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Original Article

Pattern of Bimalleolar Ankle Fractures

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Abstract

Background:. To determine the pattern and outcome of bimalleolar ankle fractures .

Methods: In this prospective observational study of 72 patients with bimalleolar ankle fractures were included and were followed up for 12 weeks. The American Orthopaedic Foot and Ankle Score (AOFAS) and Visual Analog Pain Scale (VAS) were used to assess short term outcomes as at 12 weeks. The main outcome measures were pain, functional capacity and alignment.

Results: The patients' age ranged from 19 to 63 mean 36.4 ±10.4 years. The male to female ratio was 3:2. Falls caused 50% of the fractures, motor vehicle accidents 36.1% and motor cycle accidents 13.9%. Closed fractures accounted for 63.9% of the cases. The most common fractures based on the Weber classification were B and C which occurred in 33 (45.8%) and 31 (43.1%) patients, respectively. At 3 months, the mean AOFAS was 78.2. The VAS between 1 and 3 was 43.1%. Twenty eight patients (38.8%) had no pain. There was no difference in AOFAS and VAS between operative and non operative, open or closed Weber B fracture outcomes. The Weber C fractures managed operatively had a significantly lower AOFAS, 63 compared to non-operative cases who scored 84.3. Medial clear space greater than 4mm was associated with a poor outcome.

Conclusion: Patients mostly were young. Delay in definitive treatment of up to a week post-fracture does not seem to adversely affect the outcome. The main determinant of good outcome was the medial clear space that was less than 4mm.

Key Words: Bimalleolar fractures, Visual Analog Pain Scale (VAS), American Orthopaedic Foot and Ankle Score (AOFAS), Weber classification, outcome.

Introduction

Ankle fractures account for 10% of all fractures. Their incidence is projected to triple over the next 15 years. Bimalleolar fractures constitute 25% of all ankle fractures where on an average basis 12 patients with bimalleolar fractures are treated at District Head Quarter Hospital (DHQ), Rawalpindi every month. Bimalleolar fractures may be managed either operatively or non-operatively. The ankle joint is a synovial mortise and tenon joint variety, functionally uniaxial. The lower end of the tibia and its medial malleolus, together with the lateral malleolus of the fibula and the distal tibio-fibular syndesmosis, form a mortise for the body of the talus. Ankle stability is conferred mainly by the medial and lateral ligament complexes, the distal tibiofibular ligaments, the tendons crossing the joint, the bony contours and the capsular attachments.[1-2]

A bimalleolar fracture is a fracture of the distal tibia and fibula in which the medial malleolus of the distal tibia and the lateral malleolus of the distal fibula are fractured.[2-4]Bimalleolar ankle fractures disrupt the medial and lateral stabilizing structures of the ankle joint. These fractures are commonly caused by indirect rotational, translational and axial forces. These result in subluxation or dislocation of the talus out of the ankle mortise, usually associated with a fracture complex.[5] The standard ankle radiographs include the Anteroposterior (AP), mortise and lateral views.[6]

The number and incidence of low-trauma ankle fractures in above 60 years of age rose substantially in a 30 year old period: the total number of fractures increased from 369 in 1970 to 1545 in 2000(a 319% increase), and the crude incidence increased from 57 to 150(a 163% increase). It is estimated that there will be a threefold increase in these fractures by the year 2030.[2]Most ankle fractures are isolated malleolar fractures, accounting for two-thirds of fractures, with bimalleolar fractures occurring in 25% of patients and trimalleolar fractures in the remaining 5% to 10%.[3]

Patients and Methods

A prospective observational study of patients with bimalleolar ankle fractures was done at the Orthopaedics department of District Head Quarter Hospital (DHQ), Rawalpindi. It was conducted between January and December 2015. Inclusion criteria were all patients diagnosed to have isolated bimalleolar fractures on radiography and treated at District Head Quarter Hospital (DHQ), Rawalpindi within 3 weeks of injury. Weber A, B and C injuries

were included (Figure 1) Excluded were patients with Bilateral ankle injuries, Pre-existing ipsilateral or contralateral ankle pathology, Pathological fracture (e.g. a stress fracture), Refracture of a previous ankle fracture, Diabetes mellitus, neuropathic vascular disorders that may impair healing, Unimalleolar and trimalleolar fractures, Concurrent foot deformities, Inability to attend clinic for follow-up or inability to follow the postoperative regime, Refusal to give consent. Patients with isolated ankle injuries were identified and radiographs taken (at least the anteroposterior and lateral views) (Figure 2).

