

Management of Malleolar Fractures of Ankle

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Abstract

Malleolar fractures of ankle are usually complex injury as they are associated with significant ligament and soft tissue injury. The aim of treatment is to restore normal anatomy and provide sufficient stability for early movements. Malleolar fractures require open reduction more often than any other type of ankle fracture. Our study aimed to know efficacy and outcome of operative management of it and follow then prospectively. Clinical and radiological outcome were studied and clinical indications and efficacy of procedure reviewed. *Method:* from April 2014 to March 2016, 30 patients of malleolar fractures admitted in Govt. Medical College and hospital, Latur were operated and followed up prospectively. 20% of patients achieved excellent, 73% good and 6% patients achieved poor results. We conclude that malleolar fractures encountered in clinical practice need thorough assessment and meticulous surgical intervention as it is associated with injury to ligament complex. Abduction and external rotation types of injuries are the most common type to be seen. We can achieve stable fixation and early mobilization of the ankle joint, which limits the complications of pseudarthrosis, osteodystrophy and ankle stiffness. Proper assessment and meticulous surgical technique to treat all above injuries is of vital importance to avoid complications and to yield good results. And by mentioned technique, we achieved good to excellent results of 90 percent.

Keywords: Tri Malleolar Fracture; Abduction; Lauge Hansen's; Baird and Jackson Score.

Introduction

Malleolar fractures of ankle are usually complex injury as they are associated with significant ligament and soft tissue injury. The aim of treatment is to restore normal anatomy and provide sufficient stability for early movements.

Malleolar fractures require open reduction more often than any other type of ankle fracture. After reduction it is important to check

1. Articular surface contours are satisfactory aligned.
2. Weight bearing alignment of ankle is right angle

to long axis of leg.

3. Restoration of normal relationship of ankle mortise.

Classification

Three classification are used in clinical practice for ankle fracture

1. Lauge Hansen Classification [1]
2. Denis Weber Classification [2]
3. AO classification of malleolar fractures [3]

Lauge-Hansen Classification¹ correlates specific

fracture pattern with mechanism of injury-first word designates foot's position at the time of injury and second word refers to direction of deforming force.

Most common of all is Supination Eversion Injury which leads spiral oblique fracture of distal fibula with fracture of medial malleolus or rupture of deltoid ligament

Oleary, Ward cautioned against use of Lauge Hansen Classification & recommended treatment based upon clinical judgement of ankle stability.

Whitelaw et. al [4] advised anterior drawer and talar tilt test after bony stabilisation and surgical repair of ligament disruption .

There is significant inter-observer variability and reliability between classification systems of ankle fractures. Above all classification system are useful in understanding mechanism of injury and planning treatment but do not have prognostic significance.

Isolated Fracture of Medial Malleolus

Isolated fractures of medial malleolus are treated with different modalities of internal fixation, depending on fracture geometry, comminution, and bone quality. Undisplaced fracture can be treated conservatively with cast. But now days patients have high functional demand, So ORIF is preferred which hastens healing and early rehabilitation is possible.

Commonly implants used for fixing medial malleolus-3 K-wires in Trishul position or 1 K-wire & one 4 mm screw or two 4 mm cc screws, or 2 K-wires & static tension band. Additional one cc screw parallel to ankle joint is advice when medial malleolus fracture extends into metaphysis

Isolated Fracture of Lateral Malleolus

Acceptable displacement of fibula is 0-5 mm as per the literature review. Talus displaces laterally with displacement of lateral malleolus, So ideally anatomical reduction of lateral malleolus is desirable by ORIF.

Implant choice depend upon on fracture level, fracture geometry, size of fracture fragment and associated comminution of fragments. Implants commonly used are 1/3 tubular plate 4 mm cc screw intramedullary, 2 k wire and TBW square nail if fibula has segmental fracture and 3.5 screw only.

Bimalleolar Fractures

When both medial and lateral stabilising structures are disrupted. Ankle joint kinetics is altered

& tibiotalar contact area is reduced. Anatomical close reduction is possible but cannot be maintained in cast as swelling subsides in few days. Most authors recommend ORIF for both malleoli for almost all bimalleolar fractures.

