

Pattern of Ankle Fractures And Assessment of Radiological Outcome of Surgically Treated Ankle Fractures

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I. Introduction

Till the middle of 18th century ankle injuries were described as either dislocation or subluxation. Only in mid-18th century, attempts were made to clarify malleolar fractures from dislocation. Experimental, surgical and clinical research were first carried out by English and French scientists.¹ Following the invention of X-Rays by Roentgen in 1895, the genesis, pathoanatomy, clinical diagnosis and classification have considerably changed.² Ankle fractures are one of the common the injuries treated by orthopedicians. The ankle joint is precisely aligned with little soft tissue coverage. Hence, severe injury combined with inadequate and inappropriate treatment can lead to severe complications and major disability.

Ankle joint is a weight-bearing joint, and is exposed to forces in excess of 1.25 times body weight with normal gait, and can even exceed 5.5 times body weight with vigorous activities. Normal gait requires dorsiflexion and plantar flexion along with inversion and eversion of foot as well as accommodation to rotational stresses. These are provided by the subtalar joint, whose function is linked closely with that of the ankle. The ankle is intrinsically unstable and requires support from the surrounding muscles.^{3,4,5}

Goal of management in fractures about the ankle is anatomic restoration of the joint. Open reduction and internal fixation is the standard treatment for unstable ankle fractures.⁶ However, very few studies have been done on the radiological outcome following operative treatment of ankle fractures. The purpose of this study is to analyze the causes and the patterns of ankle fractures as well as radiological outcome of surgically treated ankle fractures.

II. Materials And Methods

The present study was carried out in Father Muller Medical College, Mangalore, on 48 patients from June 2014 to February 2015, 3 patients were lost to follow up. The patients who fulfilled the below mentioned criteria was included in the study (n= 45).

Inclusion Criteria:

1. Cases of closed bimalleolar and trimalleolar ankle fractures
2. Skeletally mature patients above 18 years of age
3. Entire definite treatment done in our institution
4. Patients who comply with regular follow up for a period of at least 6 months

Exclusion criteria:

1. Children below 18 yrs.
2. Patients who lost to follow up.
3. Multiple trauma or other injuries.
4. Open fractures.
5. Neurovascular injuries.
6. Pathological fractures

Patients were initially evaluated clinically in emergency department, and a detailed history obtained. Appropriate radiological and laboratory investigations carried out. The fractures were classified as per Lauge-Hansen classification system.

Lauge Hansen⁷ described the universally accepted genetic classification is an end result of a sequence of bony and ligamentous failures which results from deforming forces leading to abnormal movement of talus in ankle mortise. He classified them as:

- I. Supination adduction injuries
- II. Supination external rotation injuries
- III. Pronation abduction injuries
- IV. Pronation external rotation injuries
- V. Pronation dorsiflexion injuries
- VI. Unclassified injuries

Initial management of the patient carried out (in way of reduction of associated ankle dislocation, fracture splinting and management of other injuries). Patient was investigated for operative and anesthesia purpose. Any associated medical problems were taken care before the operation. Preoperative counseling & informed consent of the patient and relatives regarding the operation and study were taken. Ethical committee clearance was taken prior to commencement of study. For bimalleolar fracture, the lateral malleolus is fixed first with one third tubular plate followed by medial malleolus using a cannulated cancellous screw with washer, which was inserted perpendicular to the fracture. Fracture of the posterior malleolus occurs rarely but when it does, it is located on the medial side. It is fixed from the posteromedial aspect after the medial malleolus has been stabilized by using one or two 4 mm AO cancellous screws. Intraoperatively patient was checked for syndesmotic injury and if present, a syndesmotic screw was placed.

Following stabilization of the fractures, the ankle is immobilized in well padded firm dressing incorporated with a posterior plaster splint that will hold the ankle at right angle and prevent any plantar flexion.⁸All patients underwent surgical fixation of the fractures and post operatively they were put on below knee (POP) slab. Post operative antibiotics were continued for 3 to 5 days depending on the presence of other injuries and signs of infection. Initial wound inspection was done on 3rd postoperative day and subsequent inspections on 6th post op day and staple removal on 11th day. The slab was continued till suture removal after which the patients were advised dorsiflexion and plantarflexion exercises. Once pain free, patient was trained in non-weight bearing crutch walking. Full weight bearing was permitted based on radiological evidence of callus formation and clinical evaluation.

The patients were further reviewed at three months and 6 months postoperatively and subjective assessment of the patient's ankles were done using radiographs and graded accordingly

Assessment of results of radiological outcome of surgically treated ankle fractures was done using subjective assessment and the values taken as

Grade I = Anatomical disruption with arthritic changes;

Grade II = Near anatomic with arthritic changes;

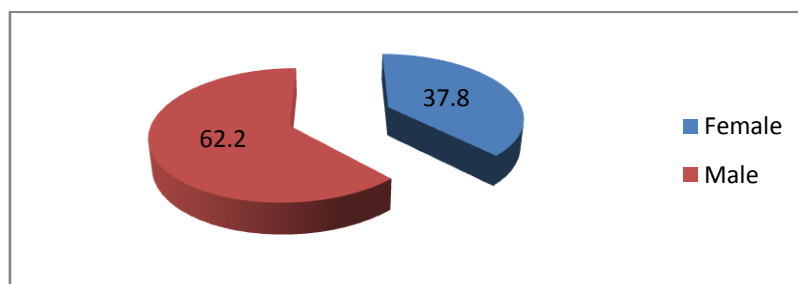
Grade III = Near anatomic with no arthritic changes.

