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A Prospective study to evaluate Clinical, Functional and Radiological Outcome in Unstable Malleolar Fractures treated surgically by various ORIF techniques.

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I. INTRODUCTION

Ankle fractures are one of the most common lower limb fractures they represent a significant portion of the trauma workload .The most common causes of ankle fractures are injuries due to Road traffic accidents, followed by falls and sports injuries.The purpose of this paper is to present a current review of pathoanatomical features, objective assessment,various surgical interventions, and clinical course associated with managing ankle fractures. Previously published studies have demonstrated a significant increase in the incidence and severity of ankle fractures among the elderly population. Closed management with manipulation, though avoids the operative risks, can result in poor long-term outcomes. This contributes to significantly higher rates of malunion, nonunion and decreased ankle range of motion. On the other hand, open surgical intervention can restore articular congruence, while it naturally carries the various operative and post-operative risks. This is particularly important when treating the elderly population. In the elderly, perioperative risk, and postoperative complications from skin infections, and the concurrent risks due to the presence of comorbid diseases are higher.Ankle fractures are managed surgically with reduction and fixation using various implants such as one third tubular plates, cc screws, tension band wiring, rush nails and external fixation. These operative techniques aim to provide anatomical restoration and immediate stability, which facilitates earlier mobilization. Surgical treatment accelerates the bone healing process by securely stabilising the fracture.

II. AIM & OBJECTIVE

1. To study the clinical and functional outcome for surgical treatment of unstable malleolar fractures by various surgical modalities.
2. To know the complication rates in open reduction internal fixation of unstable malleolar fractures.
3. To know the significance of physiotherapy in functional outcome of postoperative patients surgically treated for ankle fractures .

III. MATERIALS & METHODS

A prospective observational study from 1st September 2019 to 30th November 2020 of 50 patients who presented with displaced malleolar fractures at **Kamineni Hospitals, LB Nagar,Hyderabad who underwent surgery** and followed up for 6 months were included in the study. Clinical history, socio-demographic profile & Laugh hansen's classification was noted for all patients. Clinical and Functional outcome was evaluated for 6 months postoperatively using the **American Orthopaedic Foot and Ankle Society Score (AOFAS score)** and factors associated were assessed.

INCLUSION CRITERIA

1. Age more than 20 years
2. Ankle Fractures of AO Type (44A1,A2,A3 ;44B1,B2,B3 ; 44C1,C2,C3)
3. Gustillo-Anderson Grade I Open Fractures

EXCLUSION CRITERIA

1. Patients below 20 years of age
2. Gustillo-Anderson Type 2 & 3 open fractures
3. Patients with pre-existing joint disease (Osteoarthritis)
4. Patients with Pathological fractures,
5. Patients with Knee joint infections
6. Patients with pilon fractures, those with syndesmotic injuries were, old neglected fracture and those patients who were medically unfit for surgery and or anesthesia were excluded from the study.

CLINICAL ASSESSMENT

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The history of the injury normally gives a good indication of the mechanism of fracture and can assist in decision making regarding management. Ankle fractures usually result from torsional forces and present typically with tenderness, swelling, deformity and inability to bear weight. However, the non-displaced ankle fracture presenting post-injury with minimal swelling and no deformity. The clinical assessment of any open wounds, the condition of the skin, neurovascular status before and after any reductions.

CLASSIFICATION

According to the Lauge-Hansen classification system, the fractures were classified into supination-external rotation in 22 cases , supination-adduction in 14 cases, pronation-external rotation in 8 cases and pronation-abduction in 6 cases. The reduction and internal fixation started with lateral malleolus, then medial malleolus and posterior malleolus, and distal tibiofibular syndesmosis in sequence.

Preoperative Planning

1.Analgesics, Immobisation, Antibiotics,
2.Time for soft tissue recovery
3.Preoperative Standard AP,Mortise and Lateral view x rays
4. Preoperative Ankle clinical pictures to assess the skin condition

Preoperative Skin condition of the ankle

Preoperative Xrays (Radiographs of the ankle)

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Preoperative CT Ankle Images

IMPLANT SELECTION

1.One third tubular plates
2.4mm CC screw
3.K wires for TBW
4.Rush Nail
5.Recon Plates

Implants of choice for medial malleolus fixation : 4mm CC screws with washers are applied in compression mode with principle that screw is perpendicular to fracture plane.