Surgery for ankle fractures should be done preferably within 12-14 days or should be delayed for 12-14 day still swelling subsides. Although surgery is delayed. Immediate closed reduction and splinting is done, Delayed surgery is technically difficult but is justifiable with significant soft tissue injury.

Complications associated are prominent painful hardware, loss of reduction, non-union and soft tissue complications.

Syndesmotic Injury

Pronation-External rotation, pronation - abduction forces the talus to abduct and Ext, rotate out of mortise & causes disruption of syndesmotic ligament. Syndesmosis is assumed to be disrupted if fibula fracture occurs above distal tibio-fibular joint.

Indications for fixation of syndesmotic injury are controversial in literature studies. In general syndesmotic screw fixation is not necessary if lateral malleolus fracture is located within 5 cm of ankle joint. If fracture anatomically reduced and immobilised for 6 weeks.

If syndesmotic injury extends more than 5 cm proximal to ankle plafond syndesmotic screw fixation is recommended by most authors.

Intraoperative Cotton Test is very useful to test integrity of syndesmosis. Apply bone hook to distal fibula and try to separate it from tibia and simultaneously apply opposite force to tibia to prevent movement of tibia. No movement between distal tibia and fibula indicate intact syndesmosis. Lateral displacement for 3 to 4 mm indicates syndesmosis injury and syndesmosis fixation is mandatory in these cases.

Various implants are used to fix syndesmosis. Most commonly used is 3.5 or 4.5 cortical screw. Two screws found to provide more biomechanically secure fixation than one screw. Screw placement is done parallel to ankle joint in both cortices of fibula and on one or both cortices of tibia according to bone quality. Screws are routinely removed at 6-8 weeks before weight bearing is allowed.

Management of Fractures of Posterior Malleolus of Ankle

Posterior malleolus fracture often associated with

fracture of medial and lateral malleolus. It occurs as a part of rotational injury. Size of posterior malleolus fragment is often variable.

In general, fragment is small and laterally based and still have attachment to PITFL-posterior tibio-fibular ligament. Large fragment often associated with posterior ankle subluxation / dislocation as posterior malleolus is major posterior stabilising structure of ankle.

Posterior malleolus fixation should be undertaken when 25 to 30% of joint is involved.

In small fragments, when fibula length is obtained, it sufficiently achieves reduction of posterior malleolar fragment. Most of the small fragment fractures are stable, are reduced conservatively when fibula length is obtained and yields good results.

Ankle injuries are very important as body weight is transmitted through ankle and locomotion depends upon stability of joint. Malleolar fractures have a wide variety of presentation with different classification system of which two are commonly used, Lauge Hansen Classification [1] & Denis Weber Classification [2].

3 The purpose of study is to assess functional outcome and results of both conservative and operative treatment of posterior malleolus fracture.

Large posterior malleolus fragment involving more than 25-30% of joint surface of joint surface, generally associated subluxation or dislocation of joint should be reduced with ORIF to have proper anatomical reduction, alignment and to maintain stability of joint.

Material and Method

The study conducted upon 30 patients (Age 20 - 60 yrs.) with malleolar fractures admitted in Dept. of Orthopaedics, Govt. Medical College and hospital, Latur between April 2014 to March 2016.

Exclusion Criteria

Compound Grade 3 fracture (Gustilo Anderson classification [5]), patient presented after 3 weeks of injury, patients with associated talus fracture and medically unfit patients.

Technique

- After admission and stabilizing patient, radiograph of ankle in AP & LAT, and Mortise View taken and classification of fracture done according to Lauge Hansen Classification.