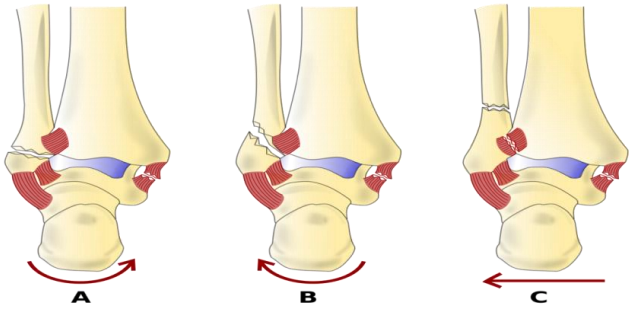

Figure 1: Weber Classification

Figure 2: Bimalleolar fracture and its open reduction internal fixation (ORIF)

Those with bimalleolar fractures were recruited into the study and followed up. Patients' bio data on age and sex were recorded on a pre-formed questionnaire. Fractures were classified as either Weber A, B or C (Figure-1). The patients were then followed-up and the modality of treatment documented, as they came for review in the fracture clinic. Assessment was done at 2, 6 and 12 weeks. The assessment at 2 weeks was for maintenance of reduction and surgical site infection (for ORIF group), at 6 weeks for clinical and radiological union, and at 12 weeks the Visual Analog Pain Scale (VAS) and American Orthopaedic Foot and Ankle Score (AOFAS) were administered and documented.

Results

The mean age of the adults presenting to District Head Quarter Hospital (DHQ)with bimalleolar fractures was 36.4 years (SD ±10.4) with an age range between 19 and 63 years (Table 1). The modal age group was between 19 and 29 years with this group accounting for 24 (33.8%) patients followed by patients aged between 30 and 39, n = 22 (31%). These 2 groups account for 64.8% of the patients. Most (42, 58.3%) bimalleolar fractures occurred in male patients. There were 30 (41.7%) female patients with bimalleolar fractures resulting in a male-to-female ratio of approximately 3:2. The right limb was involved in 62% of the patients. Closed fractures comprised 63.9% (n=46). The most common fractures were Weber B and C which occurred in 45.8% and 43.1% respectively. Most of the tibial fractures were transverse 58 (84.1%) while the fibular fractures were commonly of the oblique type, 50%.

Table 1: Bimalleolar ankle fractures- age distribution (n=72)

Age (years)	No(%)
19-29	24(33.8)
30-39	22(31.0)
40 – 60	26(35.2)

Table 2: Presentation of bimalleolar fractures by site and fracture type

	Frequency (n)	Percentage (%)
Fractured Limb		
Right	44	62
Left	27	38
Injury type		
Open	26	36.1
Closed	46	63.9
Weber classification of fracture		
A	8	11.1
B	33	45.8
C	31	43.1
Tibial fracture		
Transverse	58	84.1
Oblique	9	13
Comminuted	2	2.9
Fibular fracture		
Transverse	21	29.2
Oblique	36	50
Comminuted	15	20.8

Fall accounted for the most number of bimalleolar fractures (50%).Among the Weber A fractures, 1 was open, 7 closed, Weber B; 12 open and 21 closed, Weber C; 13 open and 18 closed. Of the 35 operatively managed fractures, 1 was Weber A, 18 Weber B and 16 Weber C (Table 2). Indications for operative management were; open fractures, displaced fractures (lateral displacement of more than 2mm) and dislocations. Superficial surgical site infection was found in 2 (5.7%) patients who were managed operatively (Table 3).

