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Research Article

TO STUDY OF SURGICAL MANAGEMENT AND FUNCTIONAL OUTCOME OF MEDIAL MALLEOLUS FRACTURE IN INDIAN ADULTS

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ABSTRACT

Ankle fractures represent 10% of all fractures. It is second most common lower limb fracture affecting people of all ages especially about 45 to 55 years, usually young males and elderly females being the high-risk victim. Treatment of ankle fractures plays a vital role in terms of fracture integrity and stability, especially if planned surgically various treatment modalities are available for fracture reduction, maintaining the reduction and achieving union at the fracture site for the betterment of patient in terms of pain relief, improved range of movements without stiffness. Management of ankle fractures and its outcome has a deliberate impact on patients socioeconomic status and well being. To analyse surgical management and to evaluate the functional outcome of medial malleolus fracture using various modality like tension band wiring, cannulated cancellous screw and K-wire. This prospective study was done in Sri Lakshmi Narayana Institute of Medical science, Pondicherry. In our study out of 30 cases 3 were isolated medial malleolus fracture remaining 27 were Bimalleolar fracture in that 16 patients showed syndesmotic disruption selected based on proposed inclusive and exclusive criteria. Classification used was Lauge-Hansen and Danis Weber classification. Road traffic accident was most common mode of injury. Patients were treated using Cannulated cancellous screw, K-wire (kirschner wire), Tension band wiring and one-third tubular plate where 16 patients required additional Syndesmotic screw fixation. Result were analysed using Baird and Jackson scoring system. About 36.7% of cases showed excellent result and 43.3% cases showed good result. Accurate anatomical reduction of fracture fixation result in good functional outcome.

Key Words: Medial malleolus fracture , Lauge-Hansen, Danis weber, Baird and Jackson scoring system.

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INTRODUCTION

Ankle fractures represent 10% of all fractures. The most injured joint in the body is ankle but least treated, said by Sir Robert Jones (Beris AE, *et al*. 1997). It is second most common lower limb fracture affecting people of all ages especially about 45 to 55 years, usually young males and elderly females. The most common mode of injury is simple fall in low energy injury and RTA in high-energy injury. Ankle injuries are usually mixed injuries with ligamentous and bony component due to deforming force. wide variety of classification are present for malleolar fracture of which only three are dominant Lauge-Hansen, Danis Weber

and AO classification. The main concern to treat ankle fracture is to achieve early restoration in day to day activities. Treatment of ankle fractures plays a vital role in terms of fracture integrity and stability, especially if planned surgically. Various treatment modalities are available for fracture reduction, maintaining the reduction and achieving union at the fracture site for the betterment of patient in terms of pain relief, improved range of movements without stiffness. Management of ankle fractures and its outcome has a deliberate impact on patient's socioeconomic status and well-being. Non-operative treatment of medial malleolus fracture was tried with splinting/casting which showed debatable outcomes in terms of union and maintaining the normal anatomical architecture. When the malleolar fracture is not reduced properly it will result in painful restriction of movement or osteoarthritis or both (Gaurav S, *et al*. 2019). Though being a subcutaneous fracture with limited soft tissue envelope following fixation, various postoperative complications like instability, wound dehiscence, superficial skin necrosis, hardware visibility and irritability, non-union, ankle stiffness have been reported.

To analyse surgical management and to evaluate the functional outcome of medial malleolus fracture using various modalities like tension band wiring, cannulated cancellous screw and K-wire.

MATERIALS AND METHODS:

Source of data:

The prospective study which has been carried out in the Department of orthopaedics, Sri Lakshmi Narayana Institute of Medical sciences, Pondicherry. The material for present study was collected from the patient who attended and admitted in department of orthopaedics with medial malleolar fracture. 30 cases of either sex were taken up for the study. Patients were well informed about the study in every aspects and informed written consent was obtained.

The period of study was 2 years. The period of follow up was up to 6 months to 1 year. The results of 30 fractures in 30 patients were analyzed and studied. The analyzed data was compared with other series in literature and discussed. A master chart was put up which deals all the aspects and variables taken for consideration.

Inclusion criteria:

1. Age ranging from 20 to 60 years
2. Both male and female
3. Closed fractures
4. Fractures not more than a week duration.
5. Fresh fracture.

Exclusion criteria:

1. Age less than 20 and more than 60 years.
2. Old operated, neglected fractures
3. Fractures more than a week duration.
4. Open fractures
5. Medical co morbidities.