- Routine lab investigations-HB, CBC, BSL, LFT, KF, HIV, HBSAg, ECG AND CXR DONE.
- The leg is immobilised with Below Knee POP Slab and limb elevation given and oral analgesics started.
- Evaluation of fracture morphology, level and extent of articular involvement done. Evaluation of local skin condition done. Surgery delayed for presence of blebs, ecchymosis and gross swelling.
- Surgery was done usually within 12-24 hrs of injury. In case of blisters, ecchymosis and swelling, surgery delayed to 12-14 days or when swelling reduces with appearance of wrinkle on skin and after healing of blisters.
- In bad skin conditions, the limb nursed carefully with MgSO₄ dressings, ice application and limb elevation and anti edema drugs such as serratiopeptidase, Trypsin, chymotrypsin, bromelin and rutoside etc. Special attention given to haemorrhagic blisters as they indicate underlying skin necrosis. Periodic examination and assessment of skin condition done.
- Patients with compound fractures taken for debridement under regional anesthesia within 6-8 hrs of injury or as early as possible. IV antibiotics started on admission.
- Routinely, patients were operated with supine position and on radiolucent fracture table. Thorough anti-septic wash, scrubbing with povidon iodine, painting and draping done of operative area. The procedure done under tourniquet to achieve bloodless operative field and to decrease blood loss.
- The Lateral malleolus was approached either closed or open method. In closed method we used square nail that inserted from the tip of lateral malleolus. In open method it was approached through a posterolateral incision. The incision was put about 5 cm proximal to tip of lateral malleolus & extends distally along the posterior margin of fibula to the tip of lateral malleolus. Soft tissue & periosteum separated. One third tubular plate was contoured to match the fibula & fixed with 3.5 mm cortical screws. In case of fractures at lower end of fibula we fix either with intramedullary 4 mm CC screw or 2 k wires or 3.5 mm lag screw.
- The medial malleolus approached with open method, incision of 5cm from the tip medial malleolus between its anterior & posterior border extending proximally taken. Carefully

entrapped periosteum between fracture fragments elevated. Reduction achieved with clamp & two parallel k wire inserted with drill from tip of malleolus. One was anterior & other was posterior from the tip of medial malleolus to the proximal tibia transfixing the malleoli the tibia without entering joint, if distal fragment size is large enough 3rd K wire passed between above 2 k wires. In young patients with good bone quality and without comminution, one or two 4 mm CC screw with or without washer passed over the guide wire.

- After fixation of medial malleoli, stability of reduction assessed under IITV control. Special attention is given to look for associated syndesmotic injury by performing Cotton's test: Distraction is applied to fibula with bone hook to try to separate it from tibia to which an opposing force has been applied to tibia to prevent tibial motion. If no significant motion is noted between distal tibia and fibula, indicates no syndesmotic injury. If displacement is 3-5mm or more, one or two syndesmotic screws passed 1.5 to 3 cm above ankle plafond and with 25-30° anterior inclination from fibula to tibia engaging two cortices of fibula and one or two cortices of tibia to maintain the reduction of syndesmosis.
- Posterior malleolar fracture was reduced by indirect means without opening the fracture site and Guide wire/ K wire inserted in Antero-Posterior direction percutaneously. If posterior malleolus fragment size is small or less than 1/3rd of articular surface, managed conservatively without internal fixation.
- 4.0mm CC screw with washer of appropriate size was inserted with small stab incision marked over Guide/K - wire and by maintaining reduction by gentle traction over calcaneus.
- The reduction was assessed repeatedly using fluoroscopic and visual control. Rotation of malleolar fragment and integrity of ankle mortise were considered for assessment and Delta frame External Fixation carried out for reinforcement of fracture stabilization if trimalleolar fracture is associated with subluxation or dislocation.
- For *Irreducible Fracture Subluxation Dislocations*
A) careful assessment done for entrapment of distal tip of proximal fragment of fibula behind tibia (*Bosworth's lesion*) B) in case with fracture fibula with intact medial malleolus with clear space between talus and medial malleolus, special attention given for entrapment of torned

deltoid ligament or posterior tibial tendons.