Grade IV = Anatomic restoration with no arthritis.

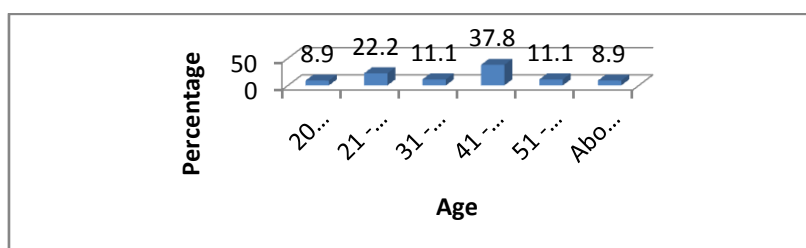
III. Results

Out of 45 cases 62.2% were male and remaining patients were female (Figure 1). Most common age group was 41-50 year age group (37.8%) (Figure 2) followed by 21-30 years (22.2%). Right side was predominantly injured with 26 cases 57.8% followed by left 18 cases 40% and 1 case was bilateral involvement 2.2% (Table 1). Majority of the cases were injured due to either road traffic accident (RTA) or were of fall at home 18 cases each (Table 2 & Figure 3).

The most common pattern as per Lauge And Hansen types (based on X-Rays) was found to be supination external rotation 17 cases (37.8%) followed by supination adduction and Pronation external rotation – 10 cases each (22.2%) (Table 3 & Figure 4)



Demographic pattern - Figure No. 1
Range : 17 – 73 years; mean age : 41.47 ± 14.43 years



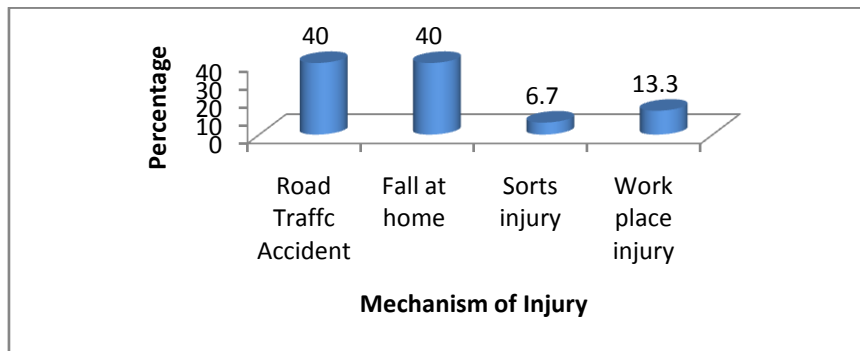
Fracture distribution based on Age - Figure No. 2

		Frequency	Percent
	Left	18	40.0
	Right	26	57.8
	Bilateral	1	2.2
	Total	45	100.0

Side of involvement - Table No. 1

		Frequency	Percent
	1	18	40.0
	2	18	40.0
	3	3	6.7
	4	6	13.3
	Total	45	100.0

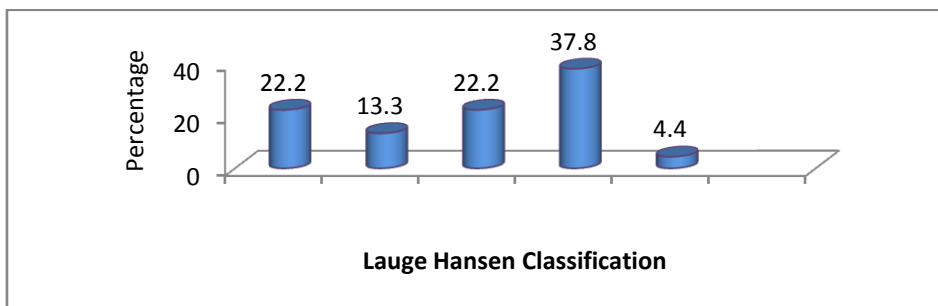
Mechanism of injury - Table No. 2



Mechanism of injury - Figure No. 3

		Frequency	Percent
	1	10	22.2
	2	6	13.3
	3	10	22.2
	4	17	37.8
	5	2	4.4
	Total	45	100.0