Cases were selected based on history, clinical examination, radiographs and routine investigations. Careful examination about the presence or absence of vascular or neurological deficits, open or closed injury, associated spine or extremity injuries were documented. A selective proforma was made for all the cases in this study. Clinical diagnosis was confirmed by Antero-Posterior, Lateral and Mortise views.

The fracture was classified by Lauge-Hansen and Danis weber classification.

Initially patient was treated with Analgesic, Anti-inflammatory with limb elevation for pain relief and swelling and below knee POP slab was applied for immobilization.

Patient also supplemented with tetanous toxid and Antibiotics as indicated.

Laboratory investigations:

Hb ,TC, DC ,Urea , creatinine ,ESR ,serum electrolytes, Urine routine profile, BT, CT , Blood grouping and typing , RBS, HIV, HbsAg , ECG, and Chest x-ray.

Radiographic investigation:

X-ray: Antero-Posterior, Lateral and Mortise views: to view the fracture morphology and pattern

CT scan: Is taken to evaluate fracture pattern and to exclude intra articular fracture of tibial plafond.

OPERATIVE TECHNIQUE:

All cases were subjected for open reduction and internal fixation of medial malleolus specifically to avoid trapping of periosteum at the fracture site and to achieve anatomical reduction.

Under spinal anesthesia the patient is on supine position on table with sand bag underneath the affected side buttock.

Pneumatic tourniquet was applied to the proximal thigh after noting the time.

The affected limb was painted with betadine solution and draped in layers from the knee joint to the nail tip and foot was covered with a glove.

Timing of surgery lasted around 1 to 1 ½ hours, open reduction and internal fixation of the medial malleolar fractures were performed by tension band wiring, cannulated cancellous screw, K- wire fixation and lateral malleolus is fixed with 1/3rd tubular plate and screws. Additionally syndesmosis is fixed with syndesmotic screw.

Exposure and Fixation of Medial Malleolus

Anteromedial incision which begin about 2 cm proximal to fracture line which extent distally and slight posteriorly then ends about 2 cm distal to medial malleolus tip. The incision was deepened to the bone protecting the long saphenous vein over the anterior part of the incision. The skin and subcutaneous tissue was reflected anteriorly and posteriorly without pressure over the skin (Whittle AP, *et al*. 1998). The fracture site was exposed and cleared of blood clots. The intervening periosteum is removed with curette or periosteal elevator exposing small serrations of the fracture. A small, chondral or loose osseous fragment is debrided and large osteochondral fragments is preserved. The distal fragment was held with a towel clip and pulled proximally to bring detached fragment to normal position. Two K- wires of 2mm diameter were passed one anterior and one posterior from the tip of the malleoli across the fracture site as temporary fixation device without entering the joint. Fracture reduction was checked with anteroposterior radiograph. A drill hole is made about 5cm proximal to the fracture, on the tibia from anteromedial aspect to anterior aspect with 3.5mm drill. 20 gauge AO wire is passed through the predrilled hole on the tibia from anteromedial to anterior aspect and made in the figure of eight passing behind the two K-wires and tensioned with an AO tensioner and cut the tips of wire with cutter. The two K- wires were bend with bender and cut the excessive K-wire and punched into bone engaging the wire while protecting the tibialis posterior tendon and neurovascular bundle.

In 12 cases tension band wire was done for medial malleolus.

In 11 cases similarly reduction of fracture was done with a towel clip and pulled proximally to bring detached fragment to normal position. Fracture stabilized with 2 smooth K-wire. A drill hole was made perpendicular to the fracture line with 3.2mm drill bit and then tapped with 4.5mm tap and 4.5mm cannulated cancellous screw is inserted. The screws were tightened to provide compression at the fracture site. In 8 cases washer was used to provide uniform compression and to prevent screw head from sinking into the thin cortex.

In 4 cases similar reduction of fracture was done with towel clip and internally fixed with 2mm K-wire and reduction was checked with anteroposterior and lateral radiography which was found to be satisfactory and the reduction was stable.

In 3 cases similar reduction of fracture was done with towel clip and pulled proximally to bring detached fragment to normal position Two K- wires of 2mm diameter were passed one anterior and one posterior from the tip of the malleoli across the fracture site as temporary fixation device without entering the joint. Fracture reduction was checked with anteroposterior radiograph. One of the K-wire was removed and drill hole was made with 3.2mm drill bit and then tapped with 4.5mm tap and 4.5mm cannulated cancellous screw is inserted. The screws were tightened to provide compression at the fracture site and guide wire was removed.

