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Functional outcome of surgical treatment of displaced malleolar fractures

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Abstract
Introduction: Ankle fractures are the common type of fractures treated by the orthopaedic surgeons. There has been an increased prevalence of ankle fractures over the last two decades both in young patients and the elderly. 85% of these ankle injuries are ankle sprains and the remaining 15% are ankle fractures. Over all ankle fracture constitute 9% of fractures.
Material and Method: In this study 30 patients of diaplaced malleolar fractures were enrolled. Detailed history, examination and baseline investigations were carried out. Fractures were classified according to the Lauge-Hansen and Weber classification. Operated within 24 hrs or after 7-10 days after the swelling subsided. The standard techniques of approach to medial malleolus, lateral malleolus and posterior lip were followed. The fractures were fixed using screws, plates and wires as and where ever indicated. Post operatively the limb was elevated using 2 pillows overnight, routine post operative care and early exercises were started for all patients. All these patients were reviewed at 2 weeks, 6 weeks, 3 months and 6 months. Functional outcome was assessed using Olerud-Molander Ankle Score at 3 and 6 months.
Result: There was a significant improvement in the mean OMA which was used to assess functional outcome at 3 months and 6 months.
Conclusion: This study concludes that surgical modalities of treatment of displaced malleolar fractures offer better results and early weight bearing with minimal complications. Although a larger sample size would be helpful for futher validation.

Keywords: Functional outcome, surgical treatment, displaced malleolar

Introduction
The ankle joint is a complex hinge joint consisting of the distal part of the tibia and fibula which articulate with the body of talus [1]. Ankle fractures are the common type of fractures treated by the orthopaedic surgeons. There has been an increased prevalence of ankle fractures over the last two decades both in young patients and the elderly [2]. 85% of these ankle injuries are ankle sprains and the remaining 15% are ankle fractures. Over all ankle fracture constitute 9% of fractures and are the most common injuries involving articular surface of a weight bearing joint [1]. Common causes of ankle fracture are trauma (Especially motor vehicle accidents), sports injuries (i.e., football players), and osteoporosis in the elderly (Including postmenopausal women) [3]. Malleolar fractures range from an isolated distal fibular fracture with minimal displacement to a trimalleolar fracture with dislocation and vascular compromise [4]. The ultimate goal in the treatment of ankle fractures is to obtain an anatomic position of the ankle mortise and a stable, mobile, and painless ankle joint [5]. The best results are obtained by anatomical joint restoration; the method used to accomplish this may be either closed manipulation or open reduction and internal fixation [6]. Fractures that are considered stable can be treated conservatively in a plaster cast for a period of at least six weeks. Unstable fractures are treated surgically unless contraindicated by significant co-morbidities. Various operative treatment options available are tension band wires, malleolar or cancellous screws, lag screws, cerclage wires, plates and screws, intermedullary fixation with Rush nail [7]. This study aims to evaluate the functional outcome following operative treatment of ankle fractures.

Material and Method
The study was conducted in the Department of Orthopaedic Surgery, Shri Ram Murti Smarak

Institute of Medical Sciences, Bareilly from November 2016 to July 2018, on a total of 30 cases of malleolar fractures treated with different surgical fixation techniques, after obtaining approval from Hospital Ethics Committee.

Inclusion criteria

1. Patients of age> 18 years
2. Patient having any malleolar fracture of ankle joint.
3. Open fracture (Gustilo Anderson type 1)

Exclusion criteria

1. Open ankle fracture. (Gustilo Anderson type 2 and 3)
2. Patients with pathological fractures
3. Patients having undisplaced malleolar fractures.

All the patients were operated using the standard operative treatment protocols.

All these patients were reviewed at 2 weeks, 6 weeks, 3 months and 6 months. At each assessment we performed a clinical examination to check for suture line, swelling and radiological examination to check for radiological union. Final functional outcome was assessed at 3 months and 6 months using Modified Olerud-Molander Ankle Score.

Modified Olerud and Molander

Parameter	Degree	Score
1.Pain	None	25
	While walking on uneven surface	20
	While walking on even surface outdoors	10
	While walking indoors	05
	Constant and severe	0
2. Stiffness	None	10
	Stiffness	0
3.Swelling	None	10
	Only evenings	05
	Constant	0
4.Stair Climbing	No problems	10
	Impaired	05
	Impossible	0
5.Running	Possible	05
	Impossible	0
6.Jumping	Possible	05
	Impossible	0
7.Squatting	No problems	05
	Impossible	0
8.Supports	None	10
	Tapping, wrapping	05
	Stick or crutch	0
9.Work/ activities of daily life	Same as before injury	20
	Loss of tempo	15
	Change to simpler job/part time work	10
	Severely impaired work capacity	0

A score of 90 to 100 is considered Excellent; 70-89-Good; 50-69-Fair and less than 50 is considered poor.

