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Outcome of Operatively Managed Cases of Fracture Trimalleoli

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Abstract:
Trimalleolar fractures of ankle are usually complex injuries, as they are associated with significant ligament and soft tissue damage. So, the primary modality of treatment is to avoid long term complications of arthritis and joint stiffness. The Study was aimed to evaluate the functional and radiological outcome and impact of trimalleolar fracture treated surgically.
Materials& method: *Thirty five patients with trimalleolar ankle fractures were treated surgically at Department of Orthopaedics.*
Results : *In this study, results were assessed using Olerud and Molander Scoring and American Orthopaedic Foot and ankle Society Scale. It was observed that 80% patients had excellent/Good Subjective Score, 17% patients had Fair score and 3% patients had poor Subjective score. According to the Olerud and Molander Objective scoring, 77% patients had Good score, 20 % patients had Fair score and 3% patients had poor Score. According to the American Orthopaedic Foot and Ankle Society Scale 80% patients had good results, 14% patients had excellent score and 6% patients had fair score.*
Conclusion: *Excellent anatomical fixation alone is not enough to assure an excellent functional outcome in the long run. Early physical rehabilitation played a pivotal role in ankle fractures in preventing post operative stiffness and ensuring good functional recovery. Our results indicated that careful surgical technique and certain modifications specific to individual fracture pattern were necessary in order to reduce incidence of complications. Favorable clinical and radiological outcome could be achieved by judicious pre operative planning considering patient factors and avoiding technical errors during surgery.*
Key words: *Trimalleolar fracture, complications, functional outcome,*

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I. Introduction:

According to John Roberts, " Ankle is worst injured part of body but least well treated" . Malleolar fractures are important as body weight transmission occurs through the ankle and locomotion depends on its stability. A Trimalleolar fracture is a fracture of the three large bony process that make up the ankle joint: the lateral, medial and posterior malleoli. A study found that the ankle is the most common site of injury in 24 of 70 sports [1]. Additionally, the increase in severity of an ankle injury results in an increase severity of ankle complications [2]. Lauge-Hansen[3] in1948-1954 recognized four patterns based on pure injury sequences and takes into account at the time of injury, deforming force direction and position of the foot.

Malleolar fractures of ankle are usually complex injuries, as they are associated with significant ligament and soft tissue injury, injury to syndesmosis and injury to medial and lateral collateral ligaments. Nowadays, MRI is useful in precisely diagnosing ligamentous injury and repairing these components have to be borne in mind, while treating these fractures. As these fractures also have associated subluxation and dislocation of talus, the aims of treatment are to restore normal anatomy and provide sufficient stability for early movements. Achieving anatomical reduction by open reduction, more often than any other fractures of ankle is necessary to avoid complications as in all intra-articular fractures [4] .

With the advent of **A.O principles of management**, the results of trimalleolar ankle fractures are better with emphasis on anatomical reduction of fracture, stable internal fixation, regaining full length of fibula and early active pain free mobilization.

After reduction, it is important to check if (a) articular surface contours are satisfactorily aligned, (b) weight bearing alignment of ankle is at right angle to long axis of the leg, (c) restoration of normal relationship of ankle mortise has been achieved.

Aims and Objectives: The study was aimed at (A) evaluating the functional and radiological outcome and impact of trimalleolar fracture treated surgically, (B) achieving perfect anatomically reduction, stable fixation and early mobilization, with specific objectives of studying " 6 months follow up of operatively managed cases of trimalleoli fractures" in terms of : pain relief, range of motion of ankle, functional

improvements, complications short term as well as long term complication rate (stiffness, deformity, ankle arthritis) and patient satisfaction.

II. MATERIALS AND METHODS

All the patients presenting with Trimalleolar ankle fractures classified with Lauge Hansen type injuries [3] in Orthopaedics Department, Government Hospital during July 2020 – December 2022 were included in the study. Inclusion criteria were both men and women aged between 18-80 years, with both closed and open Trimalleoli fractures. Modes of injury were road traffic accidents, domestic accident, assaulted, fall from height, direct impact, sports injury.