Implants of choice for lateral malleolus fixation:

Lag screw with neutralization plate or buttress plate/antiglide plate and if the fragment is too small, lag screw with k-wires (tension band wiring)

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Implants : K wire and Rush Nails

INTRA OPERATIVE C-ARM & PATIENT POSITIONING

Posterolateral Approach to Lateral Malleolus(Gatellier & Chastang Approach)

Begin incision 12 cm proximal to tip of lateral malleolus,extend distally along posterior margin of fibula.Curve anterior following course of peroneal tendons ,end 2cm below and 2 cm anterior to tip of lateral malleolus.During superficial dissection, subperiostally expose the fibula,incise sheaths of peroneal tendons and displace tendons anteriorly. During deep dissection ,if fibula is not fractured perform osteotomy 10 cm proximal to tip. Divide interosseous membrane, and anterior and posterior tibiofibular ligaments. Rotate distal fibula to expose lateral and posterior aspects of the distal tibia.Repair fibula with syndosmosis screw from proximal part of the lateral malleolus through the tibiofibular syndesmosis.Overdrill fibula to close down syndesmosis

Approach to medial malleolus : Colonna & Ralston posteromedial approach

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Begin the incision at a point about 10cms proximal and 2.5cms posterior to the medial malleolus & curve it anteriorly & inferiorly, posteriorly 4cms towards heel.Expose the medial malleolus by reflecting the periosteum, but preserve the deltoid ligament.Tibialis posterior tendon & flexor digitorum longus tendon have been retracted medially and anteriorly, and flexor hallucis longus tendon, posterior tibial vessels & tibial nerve have been retracted posteriorly and laterally.

VARIOUS OPERATIVE TECHNIQUES DONE IN OUR HOSPITAL DURING THE STUDY

A.**CC screw fixation for medial malleolus, rush nail for lateral malleolus**

II. **CC screw fixation of medial malleolus, plating for lateral malleolus**

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C.Tension Band Wiring for medial malleolus, Rush nail for lateral malleolus

Follow-up:

Patients were reviewed in Out Patient Department **every 4 weeks** and X rays were taken **every month for first 6 months** to assess union .Partial weight bearing was started after 6 weeks.Full weight bearing was allowed after radiological evidence of bony union was achieved.

At every follow up, operative site was examined for wound dehiscence and radiological evaluation was done to assess fracture union and any loss of reduction and implant related failure.

Patients were followed and evaluated 6 months postoperatively using the **American Orthopaedic Foot and Ankle Society Score (AOFAS score)** and factors associated were assessed.

American Orthopaedic Foot and Ankle Society Score (AOFAS score)

Ankle-Hindfoot Scale (100 Points Total)

Pain (40 points)	
None	40
Mild, occasional	30
Moderate, daily	20
Severe, almost always present	0
Function (50 points)	
Activity limitations, support requirement	
No limitations, no support	10
No limitation of daily activities, limitation of recreational activities, no support	7
Limited daily and recreational activities, cane	4
Severe limitation of daily and recreational activities, walker, crutches, wheelchair, brace	0
Maximum walking distance, blocks	
Greater than 6	5
4-6	4
1-3	2
Less than 1	0
Walking surfaces	
No difficulty on any surface	5
Some difficulty on uneven terrain, stairs, inclines, ladders	3
Severe difficulty on uneven terrain, tairs,inclines,ladders	0
Gait abnormality	
None, slight	8
Obvious	4
Marked	0
Sagittal motion (flexion plus extension)	
Normal or mild restriction (30° or more)	8
Moderate restriction (15°-29°)	4
Severe restriction (less than 150)	0
Hindfoot motion (inversion plus eversion)	
Normal or mild restriction (75%-100% normal)	6
Moderate restriction (25%-74% normal)	3
Marked restriction (less than 25% normal)	0
Ankle-hindfoot stability (anteroposterior,varus-valgus)	
Stable	8
Definitely unstable	0
Alignment (10 points)	
Good, plantigrade foot, midfoot well aligned	15
Fair, plantigrade foot, some degree of midfoot malalignment observed, no symptoms	8
Poor, nonplantigrade foot, severe malalignment, symptoms	0
Total=	100

American Orthopaedic Foot and Ankle Society
From: http://www.aofas.org/i4a/pages/index.cfm?pageid=3494

IV. RESULTS:

In our study of 50 patients, the age of the patients between 18-60 years with the mean age 38.05 years and the incidence of malleolar fractures found to be high in age group of 31 to 40 years. Out of 50 patients, 34 fractures in men & 16 fractures in females. The union occurred in mean period of 10 weeks. Right side fractures were more common and road traffic accidents were the most common mode of injury.

