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Clinical study of ankle fractures and role of fibula fixation

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Abstract
The objective of this study was to classify the different clinical scenarios in ankle fractures, looking at their mechanism of injury, relevant to the mode of treatment and to determine the functional outcome and role of fixation of the fibula. Out of forty patients treated, overall good to excellent results were obtained in 36 patients. The results were fair and poor in two patients each. There were no intraoperative complications. The only postoperative complication seen was superficial skin infection in eight patients.

Keywords: Ankle injuries, ankle surgery, bone screws, fractures, complications

Introduction
Ankle joint is a modified hinge joint which plays an important role in locomotion. It is a stable joint with strong medial but weak lateral ligaments, making it vulnerable for fractures instead of dislocations. Sir Robert Jones opined that the ankle is the most injured joint of the body, but least well treated. Lambert demonstrated that the fibula has weight bearing functions; carrying $1/6^{th}$ of the load applied to the knee joint. The fibula has also been shown to contribute to the biomechanical stability of the ankle mortise during gait. Close *et al.* reported increase in intermalleolar distance by 1.5mm and lateral rotation of the fibula by 2.5 degree during dorsiflexion. Scranton *et al.* demonstrated that fibula descends approximately 2.4mm during stance phase of gait. This deepening of the mortise during dorsiflexion acts to create a stable position of the ankle in the toe of phase of gait. Fibula acts as the stabilizer of the ankle in all planes.Fixation of the fibula is more important in segmental comminuted fracture of the tibia and when there is bone loss. The mechanism of injury is variable for each type of ankle fracture. The treatment requires high level of precision. Complications like joint stiffness and osteoarthiritis are because of incorrect management. Treatment varies from manipulation and closed reduction to open reduction and internal fixation with various implants. The results of open reduction and internal fixation were superior to closed reduction. The purpose of this study was to assess the clinical picture, functional outcome and role of fibula fixation in ankle fractures. The primary aim of this study was to classify different ankle fractures, their mechanism of injury and its relevance to the mode of treatment. The secondary aim was to determine the functional outcome and role of fibula fixation in ankle fractures. The results from a consecutive series of 40 patients followed for an average period of 1 year that was classified according to Lauge Hansens [1, 2] classification and treated according to the AO [3] system are presented. Assessment of the outcome were done using the scoring system of Baird and Jackson based upon subjective, objective and radiological criteria and the American Orthopedic Foot and Ankle Society ankle-hind foot score (AOFAS).The scores were graded from A to E and composite scores were calculated. All the cases were followed and evaluated until the fractures united.

Results
All the fractures were followed until both clinical and radiographic union was achieved. All fractures united in 8 weeks. Majority of patients i.e. 18 (45%) were in the age group 31-40 years, followed by 14 (35%) patients in 21-30 age group. The mean age in our study was 34.8

years (range 21-77). Males sex predominated with 34 (90%) patients and 6 (10%) patients were females. Majority of the patients 18 (45%) were manual laborers and only 8 (20%) were professionals. The major cause of fracture in our study were road traffic accidents in 20 (50%) patients and in 10 (25%) patients fracture was due to slipping and stumbling. The rest 10 (25%) patients had fractures due to other causes. Right ankle was involved in 28 (70%) patients and in 12 (30%) patients left ankle was involved.

According to Lauge and Hansens [1, 2] (Table 1) classification, 16 (40%) patients had supination external rotation injuries, 10 (25%) patients having pronation abduction, 8(20%) supination adduction, and the remaining 4(10%) had pronation external rotation and 2 (5%) patients had pronation dorsiflexion. type of injury. As per Denis Weber[4] classification majority of patients had Denis Weber[4] type B fractures 26 (65%) followed by type A in 8 (20%) patients and least was type C in 6 (15%) patients. In the present study 20 (50%) were bimalleolar fracture 14 (35%) were trimalleolar fracture and 6 (15%) were unimalleolar fractures. Average duration between trauma and surgery was 4 days (range 2-5) days in our series and average duration of surgery was 1 hour. Choice of implant varied according to surgeon and fracture pattern. There were total of 38 lateral malleolar fractures and majority 26 (68.3%) were fixed with 1/3rd semitubular plate. Tension band wiring was done in 8 (21%) cases. In our series there were 36 cases with medial malleolar fractures, tension band wiring was done in 14 (39%) of cases. In 22 (61%) case 4.5 mm cancellous screws were used. Posterior malleolifractures (4 cases) were fixed with lag screws. Post operatively ankle was splinted for 3 to 4 weeks followed by range of motion exercises and partial weight bearing at 6 weeks when fractures shows signs of healing and full weight bearing was allowed at 12 weeks. 8 patients had superficial skin infection which healed by 2 weeks. There were no other complications. In this series 24 (60%) patients had no pain and 14 (35%) patients had grade B i.e. pain with strenuous activities, only two patient had mild pain with activities of daily living. No patients had clinical instability.

Majority 38 (95%) patients could walk desired distances without limp or pain and two patient were able to walk the desired distance with slight pain.30 patients were able to run desired distances without pain, 6 (15%) patients were able to run desired distances with slight pain and 4 (10%) patients had moderate restriction in ability to run with mild pain. In our series 36 (90%) patients were able to perform usual occupation without restriction and the rest 4 (10%) patients were able to perform usual occupation with restriction in some strenuous activities. In this series 22 (55%) patients had range of motion of the ankle within 10° of uninjured ankle and 14 (35%) patients were having motion within 15° of uninjured ankle. The rest 4 (10%) patients had motion with in 20° of uninjured ankle. In the present study of 40 patients with ankle fractures treated by open reduction and internal fixation, excellent results were achieved in 26 (65%) patients, good in 10 (25%), Fair in 2 (5%) and Poor in 2 (5%) patient. Excellent results were observed in all isolated lateral malleolar and bimalleolar fractures. Two (14%) patient with trimalleolar fracture had poor to fair results. The patient with the poor result had mild pain with activities of daily living, diminution in the abilities to run and to do work due to reduced motion of the ankle and narrowing of joint space.