- Postoperatively limb was elevated, analgesics anti-inflammatory oral medications started and intravenous broad spectrum antibiotics given for 3 days and oral antibiotics continued till 7th post op day. Check X-rays done and assessed for articular configuration and stability of the ex-fixator construct.
- Check dressing on 2nd post op day and 7th post op day done. In case of external fixator, daily pin tract dressing done with all aseptic precautions.
- Suture removed after 12 day on an average or depending on wound healing. Patient discharged with non weight bearing below knee cast. Range of motion exercises at the knee joint And toes was started on the second day.
- Patient was allowed to non-weight bearing ambulation using axillary crutches from the 2nd day. Partial weight bearing allowed only after 12 weeks.
- Patient was followed at 4, 8, 12 and 24 weeks for clinical and radiological evaluation and final results at the end of 24 weeks by using *Baird and Jackson scoring system* [6].

Results and Discussion

ankle joint is most common joint involving intra articular fractures, every malleolar fracture require specific treatment according to pattern of injury, soft tissue condition, ligament injury and fracture pattern.

In our study of 30 patients, the age of the patients between 25-60 years were studied and the incidence of malleolar fracture found to be high in age group of 30 to 45 years with mean age of patient being 38 years which is comparable to the studies made by, Beris et al [12], Roberts RS [11] and Baird and Jackson [6]. Out of 30 patients, 18 (60%) fractures were found in men & 12 (40%) fractures were in females. more active life of males leading to more exposure to traumatic events. right side was involved in 17 (57%) patient and left side in 13 (43%) patients, which is comparable with Roberts RS [11], Beris et al [12]. Bimalleolar fracture was seen in 22 patients and 8 patients had trimalleolar fracture.

The union occurred in mean period of 12-16 weeks. Baird and Jackson scoring used to final result evaluation Baird and Jackson scoring [6] of patients has proven to be strict and allowed only very small fluctuation from normal about 80% 6 (20%) Patients

in this series achieved excellent result. 22 (73%) Achieve good results and 2 (6%) achieved poor results, The results in current study were comparable with that of Burnwell & Charnley [8], Ganit Segal et al [10], Beris et al [12].

Passive mobilization started on postoperative day 2 in compliant patients. Despite of good intraoperative reduction and early mobilization 4

(13%) patients developed ankle stiffness which is comparable to E Bugler et al [8]. Two (7%) patients developed superficial skin infection which was recovered after debridement regular dressing and 3 weeks of antibiotic coverage.

Implant removal was not advised and performed in only one case because of demanding patient with hardware prominence after 18 months of surgery.

Table 1: Baird and Jackson scoring system [6]

Pain Score	Score
No Pain	15
Mild pain with strenuous activity	12
Mild pain with activities of daily living	8
Pain with weight-bearing	4
Pain at rest	0
Stability of ankle	
No clinical instability	15
Instability with sports activities	5
Instability with activities of daily living ability to walk	0
Able to walk	
Able to walk desired distances without limp or pain	15
Able to walk desired distances with mild limp or pain	12
Moderately restricted in ability to walk	8
Able to walk short distances only	4
Unable to walk	0
Able to run	
Able to run desired distances without pain	10
Able to run desired distances with slight pain	8
Moderate restriction in ability to run with mild pain	6
Able to run short distances only	3
Unable to run	0
Ability to work	
Able to perform usual occupation without restrictions	10
Able to perform usual occupation with restrictions in some strenuous activities	8
Able to perform usual occupation with substantial restriction	6
Partially disabled; selected jobs only	3
Unable to work	0
Motion of the ankle	
Within 10 of uninjured ankle	10
Within 15 of uninjured ankle	7
Within 20 of uninjured ankle	4
<50 of uninjured ankle, or dorsiflexion <5	0
Radiographic result	
Anatomical with intact mortise(normal medial clear space, normal 25 superior 25joint space, no talar tilt)	25
Same as a with mild reactive changes at the joint margins 15	15
Measurable narrowing of the superior joint space, superior joint space 2mm, or talar tilt >2mm	10
Moderate narrowing of the superior joint space, with superior space between 2 and 1mm.	5
Severe narrowing of the superior joint space, with superior joint space <1mm, widening of the medial clear space, severe reactive changes(Sclerotic subchondral bone and osteophyte formation)	0