The wound is washed with Betadine and normal saline and wound was sutured in layers. Sterile dressings were applied and compression bandage given. tourniquet was removed and the appearance of capillary filling over the toes was confirmed. Below knee posterior pop slab was applied. The patient was shifted to recovery room and then to post operative ward.

In our study out of 30 patients 27 patients had Bimalleolar fracture.

For lateral malleolus fracture is fixed with 1/3rd Tubular fracture though posterolateral approach. 11 patients required additional syndesmotic screw.

Post operatively patients was treated with analgesic and anti-inflammatory drugs with parental antibiotics. Physiotherapy was started in the form of active toe movement with quadriceps strengthening exercise. postoperative X-rays were taken to assess the congruity of the joint and assess the alignment of the fractures. Suture was removed on post-operative day 10 to 12. . Patient was discharged from the hospital with below knee slab and instructed non weight bearing with crutch walk for a period of 6 weeks and to come for follow-up after 1 month. At 6 weeks x- ray of the ankle was taken both AP and lateral views and looked for signs of fracture union and then were advised partial weight bearing for further period of 6 weeks. If the fracture is healing well then the patients were allowed full weight bearing on the affected limb after 12 weeks (Baird RA and Jackson ST. 1987). Regular follow up was done at an interval of 4 weeks till the fracture united. All the patients were advised removal of implants after complete union not less than 1 year.

Few patients with Syndesmotic screw fixation was removed before weight bearing is allowed and was done at 6 to 8 weeks depending on the radiological union (Parvataneni Prathap DA, *et al*. 2016).

Functional and Radiological Evaluation:

Functional and radiological results were analyzed using the ankle scoring system of Biard and Jackson. The evaluation was based on physical and radiological examination. Physical examination included the measurement of active dorsiflexion and plantar flexion of injured ankle compared with the uninjured ankle, with forepart of foot in neutral position. Radiologically the medial clear space superior joint space and talar tilt was measured.

There are seven categories in the scoring system each categories has being assigned a point score.

Final scores were based on the combined point scores from seven categories of subjective objective and radiographic evaluation. Results were designated as excellent, good, fair and poor. A score of 96- 100 points was considered excellent; 91 to 95 good; 81- 90 points fair and zero to 80 points poor.

OBSERVATION AND RESULTS

From this study sample of 30 patients, 15 patients were between 40-50 years of age (50%) followed by 9 patients between 30-40 years of age (30%).The mean age being 41.43 ± 7.45.

In our study 21 patients (70%) had involvement of right ankle and 9 patients (30%) had involvement of left ankle. There were no Bilateral cases in this study.

In our study 21 patients were male (70%) and 9 patients were female (30%) showing male preponderance of (M: F=2.3:1).

In our study 17 patients (56.7%) gave history of road traffic accident and 12 patients (40%) gave history of twisting injury followed by 1 patient (3.3%) gave history of fall from height.

In our study series all patients are classified by Lauge-Hansen classification system 15 patients (50%) had Supination External Rotation followed by 9 patients (30%) had Pronation External Rotation and 5 patients (16.7%) had Supination Adduction.

In this series all patients were classified under Danis Weber classifications system, 15 patients (50%) were grouped under type B followed by 10 patients (33.3%) were grouped under type C and 5 patients (16.7%) were grouped under type A.

In our study there were 30 patients with medial malleolar fracture, 12 patients (40%) were fixed with Tension Band Wiring and 11 patients (36.7%) were fixed with Cannulated Cancellous Screw followed by 4 patients (13.3%) were fixed with K-wire (Kirschner wire) and 3 patients (10%) were fixed with both Cannulated Cancellous Screw and K-wire.

In our study 15 patients (50%) showed union at 14 weeks post operatively and 11 patients (36.7%) showed union at 10 weeks followed by 2 patients (6.7%) showed union at 18 weeks and 1 patient (3.3%) showed union at 22 weeks. Mean radiological union was 13.0±3.76.

In our study 24 patients (80%) had no complication. Where as 3 patients (10%) had superficial infection and 1 patient (3.33%) had deep infection. 1 patient (3.33%) had non-union due to implant failure followed by 1 patient (3.33%) had arthritis due to mal union.

In our study the mean Baird and Jackson score was 92.0±6.33. About 11 patients (36.7%) showed excellent result followed by 13 patients (43.3%) showed good result and 4 patients (13.3%) showed fair whereas 2 patients (6.7%) showed poor outcome.

Table 1: Baird and Jackson Scoring system31

Pain	**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 activites	5
Instability with activites 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 mortice(normal medial clear space, normal superior joint space, no talar tilt)	25
Same as a with mild reactive changes at the joint margins	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.
Maximum possible score 100.