Results

Patients had age ranging between 21 and 66 years. Majority of patients (33.3%) belonged to the 41-50 years age group. The average age was 40.50 yrs ± (12.84 SD).

The percentage of males was 83.3 as compared to only 16.7 females. It suggests that males more frequently sustain these injuries.

Swelling was moderate in 50%, mild in 30% and severe in 20%. It suggests that moderate swelling is more frequently in these injuries.

Most of the patients 46.7% were involved in slipping, 23.3% patients had motor accident, 20% patients sustained the injury following fall from height and 10% had direct violence.

According to type of fracture as per Lauge Hansen classification system. 46.7% patients had Supination Adduction injury followed by Supination-External Rotation injury 26.6.%, Pronation External Rotation 20%, and least being Pronation Abduction injuries 6.7%. (Table 1).

Table 1: Distribution of patients according to Lauge Hansen Classification

Type of Fracture	Number of Patients	Percentage
Pronation Abduction	2	6.7
Supination Adduction	14	46.7
Pronation – external rotation	6	20
Supination- external rotation	8	26.6
Total	30	100

According to type of fracture as per Weber classification system. 26.7% patients had Type B injury followed by Type C injury in 23.3%, unclassified 33.3% and least being Type A 16.7%. (Table 2)

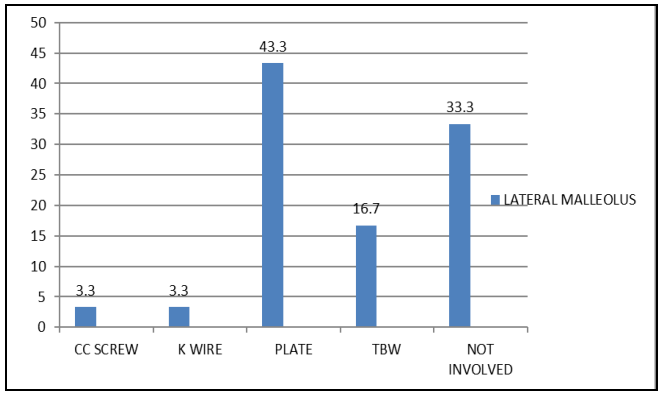
Table 2: Distribution of patients according to Weber classification.

Type of Fracture	Number of Patients	Percentage
Type A	5	16.7
Type B	8	26.7
Type C	7	23.3
Unclassified	10	33.3
Total	30	100

Majority of patients 17 (56.7%) had trauma to right lower extremity while 13 (43.3%) patients suffered trauma to left lower limb.

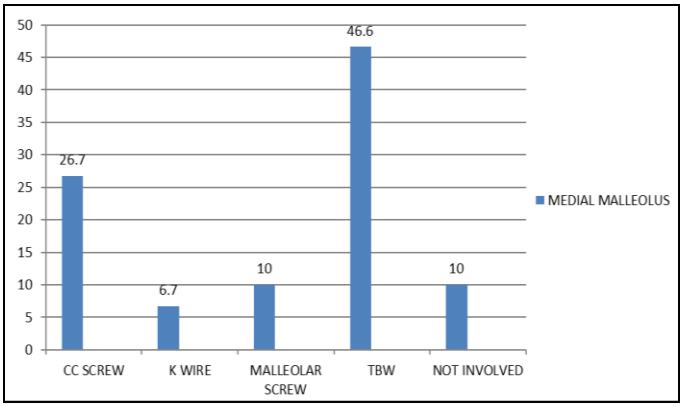
The duration between injury and surgery ranged from 1 to 10 days with most common being within 5 days in 46.7% patients. The mininmum interval for surgery was 1 day and maximum was 10 days.

A plethora of implants were used to fix lateral malleolus of which plating (Semi tubular) was used in 13 (43.3%) cases out of 30 followed by tension band wiring in 5 (16.7%), CC screw in 1(3.3%), Kwire in 1(3.3%). Out of the 30 cases, In 10 patients lateral malleolus was not involved. (Graph 1).