Table 2: Scores according to the Baird and Jackson scoring system [6]

Excellent	96-100
Good	91-95
Fair	81-90
Poor	0-80



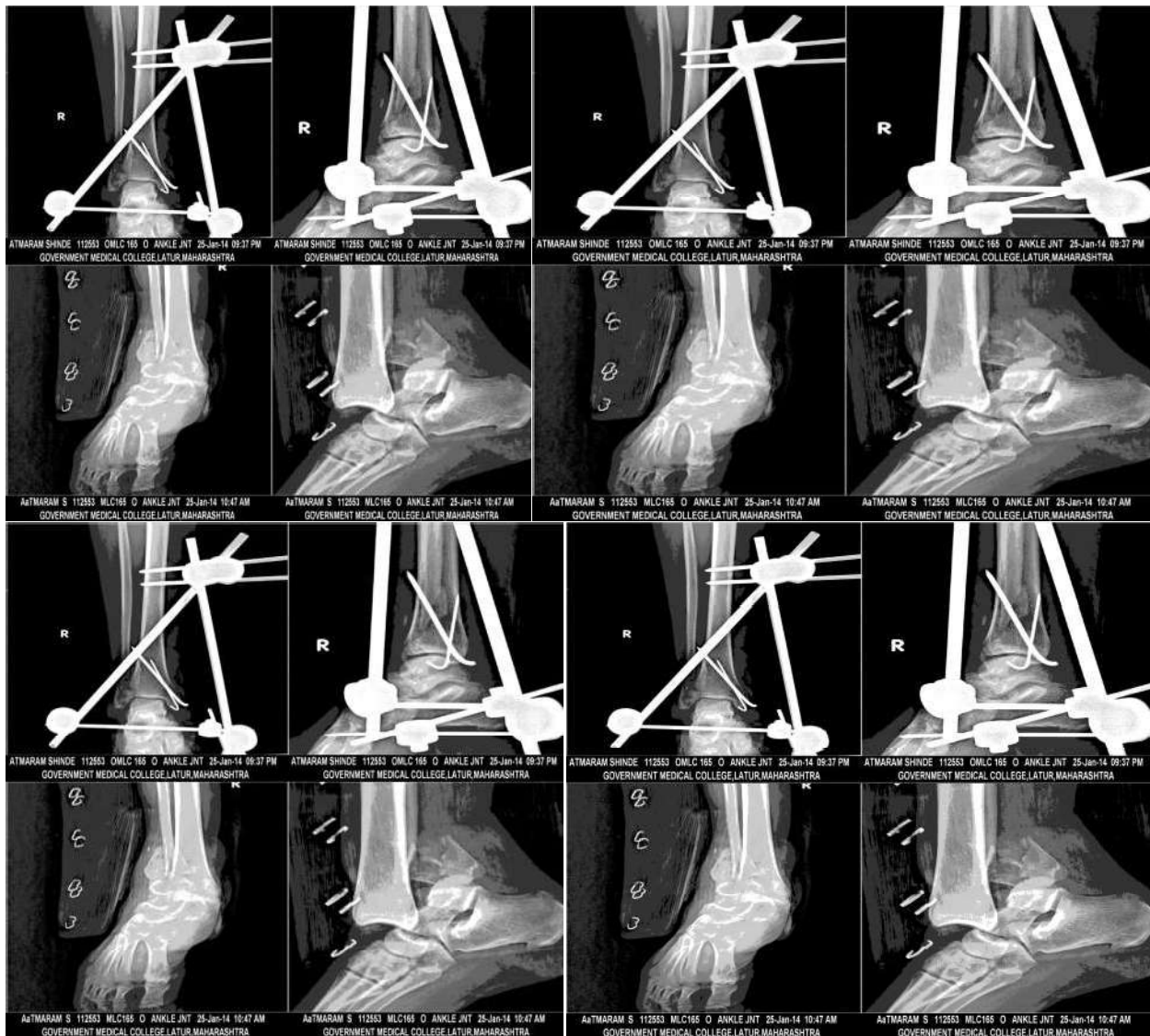
Case 1: PREROP POST OP AND FOLLOW UP (Bankat) Routine potts