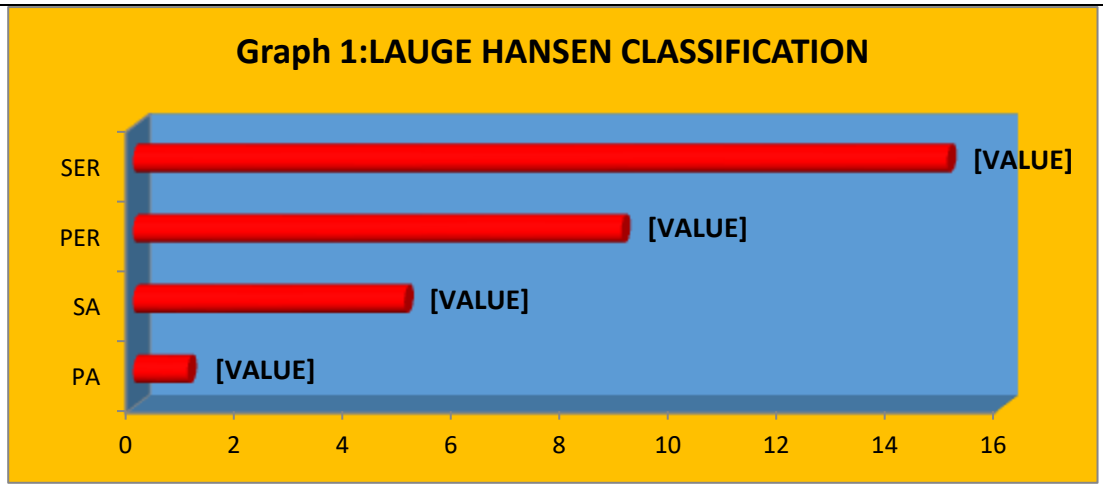
Excellent	96-100
Good	91-95
Fair	81-90
Poor	0-80

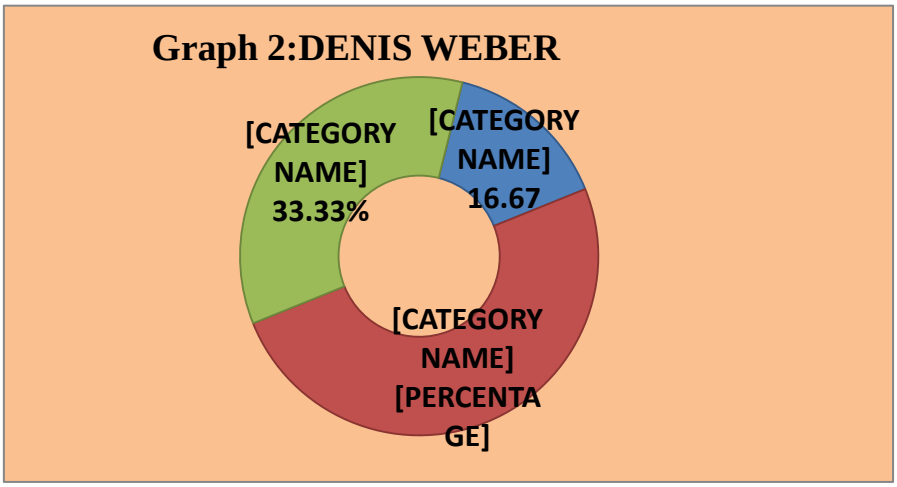
CASE 1
Fig 1:Pre operative x-ray

Fig 2:Post operative x-ray

CASE 2
Fig 3: Pre operative x-ray

Fig 4: Post operative x-ray





DISCUSSION

Ankle fractures represent 10% of all fractures. It is second most common lower limb fracture affecting people of all ages especially about 45 to 55 years. Ankle fracture occurs as a result of high energy trauma and most common modality being road traffic accident and fall from height and low energy trauma such as simple fall with twisting injury.

In our study the main aim is to assess the functional outcome and the results of surgical management of medial malleolar fracture and evaluated by Baird and Jackson scoring system.

In our study the key feature was restoration of anatomical architecture of ankle joint by using cannulated cancellous screw, kirschner wire and tension band wiring. Prevention of infection and promoting early motion with restoration of daily activates.

In our study there were 27 Bimalleolar fracture and 3 were Unimalleolar (medial malleolus) fracture.

From our study sample of 30 patients, 15 patients were between 40-50 years of age (50%) followed by 9 patients between 30-40 years of age (30%), mean age being 41.43 ± 7.45.