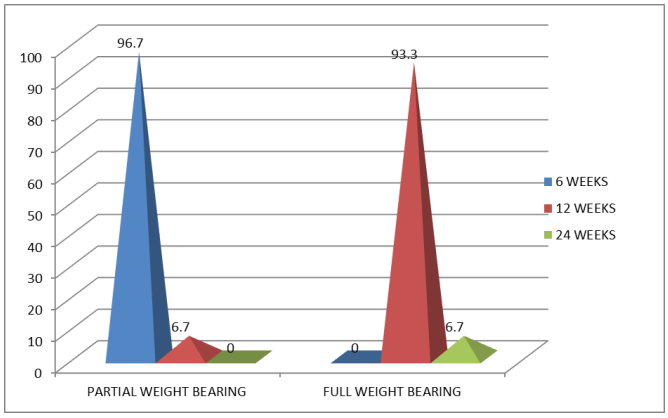
Graph 1: Implants used for fixation of Lateral Malleolus

For medial malleolus fixation tension band wiring was commonly used with 46.6% usage in 14 patients out of total 30 patients followed by CC screw in 8 patients (26.6%), malleolar screw in 3 patients (10%), k-wire in 2 patients (6.7 percent). Out of the 30 cases, in 3 patients medial malleolus was not involved. In Two cases CC screw was supplemented with k-wire. (Graph 2)



Graph 2: Implants used for fixation of Medial Malleolus

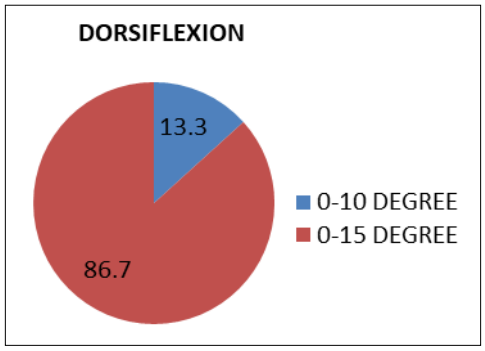
In our study out of 30 patients, partial weight bearing was started in 6th week in 28(93.3%) and in two patient in 12th week (6.7%). Mean partial weight bearing is (6.20 weeks ±1.52 SD) while full weight bearing was started in 12th week in 28(93.3%) and in 4 patients in 24th week (6.7%). Mean full weight bearing is (12.80 weeks ± 3.04, SD). (Graph 3)



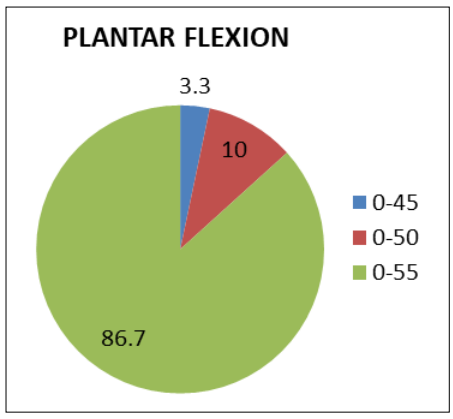
Graph 3: Partial and Full weight bearing at 6 weeks, 12 weeks and 24 weeks.

Radiological union was seen in 12th week in 28 (93.3%) and in 2 patients at 24th week (6.7%). Mean radiological union was (12.80 weeks ±3.04, SD).

At 6 months follow up, in 86.7% cases Dorsiflexion was 0-15 degree and 0-10 degree in13.3% and for Plantar-flexion range of motion was 0-55 degree in 86.7% followed by 0-50 degree in 10% and 0-45degree in 3.3%. (Graph 4 & 5)



Graph 4: Range of motion of Dorsi-Flexion



Graph 5: Range of motion of Plantar-Flexion

OMA score at the 3rd month was 50 in 33.3% patients followed by score 55 in 33.3%, score 65 in 13.3% and score 45 and 60 in 10% each. It was fair in 28 patients and poor in 2 patients.

At the 6th month 33.3% patients had OMA score 80 followed by score 85 in 26.7%, score 90 in 16.7%, score 65 in 10%, score 70 in 3.3% and score 75 in 3.3%. It was excellent in 7 patients and good in 20 patients and fair in 3 patients at 6th month. (Table 3 & 4)