Patients aged less than 18 years and above 80 years, pregnant women, vascular injury, nerve injury, diabetic foot and other fractures in the same limb were excluded for this study. Total sample size was 35.

Radiographic evaluation included anteroposterior and lateral radiographs of the ankle joint, including the foot and the knee joint. Application of manual traction of the limb during radiographs often clarified fracture morphology. Radiographs always included the foot and knee joint because of the risk of ipsilateral foot and knee injuries. Anteroposterior and lateral radiographs of the uninjured limb helped to plan fracture fixation, determine alignment, and preoperatively determine choice of implants.

Preoperative planning:

- Evaluation of fracture morphology and level and extent of articular involvement were done; evaluation of local skin condition was done. Surgery was delayed for presence of blebs, ecchymosis, and gross swelling.
- Determination of the type of fixation required for medial, lateral as well as posterior malleoli.
- Evaluating the type of implants to be used for the surgical fixation for the particular fracture pattern
- Evaluating the need to intervene specifically for syndesmotic injury if present in the patient

Surgical Approach:

Lateral Malleoli: The lateral malleolus was approached by either closed or open method. In the closed method, we used a square nail/TENS nail that was inserted from the tip of the lateral malleolus following a stab incision over the tip of the lateral malleolus and soft tissue dissection. In the open method, it was approached through a lateral or posterolateral incision. The incision was made about 5 cm proximal to tip of lateral malleolus and extends distally along the posterior border of fibula to the tip of lateral malleolus.

Medial Malleoli: The medial malleolus was approached with open method.

Duration of hospitalization: The average duration of hospital stay following surgery was 5 days ranging from 4-8 days

Follow up: The maximum follow up was two years and minimum follow up was six months and the average being 13 months. Patients were called for review at 3 weeks, 6th week, 3rd month, 6th month. If there is substantial evidence of union both clinically as well as radiologically, gradual weight bearing started accordingly[5]. Patients were put on physiotherapy for mobilization of ankle joint post operatively between 3rd day to 3 weeks depending upon type of fixation and presence of other soft tissue injury.

Condition at discharge: All patients were advised non weight bearing mobilization with active ankle and toe mobilization physiotherapy.

III. OBSERVATION / RESULTS:

Maximum number of injuries were found to be in the fifth decade of life,and was more common in males, 22 (62.85%) than females, 13 (27.15%) which corroborated with significant number of injuries occurring due to road traffic accidents (51.42%) and along with industrial and sports injuries (5.71%). Right dominant side was more commonly involved-30 patients (85.71%) which pointed towards the dominant weight bearing limb being prone to twisting injuries during the normal gait of an individual.

MECHANISM OF INJURY: The method by which trauma and its associated forces directly or indirectly impacts the ankle joint describes the fracture pattern and associated soft tissue injury. Inversion and plantar flexion type of injury was found to be the commonest mechanism whereas eversion and dorsiflexion was found to be least prevalent (Table 1) based upon patient history and Radiological findings.

Table 1: Type of injury in study population

MECHANISM OF INJURY	NUMBER OF PATIENTS	PERCENTAGE
Inversion Plantar flexion	22	62.85
Eversion Plantar flexion	8	22.85
Eversion Dorsiflexion	1	2.85
Inversion Dorsiflexion	4	11.45
Total	35	100

FRACTURE PATTERN: Based on the position of foot and direction of force applied to foot, four types of injury patterns are described by Lauge-Hansen and their incidences in this study are shown in Table 2. In the present study, the most common fracture pattern seen was supination-external rotation type of injury in 23 cases (65.71%) , followed by pronation- external rotation and supination-adduction type of injury in 5 cases (14.28%) each.

Table 2: Pattern of injury as per Lauge Hansen Classification

Injury Pattern	Number of Patients	Percentage
Supination-Adduction	5	14.28
Supination External Rotation	23	65.71
Pronation Abduction	2	5.72
Pronation external rotation	5	14.28
Total	35	100

Subjective scoring criteria by Olerud and Molander [6] included pain on walking, stiffness, stair climbing, running , squatting and other activities of daily life. So the functional subjective scoring was expressed as Excellent, Good, Fair and poor. Whereas, objective score was based on clinical and radiological criteria. Clinical criteria include pain, range of ankle movements and deformity. radiological criteria on the evidence of osteoarthritic changes, talar tilt, talar shift and restoration of joint congruity. Based on the fracture pattern the functional outcome as per the subjective and objective scoring are shown in the following charts I & II respectively.