Table 3: Treatment and reassessment of patients with bimalleolar fracture

	Frequency	Percent
Treatment		
Operative	35	49
Non-operative	37	51
Surgical site infection (operative at 2 weeks)		
Yes	2	5.7
No	33	94.3
Clinical or radiologic union (at 6 weeks)		
Yes	70	97.2
No	2	2.8

Radiographs taken at 2 weeks showed a medial clear space greater than 4mm in 6(8.3%) patients. Three had been managed operatively. One was Weber B and the other 5 Weber C. There were no patients reporting severe pain (VAS score ≥7).Most patients reported mild levels of pain represented by scores between 1 and 3 (43.1%). Twenty eight patients (38.8%) scored pain at 0 and the remaining 18.1% of patients reported moderate pain (VAS scores 4-6). There were no significant differences in the patients reported level of pain on VAS and type of treatment (p = 0.759), time since treatment (p = 0.535), type of injury (p = 0.405) or Weber classification of fracture (p = 0.478). Most 56 (84.8%) patients with medial clear space of 0-4 mm reported VAS < 3 compared to 50% of patients with medial clear space > 4 mm who similarly reported VAS < 3 (p = 0.034). The mean AOFAS score for patients with bimalleolar fractures at DHQ was 78.2 (SD ± 20.7), range 17 to 100. The mean AOFAS for Weber A, B and C were 96.6, 80.3 and 72.9 respectively (Table 4). There were significant differences in mean AOFAS score for patients on the operative compared to non-operative treatment (p = 0.001) and patients with open compared to closed injury (p = 0.002). The AOFAS score was significantly related with patient level of education (p = 0.03) but not with age (p = 0.790) or sex (p = 0.111) (Table 5).

Table 4: Mean AOFAS scores according to type of injury and treatment

	Mean	SD	ANOVA F	P value
Type of treatment				
Operative	69.6	20.6	12.28	0.001
Non-operative	85.6	17.5		
Time to treatment				
<48 hrs	77.0	20.7	0.12	0.891
<7 days	81.7	15.6		
>7 days	77.7	21.8		
Type of injury				
Open	68.3	21.1	10.65	0.002
Closed	83.8	18.4		
Weber classification of fracture				
A	90.6	12.9	2.77	0.070
B	80.3	21.2		
C	72.9	20.5		

Table 5: Comparison of clinical AOFAS and VAS pain scores and clinical outcomes according to Weber classification

	Clinical / radiologic union, n (%)	Median VAS	Mean AOFAS	P*
	6 weeks	12 weeks	12 weeks	
Injury type				
Open (n = 26)				
Weber A (n = 1)	1 (100%)	-	-	
Weber B (n = 12)	12 (100%)	2	68.3	
Weber C (n = 13)	13 (100%)	3	66.3	0.821
Closed (n = 42)				
Weber A (n =7)	6 (86%)	1	90	
Weber B (n = 21)	21 (100%)	0	87.1	
Weber C (n = 18)	17 (94%)	2	77.6	0.121
Medial clear space				
Space <4 (n = 66)	64 (97%)	2	80.2	
Space >4 (n = 6)	6 (100%)	3.5	57.2	0.008
Treatment				
Operative (n = 35)				
Weber A (n = 1)	1 (100%)	-	-	
Weber B (n = 18)	18 (100%)	2	74.1	
Weber C (n = 16)	16 (100%)	3	63	0.117
Non operative (n = 37)				
Weber A (n = 7)	6 (86%)	1	90	
Weber B (n = 15)	15 (100%)	0	87.7	
Weber C (n = 15)	14 (93%)	1	83.4	0.523
* comparison of Weber B versus C				

ANOVA analysis showed that patients with secondary level education on average had an AOFAS score that was15.5 points higher compared to those with primary education ($p = 0.03$) corresponding to less pain in patients with primary compared to secondary education. The scores for secondary and tertiary levels did not differ ($p = 0.435$).