In our study 21 patients were male (70%) and 9 patients were female (30%) showing male preponderance of (M:F=2.3:1).

In our study 9 out of 30 patients (30%) reported to hospital on the day of injury and 9 out of 30 patients (30%) reported on 2nd day followed by 6 patients (20%) reported within 1 day. After admission initiation of appropriate medications and limb elevation gives good reduction in swelling.

In our study 17 patients (56.7%) gave history of Road Traffic Accident followed by 12 patients (40%) gave history of Twisting injury and 1 patient (3.3%) had Fall from Height.

In this study series Lauge-Hansen classification was used to see mechanism of injury and their fracture

pattern. The most common type of injury is Supination External Rotation for 15 patients (50%) followed by Pronation External Rotation for 9 patients (30%) and Supination Adduction for 5 patients (16.7%).

In our study all the patients were classified under Danis Weber classification system. 15 patients (50%) grouped under type B followed 10 patients (33.3%) were grouped under type C and 5 patients (16.7%) were group under type A.

In our study there were 30 patients with medial malleolar fracture, 12 patients (40%) were fixed with Tension Band Wiring and 11 patients (36.7%) were fixed with Cannulated Cancellous Screw followed by 4 patients (13.3%) were fixed with K-wire (Kirschner wire) and 3 patients (10%) were fixed with both Cannulated Cancellous Screw and K-wire.

In our study 27 patients (90%) were fixed with 1/3rd tubular plate whereas 16 patients (53.3%) required additional syndesmotic screw fixation.

In our study majority of patients 23 (76.7%) underwent surgical fixation between 3 to 4 days after admission followed by 4 patients (13.3%) were operated on day 2 and 3 patients (10%) operated on day 5. The mean time interval is 2.0±0.844 days.

In our study 15 patients (50%) showed union at 14 weeks post operatively and 11 patients (36.7%) showed union at 10 weeks followed by 2 patients (6.7%) showed union at 18 weeks and 1 patient (3.3%) showed union at 22 weeks. Mean radiological union was 13.0±3.76.

In our study serious all operated patients (30 patients) were analysed clinically in terms of their functional outcome to carry out their daily routine activities, early resume to work and activities of leisure. A standard scoring system Baird and Jackson scoring system was used for assessing functional outcome.

In our study all patients (30 patients) was analysed functional outcome using Baird and Jackson scoring system in that 11 patients (36.7%) had excellent outcome followed by 13 patients (43.3%) had good outcome and 4 patients (13.3%) had fair and 2 patients (6.7%) had poor outcome. The mean Baird and Jackson score was 92.0±6.33.

In our study 24 patients (80%) had no complication whereas 3 patients (10%) had superficial infection which was controlled by oral antibiotic and regular dressing and 1 patient (3.3%) had deep infection which was managed by wound debridement and higher antibiotics (Inj. Piperacillin 400mg + Tazobactum 500mg) followed by 1 patient (3.3%) had Post traumatic arthritis due to mal-union because patient has lost the follow up and turned up after 22 weeks and 1 patient (3.3%) had implant failure with non-union because patient did early weight bearing against our protocol at 12 weeks followup and patient was advised for revision surgery but patient did not turn up for further management.

CONCLUSION

In our study group of 30 patients 3 were isolated medial malleolar fracture remaining 27 patients were Bimalleolar fracture, In that 16 showed syndesmotic disruption. All this patients were subjected to surgery, Open Reduction and Internal Fixation was preferred to prevent trapping of periosteum at the fracture site and retaining anatomical reduction, articular congruity to improve clinical and radiological union with adequate joint motion.

Open Reduction and Internal Fixation was successful in terms of union and restoration of joint function by Tension Band Wiring, Cannulated Cancellous Screw, K-wire (kirschner wire) and Cannulated Cancellous Screw + K-wire fixation achieving good functional outcome of the affected ankle joint.

By Open Reduction and Internal Fixation the length of lateral malleolus is re-estabilised using the 1/3rd Tubular plate with additional Syndesmotic Screw fixation to prevent chronic ankle pain and joint stability[7].

In our study 11 patients (36.7%) showed excellent outcome and 13 patients (43.3%) showed good outcome after being subjected to standard scoring system Baird and Jackson promoting activities of daily living and patients well being.

In our study all medial malleolus fractures were subjected to open reduction rather than percutaneous fixation in order to avoid the risk of non-union in terms of anatomical reduction and periosteal trapping at the fracture site. Open Reduction and Internal Fixation is consider to be the best option to have good radiological union with good functional outcome of the ankle joint.

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