Chart I: Subjective scoring of patients

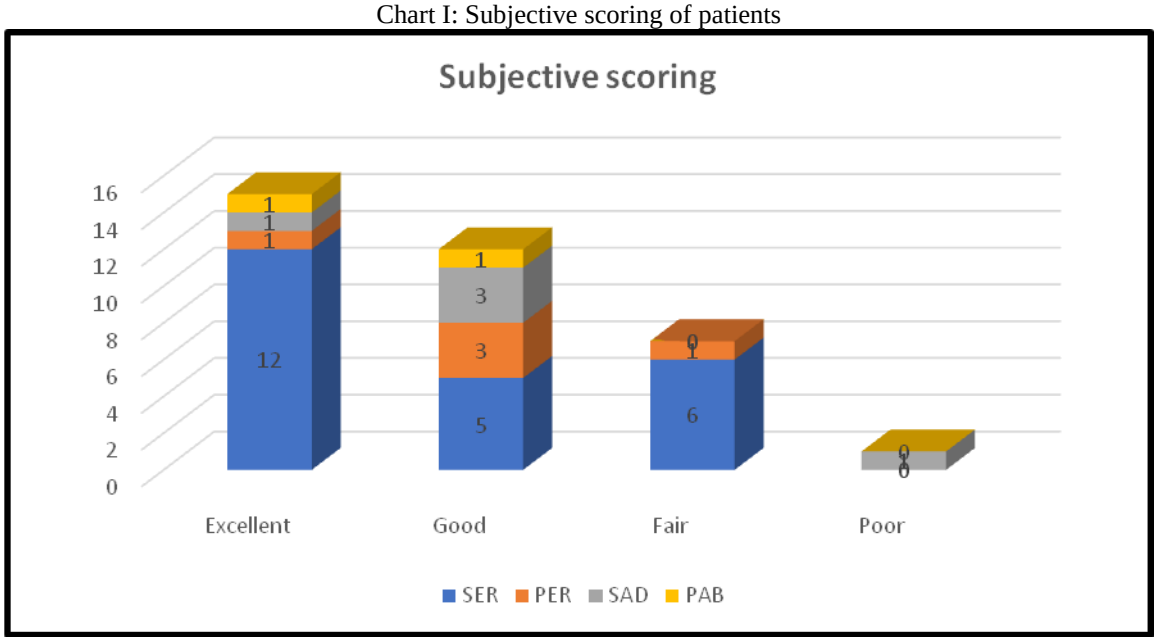

Table 3: Overall functional outcome for our patients were as follows.

Results	No. of patients	Percentage
Excellent (>90%)	15	42.85
Good (81 - 90%)	13	37.15
Fair (60 -80%)	6	17.15
Poor (<60%)	1	2.85
TOTAL	35	100

IV. DISCUSSION

Trimalleolar fractures are often a result of twisting injuries associated commonly with soft tissue and ligamentous injuries which have led to the prime importance being given to post operative rehabilitation and physiotherapy even after satisfactory anatomical surgical fixation. The high incidence of subtalar arthritis stiffness and mal-union of fractures have led to abolition of conservative treatment in modern trauma care. Our study consists of 35 cases of closed trimalleolar ankle fractures.

Stress radiographs are useful to assess ankle instability. Schonk et al [7] suggested that gravity stress test was comfortable and more sensitive than manual stress test. Evaluation of deep deltoid ligament injury associated with ankle instability was assessed by stress radiographs which helped to differentiate SER2 injury from SER4 equivalent injury[8]. SER4 fractures are unstable and need syndesmotic stability [9]. In our study, manual stress or hook test was used to evaluate syndesmotic injury and in SER pattern, 17 out of 23 patients had good to excellent functional outcome. Among three patients who had dislocations with SER type of trimalleolar fracture, two had good outcome due to early closed reduction of ankle joint followed by open reduction and internal fixation of malleoli. In another patient with dislocation, who had reported late (3 days after trauma), we had fair outcome indicating the importance of early reduction of ankle dislocation.