There was no significant difference between open and closed, or operative and non operative Weber B fractures. Operatively managed Weber C fractures had a significantly lower score than conservatively managed fractures at 63 and 84.3 respectively. The AOFAS score did not show any significant clinical or radiologic union, physiotherapy ($p = 0.052$), medial clear space ($p > 0.99$), surgical site infection or time of surgery.

Discussion

Majority of the patients were young patients under 40 years with a slight male predominance. Fifty percent of the fractures were caused by RTAs while the other 50% was by falls. African studies showed a predominance of RTAs as the main cause of the fractures majority of them being men as opposed to Caucasian studies where the majority were caused by falls and were predominantly women. [7-14] It was consistent with a Nigerian study that had RTAs causing 46.3% of the ankle fractures and a South African study that had falls causing 53% of the injuries. Road traffic injuries are common in 3rd world countries due to, social inequality, vulnerable road pedestrians, cyclists, bus and minibus passengers.[11,13,14]

Open fractures were 26 (36%), this was higher than the Caucasian studies where open bimalleolar fractures were lower than 5%.[15] This may be related to the aetiology of the fractures where in the Caucasian population most ankle fractures were caused by falls which are low energy as opposed to the Pakistani population where the fractures were due to high energy trauma.

Weber B fractures were the most common (45.8%) which was comparable to other results by Hughes, Reuwer and Schweiberer.[16,17]Forty nine percent of the patients were managed operatively. These were patients who had displaced Weber B and C injuries and also open fractures. There was no significant difference in the AOFAS score between the operative and non operative Weber B fractures. However the operative Weber C bimalleolar fractures had a significant lower AOFAS score than the non operative Weber C fractures. The low operative AOFAS score may be as a result of the severity of the injury or syndesmotic injury, rather than the operative treatment. Operatively managed fractures were likely to be severe ankle injuries that were displaced and comminuted. Sixty one percent had the definitive treatment done after a week. The causes of delayed treatment were; late presentation to the hospital due financial or infrastructure constraints, septic openfractures, blistering, swelling and theatre space unavailability. There was no significant difference between early and late treatment of bimalleolar fractures. These findings were similar to those of Breederveld who found no difference in outcome on patients who had delayed treatment up to 8 days.[24] Konvath also found no difference in outcome between early (mean 1.5 days from injury to surgery) and late (mean of 13.6 days from injury to surgery) treatments of bimalleolar fractures. [23] The longest duration was 11 days due to lack of theatre space. Early surgery is recommended to reduce the hospital stay and cost to the patient, however if there is swelling or blistering treatment should be delayed until it subsides.[20,21] There was mild to moderate pain in 61.2% of the patients. Previous studies report pain at 23%-60% at one year.[18,19]

The pain incidence was higher in this study because it has a short duration of follow up. It is expected to reduce with time. Patients with a medial clear space >4mm had a poorer VAS than the well reduced fractures which was similar to the Clement et al study.[22]

The functional capacity was reduced by a high medial clear space, operative management and physiotherapy. Previous studies show either a better outcome with operative treatment or similar outcome between operative and non-operative treatment.[22-26] Makwana's study showed a better functional capacity in the non operative group although there was no difference between the two groups overall outcome.[23,27]Most of the above studies were on the elderly majority of whom had low energy trauma. Majority of the patients in this study were young, the patients who underwent surgery were likely to have had high energy injuries with displacement and syndesmotic injuries. The open fractures were managed operatively which were associated with a lower AOFAS score. Only 23.6% of patients had physiotherapy, yet these patients had reduced functional capacity. These are likely to be those who had severe injuries and therefore functional impairment was anticipated and therefore needed physiotherapy. Majority of the patients had a basic and secondary level of education; these are likely to be

low income earners, who walk for long distances. This may explain why the functional outcome was good despite not having physiotherapy.

Conclusion

1.Patients presenting were mostly young.
2.Delay in definitive treatment of up to a week post-fracture does not seem to adversely affect outcomes despite poorly supervised physiotherapy.
3.The main determinant of good outcome was the medial clear space, if it was less than 4mm.

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