In the study conducted ,outcomes were evaluated using AOFAS scores at 1st ,3rd and 6 months

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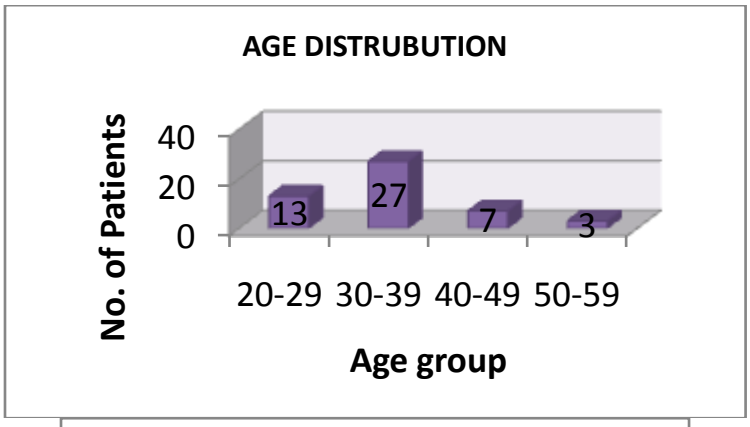
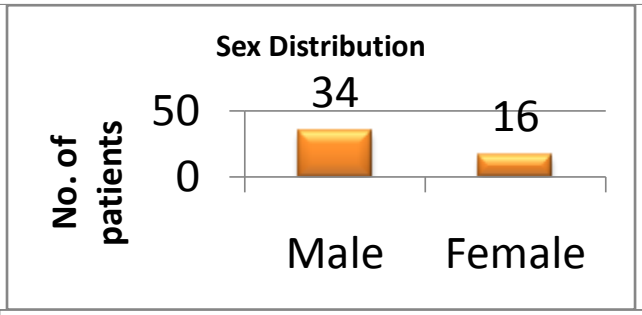
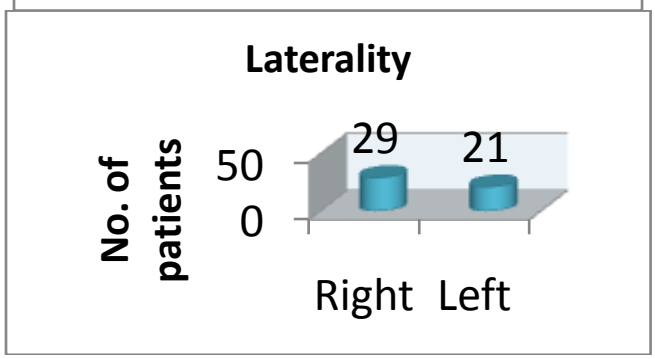
intervals.We had excellent results in 36 patients ,good outcome in 12 patients and poor outcome in 2 case. Partial weight bearing allow after 6 weeks. Until 2 weeks patients were advised to continue with below knee pop slab, there after passive mobilization started. The American Orthopaedic Foot and Ankle Society (AOFAS) scores were found to an average of 12 prepoperatively and 73 on average post operatively .

Supination external rotation was the most commonly seen injury in our patient population.Bimalleolar fracture was the most common anatomic type of fracture. According to Weber's classification, type B was the most type.The medial malleolus was fixed with canullated cancellous screws in 16 cases and with tension band wiring in 7 cases. 14 cases with lateral malleolus fracture were fixed with tubular locking plates and another 4 cases were fixed using syndesmotic screws through tubular locking plates.

Postoperatively, superficial skin infections were seen in 3% and restricted ankle movement in 2% patients. Patients aged less than 45 years were significantly associated with excellent and good functional outcomes as compared to patients of older age. Supination external rotation was also found to be significantly associated with excellent and good functional outcomes .Gender of the patients was not found to be significantly associated with the functional outcome.







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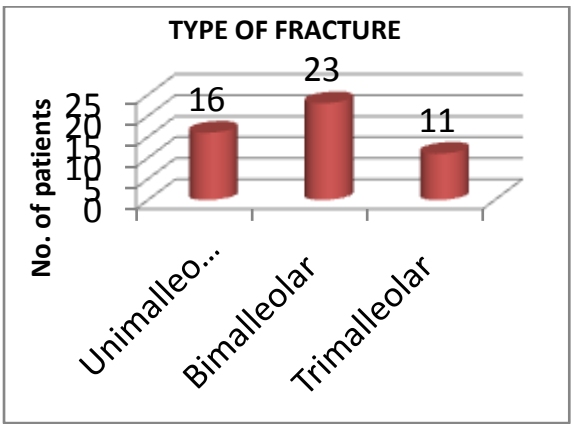

Outcomes evaluated using AOFAS scores for various surgical techniques:

Operative technique	Excellent	Good	Fair	Poor
CC screw for medial malleolus	11	4	1	0
TBW for medial malleolus	5	1	1	0
Rush nail for lateral malleolus	8	2	1	0
Plating for lateral malleolus	12	1	1	0