Lauge and Hansen types (based on x-rays) - Table No. 3



Lauge and Hansen types (based on x-rays) - Figure No.4

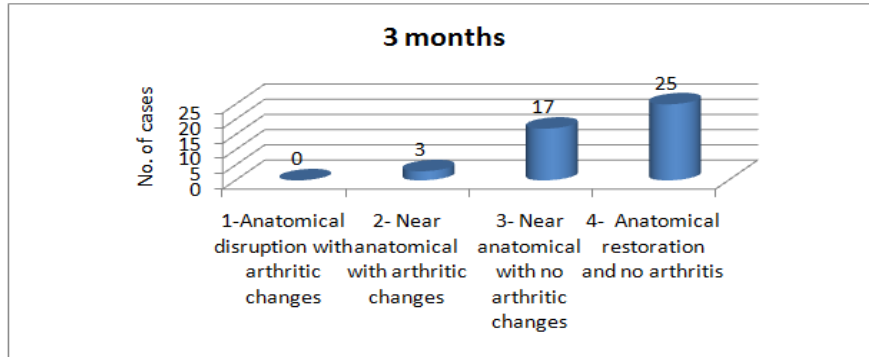
		6mradio				Total
		1	2	3	4	
3mradio	2	0	1	2	0	3
		.0%	33.3%	66.7%	.0%	100.0%
	3	1	3	13	0	17
		5.9%	17.6%	76.5%	.0%	100.0%
	4	0	0	1	24	25
		.0%	.0%	4.0%	96.0%	100.0%
Total		1	4	16	24	45
		2.2%	8.9%	35.6%	53.3%	100.0%

Subjective radiographic assessment at 3 months and 6 months post-op - Table No. 4

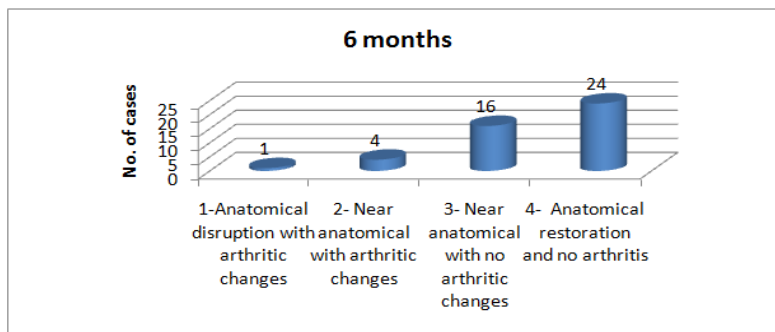
6mradio - 3mradio		
Wilcoxon signed rank test z value	p	
1.26	.206	> 0.05, NS

Table No. 5

No significant improvement in the radiographic assessment from 3rd month to 6th month post-op.



Radiographic assessment from 3rd month to 6th month post-op - Figure No. 5



Radiographic assessment at 6th month post-op - Figure No.6

Subjective radiographic assessment failed to show any statistically significant improvement from 3 months post-op to 6 months post-op. (figure5,6 & table4,5).

IV. Discussion

The aim of operative treatment for fractures of the ankle is to allow early movement after stable internal fixation. In this prospective, randomized study we have used subjective method to assess the radiological outcome of the operative treatment of these injuries.

The study consisted of 45 patients aged between 17-73 years, of which 17 were females and 28 were males. Eighteen patients had left ankle fracture, twenty-six had right ankle fracture, whereas one patient had bilateral involvement. The most common mode of injury was road traffic accidents.

Eight patients had local wounds in the form of abrasions and lacerations. Skin condition was not found to be good in 5 patients. The most common injury pattern seen was supination external rotation followed by supination adduction and pronation external rotation.

The most common modality of fixation for the lateral malleolus was 1/3rd tubular plate, and for the medial malleolus was with 4 mm cannulated cancellous screws with washers. Syndesmotic screws were not used in any of the cases. Kortekangas et al in 2014 in their study compared the functional and radiologic results of syndesmotic transfixation with no fixation in supination external rotation ankle fractures and found no significant difference in functional outcome or radiologic findings after a minimum follow up of 4 years.⁹ The average duration of hospital stay was 13 days.

One patient was found to have loss of reduction, which was attributed to early weight bearing against medical advice. He went on to have a malunion of the fracture and had to undergo a corrective surgery. This is in concordance with a similar study done by Hong et.al in 2014 in which he reported residual pain, swelling and ankle stiffness as the most common complications at 1 year follow up¹⁰.

There was a statistically significant improvement in the subjective assessment of pain, walking, activity levels, ankle joint function and subtalar joint function from 3 months post-op to 6 months post-op. However

subjective radiographic assessment failed to show any statistically significant improvement from 3 months post-op to 6 months post-op.

The study had the following limitations: The study group was relatively small, with a shorter duration of follow up. Variations in surgical techniques and experience, fracture patterns, errors of measurement and patient adherence to postoperative mobilization regimens could not be accounted for in this study.

V. Conclusion

Ankle fractures are always a challenge for the orthopedicians. Stable fixation of the medial and lateral malleoli along with ankle joint reduction have been of paramount importance in ankle fractures. This study has failed to show any statistical significance in radiological improvement in fracture fixation, however pain, walking ability, activity levels and ankle and subtalar joint function has been remarkably improved in adequately fixed fractures. Thereby the fixation in ankle fractures has again proved to be a skillful necessity.

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