In cases of pronation- abduction injuries, studies by Ebraheims et al [10] stated the advantage of fixing medial malleoli first followed by fibula by plating or screw led to lesser incidence of non-union. However, there were no cases of nonunion and difference in outcome in our study where we fixed lateral malleolus first.

In pronation-external rotation injury, restoration of the fibular length and rotation, ankle mortise and syndesmotic stability are important factors as noted by Miller et al [12]. We had fairly good results in all five cases of pronation external rotation injury as we could maintain the syndesmotic stability and fibular length by a nail or fibular plating.

We assessed syndesmotic stability intraoperatively by cotton test or hook test. AO foundation stated that intraoperative cotton or hook test was important to assess the syndesmotic disruption & inturn ankle instability. Boden et al[13] suggested when rigid medial fixation was achieved, no syndesmotic stabilization was required. In absence of rigid medial fixation, if the height of the fibular fracture is more than 4.5 cm, the joint line syndesmotic stabilization is required. Even though Lauge-Hansen classification[3] describes in detail about the pattern of ankle fracture, it does not deal with syndesmotic injuries. According to Micheal Bekorom supination injuries/weber C are more commonly associated with syndesmotic injuries than pronation injuries/weber B. Our study also reflected similar incidence of syndesmotic injury among the various fracture patterns, as all 9 cases of syndesmotic injury belonged to supination injury pattern.

Patients with fixation of fibula with nails and malleolar screws had less satisfactory results than in those patients where we used a contoured reconstruction or one third tubular plate for fibular fixation. This might be due to the fact that contoured plates accommodated the valgus bend of fibula and provided sufficient stability to the fibular reduction. In a systematic review article [14] published in the Journal of Foot & Ankle Surgery (2015), the authors concluded that based upon the clinical and biomechanical studies, they identified the following three factors that would prognosticate ankle injuries outcome, namely, the presence of fracture-dislocation at the injury, articular surface congruity, and residual talar subluxation.

Hong et al[16] in 2013, evaluated the functional outcome and limitation of sporting activities after trimalleolar ankle fractures. At 1 year follow up, most of the patients gained good function and had good to excellent Olreud and Molander scores. However, out of the 47 patients, 26 (55.3%) had residual pain, 29 (61.7%) complained of stiffness and 21 (44.7%) had ankle swelling. Out of 33 (70.2%) patients who were involved in sporting activities prior to the ankle injury, 9 (27.3%) were able to return to pre injury level of sporting activities with no difficulties[17]. In our study on follow up at 6 weeks, 29 out of 35 patients had persistent swelling and/or residual pain, 25 patients had only residual pain and 20 patients had only persistent swelling. This is in concordance with a similar study done by Hong et al [16] in 2013 in which he reported residual pain, swelling and ankle stiffness as the most common complications at 1 year follow up. However, on 6 months follow up only 7 patients had residual pain and 8 patients had intermittent swelling.

In a study by Hafiz et al (2017) [17], subjective scoring outcome was excellent and good in 84% and objective scoring was good in 78.8% and poor in 4.2%. The results are comparable with our study that the subjective scoring of Olerud and Molander was excellent and good in 28 patients each (79.90%), fair in 6 patients and poor in 1 patients. The objective scoring of Olerud and Molander was good in 27 patients (77.4%), fair in 7 patients and poor in 1 patients (2.86%).

STUDY	**SUBJECTIVE SCORE**			**OBJECTIVE SCORE**		
	Excellent/Good	Fair	Poor	Good	Fair	Poor
Hafiz et al	84	9.2	6.8	78.8	17	4.2
Present Study	79.90	17.15	2.85	77.14	20	2.85

Limitations of the study: The results of this study may be limited by measurement error. The physical measurements may be subject to both, observer' s errors and patient variability. The study is also limited to patients having surgical fixation for their fracture. These results therefore, cannot necessarily be compared to the outcome achieved with non-operative management or other modalities of treatment.

Conflict of interest: NIL

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