Outcome evaluated using AOFAS scores for various mechanisms of injuries:

Mechanism of injury	Excellent	Good	Fair	Poor

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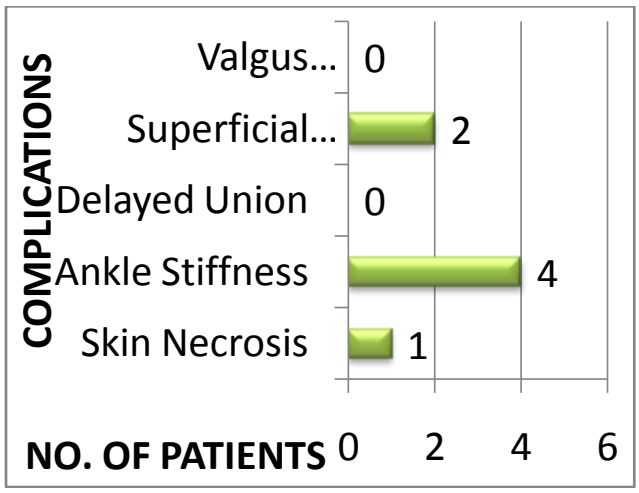
Supination external rotation (SER)	14	8	1	0
Supination adduction (SAD)	8	3	1	0
Pronation external rotation (PER)	5	2	1	0
Pronation abduction (PAB)	2	4	0	0



Case A: 34y, female, History of fall from 2 wheeler resulting in ankle fracture SER 4 type. Bimalleolar fracture ,treated with CC screw of medial malleolus and plating of lateral malleolus.

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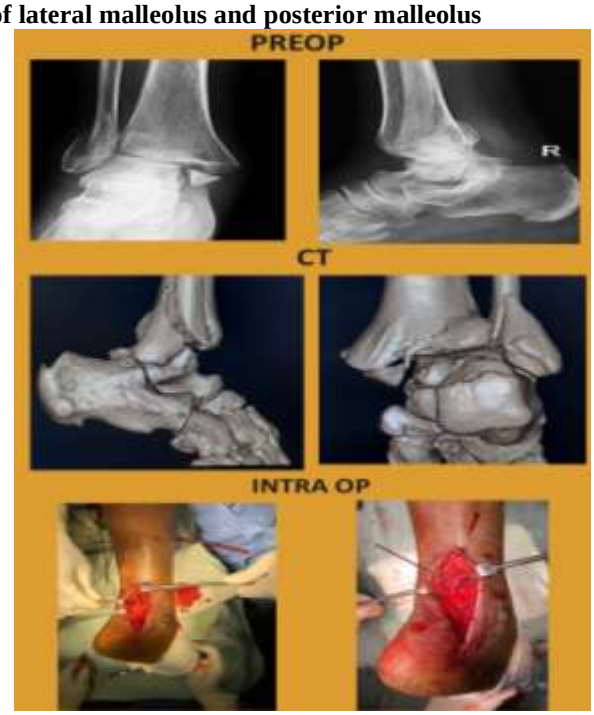
Case B : **45 year, female, h/o RTA with skid & fall from bike sustaining Trimalleolar fracture .TBW of medial malleolus, plating of lateral malleolus and posterior malleolus**



V. DISCUSSION

- Our study demonstrated that majority of the patients had excellent and good functional outcome at the end of six months.
- We had ankle stiffness in 4 patients. Noncompliance of the patient to physiotherapy regimen which was advised to all patients in the follow up period could be the reason for this.
- Posterior malleolus fracture are also associated with poor outcomes.
- Statistical significance for functional outcome pertaining to time duration between injury and surgery have been demonstrated.
- These findings suggest that ankle fractures operated within 24 hours from injury had excellent to good functional outcome as compared to fracture operated after 24 hours.
- Superficial skin infections were seen in 2 patients in our study. These infections usually occur in the early postoperative period and were treated with Intravenous antibiotics.

VI. CONCLUSION

- There are several different methods of ankle fracture fixation, however the goal of treatment remains a stable anatomic reduction of talus in the ankle mortise and correction of the fibula length as a 1mm lateral shift of the talus in the ankle mortise reduces the contact area by 42% and displacement of the fibula more than 2 mm will lead to significant increases in joint contact pressures
- Tension bend wiring is the method preferred for small fragments and osteoporotic bones
- Fibular fixation can be achieved with a number of different techniques, including intramedullary fixation, interfragmentary screw fixation, and plate fixation . Fixation with one or two lag screws can only be used in younger patients with long oblique fractures

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