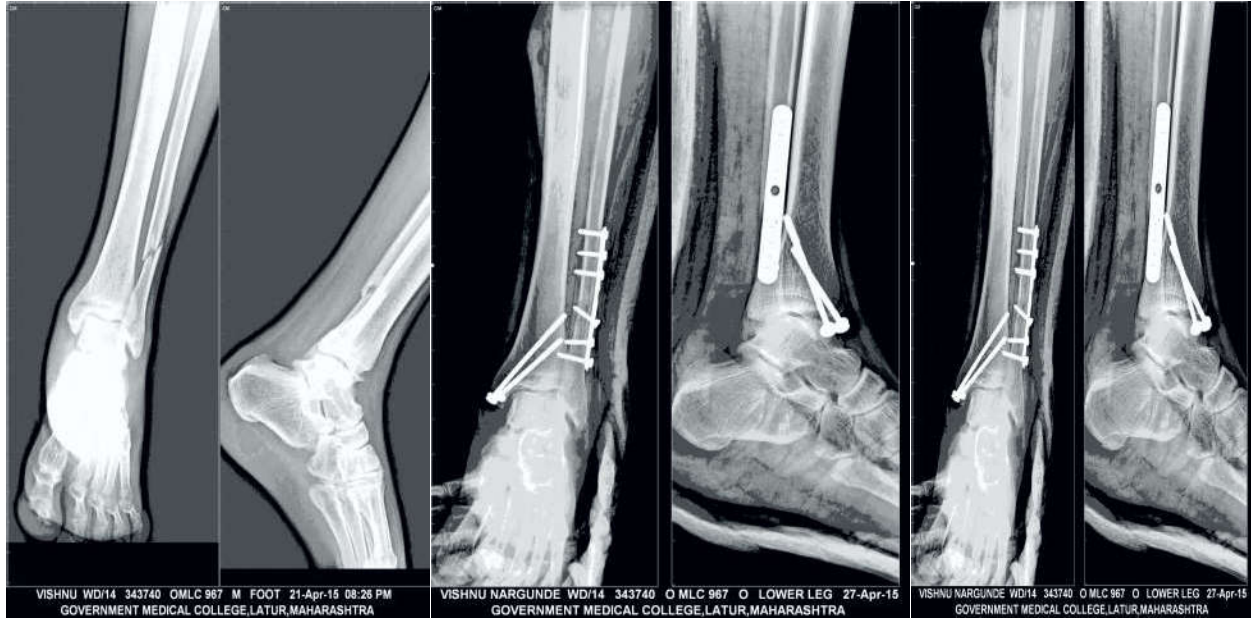
Case 2: Prerop post op and follow up (Abdul Shaikh) syndesmosis injury



Case 3: Pre P Post OP and Final AP Lateral kisan (Trimalleolar)



Case 4: Pre P Post OP and Final AP Lateral (Atmaram) fracture dislocation



Case 5: Pre O P Post OP and Final AP Lateral (Vishnu) potts

Conclusion

Understanding the mechanism of injury is essential for good reduction & internal fixation. The fibular length has to be maintained for lateral stability of the ankle. Anatomical reduction and stable fixation of articular fragment is essential and necessary step to restore joint congruity and is important in all intra articular fractures management for more so if a weight bearing joint like ankle joint is involved.

Ankle mortise incongruity is poorly tolerable and leads to post traumatic painful restriction of movement and secondary osteoarthritis. More severe injuries were followed by least satisfactory results. Presence of posterior malleolar fragment affects the final outcome.

Delta ex fix application is the method preferred for unstable fracture configuration and osteoporotic bones. meticulous surgical procedure, early mobilization and periodic follow up is key in management of malleolar fractures

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