Table 3: OMA score at 3 months

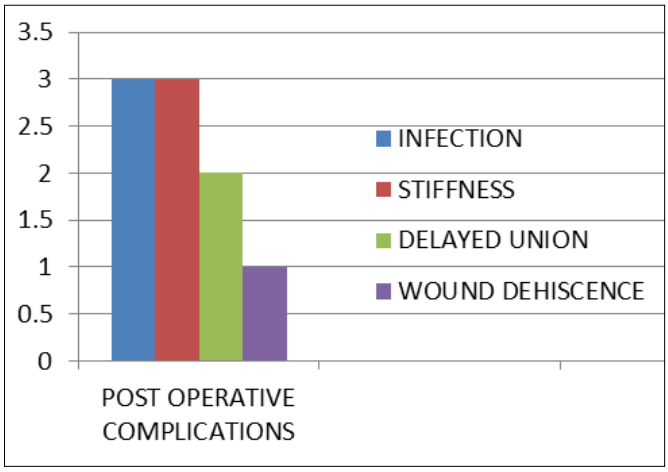
Oma Score At 3 Months	Number Of Patients	Percentage
45	3	10
50	10	33.3
55	10	33.3
60	3	10
65	4	13.3
Total	30	100

Table 4: OMA score at 6 months

Oma Score At 6 Months	Number Of Patients	Percentage
65	3	10
70	1	3.3
75	1	3.3
80	10	33.3
85	8	26.7
90	5	16.7
95	2	6.7
TOTAL	30	100

The mean OMA score at 3 month was 54.17 ± 5.88 and mean OMAS score at 6 month was 82.0 ± 7.94. There was significant correlation between 3 month and 6 month (p <0.001).

Out of 30 patients, post operative complications were seen in 9 patients and none in 20 patients. Infection in 3, Delayed union in 2 and stiffness in 3 and wound dehiscence in 1. (Graph 6).



Graph 6: Post-operative complications (n=9)

Clinical photographs

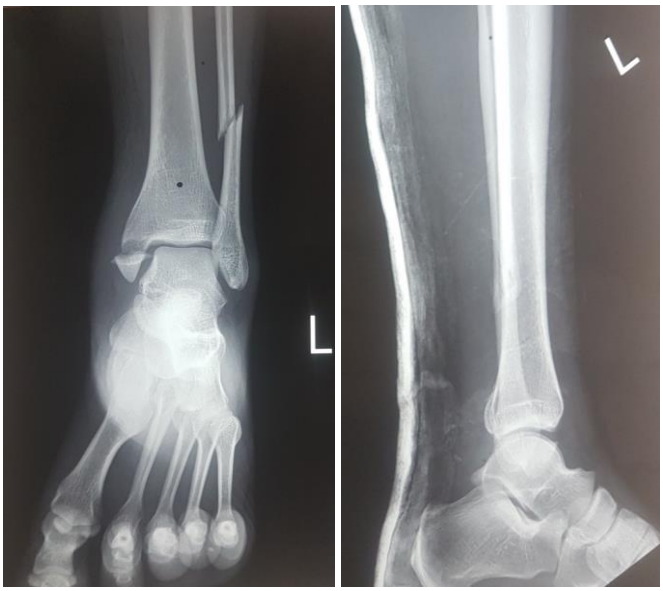


Photo 1: Pre- operative X-ray (AP and Lateral view)

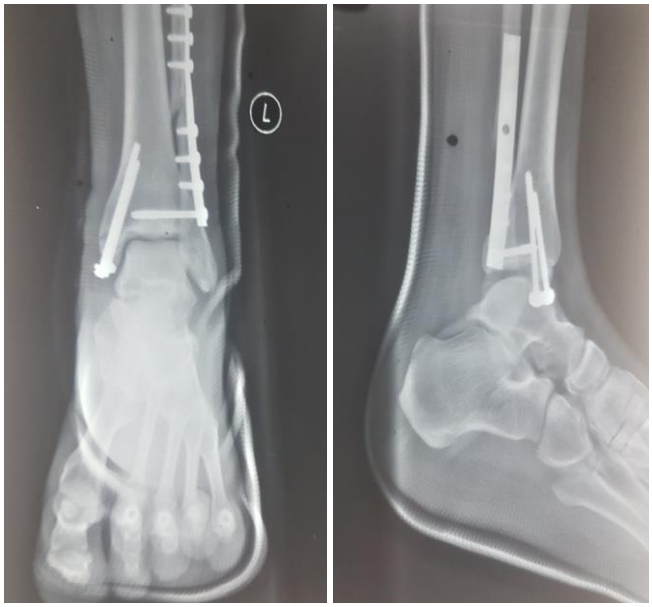


Photo 2: Immediate Post operative X-ray (AP and Lateral view)

Photo 3: X- ray after 3 months (AP and Lateral view)

