plating for lateral malleolus fracture. Present study shows complications were not much of concern if patients are followed regularly with crutch walking properly and gradual weight bearing.

### References

- Burks RT, Morgan J. Anatomy of the lateral ankle ligaments. *Am J Sport Med.* 1994; 22:72-77.
- Boss AP, Hintermann B. Anatomical study of the medial ankle ligament complex. *Foot ankle Int.* 2002; 23:547-553
- Kannus P, Palvenen M, Niemi S, *et al.* Increasing number and incidence of low trauma ankle fractures in elderly people. Finnish statistics during 1970-2000 and projections for the future *Bone.* 2002; 31(3):430-433.
- Tile M. Fractures of the ankle. In: Schatzker J, Tile M, eds. *The Rationale of Operative Fracture Management.* Ed. New York, NY: Springer. 2005, 551-590.
- Bugler KE, Whit, TO, Thordarson DB. Focus on Ankle Fractures. *The Journal of Bone and Joint Surgery.* 2012; 94:1107-1112.
- Court-Brown CM, Mebirnie J. Adult fractures an increasing problem. *Acta Orthop Scand.* 1998; 69:43-47.
- Daly PJ, Fitzgerald RH, Melton LJ *et al.* Epidemiology of ankle fractures in Rochester, Minnesota. *Acta Orthop Scand.* 1987; 58(5):539-544.
- Fracture and dislocation compendium. Orthopaedic Trauma Association Committee for Coding and classification. *J Orthop Trauma.* 1996; 10(suppl 1):4-9, 1-154.
- Lauge-Hansen N. Fractures of the ankle. Combined experimental-surgical and experimental-roentgenologic investigations. *Arch Surg.* 1950; 60(5):957-985.
- Hasselmann CT, Vogt MT, Stone KL, Cauley JA, Conti SF. Foot and ankle fractures in elderly white women. Incidence and risk factors. *J Bone Joint Surg (Am).* 2003; 85:820-4.]
- Gertrud Nilsson, Kjell Jonsson, and Magnus Eneroth. Outcome and quality of life after surgically treated ankle fractures in patients 65 years or older. *BMC Musculoskeletal Disord.* 2007; 8:127.
- Baird AR, Jackson TS. Fractures of the distal part of the fibula with associated disruption of the deltoid ligament. *J Bone Joint Surg.* 1987; 69A:1346-52.
- Motwani, Girish, Himanshu Shah, Vishwanath H Chavli, Daveshwar Rn, Haresh R. Parmar and Pokhraj Prakashchandra Suthar. Results of open reduction and internal fixation in closed bimalleolar Pott's Fracture of Ankle in Adults, 2015, 4(7).
- Belcher GL, Radomisli TE, Abate JA, *et al.* Functional outcome analysis of operatively treated malleolar fractures. *J Orthop Trauma.* 1997; 11:106-10.
- Tropp H, Norlin R. Ankle performance after ankle fracture: a randomized study of early mobilization. *Foot Ankle Int.* 1995; 16:79-83.
- Egol KA, Tejwani NC, Walsh MG, Capla EL, Koval KJ. Predictors of long term Functional Outcome, Following Ankle Fracture Surgery. *The Journal of Bone and Joint Surgery (American).* 2006; 88:974-979.
- Schepers T, DeVries MR, Van Lieshout EM, Vander Ist M *et al.* The timing of ankle fracture surgery and the effect on infectious complications; a case series and systematic review of the literature. *Int Orthop* 2013; 37: 489-94.
- SooHoo NF, Krenek L, Eagan MJ, Gurbani B, Ko CY, Zingmond D. Complication rates following open reduction and internal fixation of ankle fractures. *Bone Joint Surg Am.* 2009; 91:1042-9.
- Solonen K, Jones KB, Maiers-Yelden KA, Marsh JL, Zimmerman MB, Estin M, Saltzman CL. Ankle fractures in patients with diabetes mellitus. *J Bone Joint Surg Br.* 2005; 87:489-95.
- Egol KA, Tejwani NC, Walsh MG, Capla EL, Koval KJ. Predictors of Short-Term Functional Outcome. Following Ankle Fracture Surgery. *The Journal of Bone and Joint Surgery (American).* 2006; 88:974-979.
- Olerud C, Molander Bimalleolar H, Trimalleolar ankle fractures operated on with non-rigid internal fixation. *Clin Orthop Relate Res.* 1986; 206:25.
- Karlsson J, Peterson L. Evaluation of ankle joint function: the use of a scoring scale. *The Foot.* 1991; 1:15-19.
- Gertrud Nilsson, Kjell Jonsson, Charlotte Ekdahl, Magnus Eneroth. Outcome and quality of life after surgically treated ankle fractures in patients 65 years or older. *BMC Musculoskeletal Disorders.* 2007; 8:127.
- Duchesneau S, Fallat LM. The Maisonneuve fracture. *J Foot Ankle Surg.* 1995; 34(5):422-428. doi:10.1016/S1067-2516(09)80016-1
- Colton CL. The treatment of Dupuytren's fracture



- dislocation of the ankle. *J Bone Joint Surg*, 197; 53B:63-71.
26. Alexander Beris, *et al.* surgical treatment of malleolar fractures. *CORR*. 1997; 341:90.
  27. De Souza LJ, Gustilo RB, Meyer TJ. Results of operative treatment of displaced external rotation-abduction fractures of the ankle. *J Bone Joint Surg Am*. 1985; 67:1066-1074.
  28. Makwana N, Bhowal B, Harper WM, Hui AW. Conservative versus operative treatment for displaced ankle fractures in patient over 55 years of age: a prospective randomized study. *J Bone Joint Surg*. 2001; 83B:525-9.
  29. Burwell HN, Charnley AD. The treatment of displaced fractures of ankle by rigid internal fixation and early joint movement. *J Bone Joint Surg*. 1965; 47B:634-60.
  30. Carragee EJ, Csongradi JJ, Bleck EE. Early complications in the operative treatment of ankle fractures. *J Bone Joint Surg*. 1991; 73B:79-82.
  31. Shelton Mar Vin L. Complication of fractures and dislocation of the ankle. In: *Complications in orthopaedic surgery*, Chapter 23, 3rd edn., ed. EPPS, Charles H, Philadelphia: J.B. Lippincott Company. 1994; 1:595-648.
  32. Leyes M, *et al.* Complications of open reduction and internal fixation of ankle fractures. *Foot Ankle Clin N Am*. 2003, 8:131-147.
  33. Ahmed Hafiz Z, *et al.* Ankle Fractures: The Operative Outcome. *Malaysian Orthopaedic Journal*. 2011; 5:1.