Photo 4: Clinical photograph showing dorsi flexion and plantar flexion

Discussion

The mean age of cases with malleolar fractures in the study was 42 years which was comparable to other studies. Kenneth A. Egol *et al.* [8] in their study found the average age of 42 years. This reflects that malleolar fractures are more commonly seen in middle aged adults who are commonly involved in outdoor activities. Kumar P *et al.* [9] reported cases range from 18-65 years with an average age of 39 years in a study of 28 patients to which present study agreed with the youngest being 21 years and oldest being 66 years. Segal *et al.* [10] reported mean age was 47.3 ± 14.6 years which was compararable to present study which was 40.50 yrs ± 12. In present study the percentage of males was 83.3% as compared to only 16.7% females. These fractures exceedingly occurred in the male population 25 out of 30 cases seen in the male gender amounting 83.3% of the total cases comparable to Kenneth Egol *et al* [8] who also showed male predominance in their study. Nirmal tejwani *et al.* [11] 2007 reported 53% males and 47% female. Most of the cases 46.7% were involved in slipping followed by 20% cases sustained the injury following fall from height as compared to Court Brown *et al.* [12] in

which 58% of all ankle fractures are caused either by a twisting injury or a simple fall. Burwell N.H *et al*. [13] reported in a study of 135 cases who had sustained displaced fractures at ankle that 46% of total accounted for slipping and stumbling, 7% of direct violence and 15% of motor accident. Right side of lower extremity was involved in most of the cases 56.7% which were compared to 56% in Roberts *et al*. [14] In previous studies most commonly involved side was right as reported by Alexandro *et al*. [15] 73% and 65.1% in Makwana *et al*. [16]. Suppination adduction injury 46.7% was seen in most of the cases followed by Supination-external rotation injury 26.6.%, pronation external rotation 20%, and least being pronation abduction injuries 6.7%. Previous studies reported most common supination external rotation injury being 57.4% by YDE *et al*. [17], 63% by Michael J.*et al*. [18] and 26.6 percent as per present study. This pattern strengthens the fact that inter-observer variability exists while using Lauge-Hansen classification. In present study Weber Type B was the commonest fracture pattern seen in 26.7% cases as compared with 52% Court- Brown *et al*. [12] and 53.6% in Kumar P *et al*. [9] Kenneth Egol [8] reported 68% of Type B, 24% Type C and 8% Type A. Plating was the most common treatment for displaced lateral malleolus fracture being 43.3% which was similar to Ahmad Hafiz Z *et al* [3] reported 56.1% and Kulloli *et al* [2].

46.6% cases of medial malleolus fracture were treated with TBW followed by CC screw fixation in 26.6% cases which were compared to Kulloli *et al*. [2] with 25% screw fixation and 60% TBW and Burwell *et al*. [13] reported 88% of screw fixation. The mean partial weight bearing was 6.20 ± 1.52SD as compared to 6 weeks and the mean full weight bearing was 12.80 ± 3.04SD as compared to 8 weeks in Kumar P *et al*. [9] 2016. In present study the mean radiological union was 12.80 ± 3.04SD weeks as compared to 12 weeks reported by Alexandro *et al*. [15] and 3 months by Egol K *et al* [8].

There were 3 cases with infection, 3 cases of stiffness, 2 cases of delayed union and 1 case of wound dehiscence. Previous studies as reported by Tunturi *et al*. [19] there were 9 superficial infection, 2 local necrosis of skin and 1 redislocation.

Conclusion

In our study we treated 30 patients of malleolar fractures. It was concluded that majority of individuals belonged to 41-50 years age group. Males were most commonly observed to be affected. The lateral malleolus was fixed using the semi tubular plate followed by tension band wiring, C screw and K-wire in decreasing frequencies. The medial malleolus was fixed using the band wiring followed by CC screw, malleolar screw and K-wire in decreasing frequencies. The clinical outcome was evaluated by assessing the partial weight bearing which was started in 96.7% patients by 6th week and in 6.7% patients by the 12th week and also full weight bearing which was started in 93.3% patients by 12th week and in 6.7% by the 24th week. Most commonly OMA score was 50 in 33.3% patients by the end of 3rd month and 80 in 33.3% by the end of 6th month. The OMA score was excellent in 7 patients, good in 20 patients and fair in 3 patients at the end of 6 months. The radiological union was achieved in 93.3% (28 cases) by the 12th week while in only 2 patients it was seen at 24 weeks. Post operative complications were seen only in 9 patients. The complications seen were infection, delayed union, wound dehiscence and stiffness.

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