Table 1: Type of Injury as Determined BY Lauge Hansen Classification

Type	No. of patients	Percentage
Supination adduction	4	20
Supination external rotation	16	40
Pronation abduction	10	25
Pronation external rotation	2	10
Pronation dorsiflexion	1	5

Table 2: Final Score According To Subjective Objective and Radiological Criteria (Jackson and Baird)

Category			Grade (No. of patients)			
	A	B	C	D	E	Total
Pain	26	12	2	-	-	40
Stability	40	-	-	-	-	40
Walking	38	2	-	-	-	40
Running	30	8	2	-	-	40
Work	36	4	-	-	-	40
Motion	22	14	4	-	-	40
Radiographs	38	-	2	-	-	40

Excellent score 96-100, good 91-95, fair 81-90 and poor 0-90

Table 3: Final Score According To the American Orthopedic Foot and Ankle Score (Aofas) For Fibula Fixation

Category			Grade (No. of patients)			
	A	B	C	D	E	Total
Pain	26	12	2	-	-	40
Function	36	4	-	-	-	40
Maximum walking distance	36	4	-	-	-	40
Gait abnormality	34	6	-	-	-	40
Walking surfaces	34	6	-	-	-	40
Footwear requirments	26	14	-	-	-	40
Alignments	32	8	-	-	-	40

Based on pain, function and alignment

Discussion

Better understanding of ankle fractures decreases morbidity and improves functional outcome. Anatomical reduction and stable fixation [1, 2] is a prerequisite to good functional outcome. This study supports these conclusions. In our series 65% patients achieved excellent results and 25% patients achieved good results and anatomical reduction of the lateral malleolus and talus radiologically The mean age in this study was 34.8 years and road traffic accident was the commonest mode of injury. This finding was similar to observation of Baird and Jackson [5], Roberts RS [8], Beris [13] *et al.* and Lee *et al.* [10] with male sex predominant.

Table 4: Type of Injury in Various Studies As Determined By Lauge Hansens Classification

Study	No.of patients	Most common type	Percentage
Roberts SR [8]	25	Supination external rotation	34
Baird and Jackson [5]	24	Supination external rotation	44
Beris, *et al.* [13]	144	Supination external rotation	-
Present study	28	Supination external rotation	45

Table 5: Final results of this study compared with other studies

Authors & years	Good to excellent	Fair	Poor
Burnwell & Charnley [6]	102 (77.3%)	22 (16.7%)	8 (6%)
Colton [7]	18 (70%)	4 (15%)	4 (15%)
Beris *et al.* [13]	105 (74.3%)	21 (14.6%)	16 (11.1%)
Desouza [9]	135 (90%)	9 (6%)	6 (4%)
Present study	36(90%)	2(5%)	2(5%)

The results in this study were compared with that of Burnwell and Charnley [6], Colton [7], DeSouza *et al.* [9], Beris *et al.* [2].
In Colton [7]. Series he found that eighteen (70%) of patients had good to excellent results. Burnwell and Charnley [6] in their series of 132 patients, 102 (77.3%) had good results, 16% had fair results and 6% patients were found to have a poor score.
Observation in this study support the contention of Yablon *et al.* [12] that lateral malleolus is the key to the anatomical reduction of bimalleolar fractures, because the displacement of the talus faithfully followed that of the lateral malleolus. Poor reduction of distal part of fibula would result in persistent lateral displacement or residual shortening. This does not necessarily lessen the importance of the medial malleolus in contributing to the congruity of medial aspect of ankle. The patient who had poor result did not have anatomical reduction of lateral malleolus.
The extent of skeletal involvement had a significant prognostic value in the outcome, where unimalleolar and bimalleolar fracture were associated with better result compared with trimalleolar fractures. The 4 (28%) patients with trimalleolar fracture were treated by fixing the posterior fragment. Posterior malleolar fragment was fixed with posterior lag screw in one case and by lagging the fragment from an anteriorly placed screw in another case. Out of 14 patients with posterior malleolar fractures 14% had excellent results. 71.4% of the patients who had trimalleolar fractures had good results and 14%had poor result. The decision of fixation was taken according to the assessment of the size of the posterior malleolar fragment.

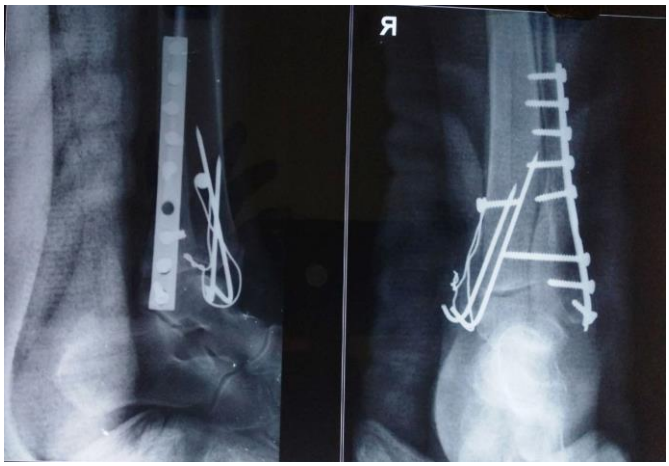
Conclusion

Type of fracture, severity of injury is inversely proportional to the final results obtained.
Plaster cast immobilization for 3 weeks did not diminish the ankle motion.

Limitation of study

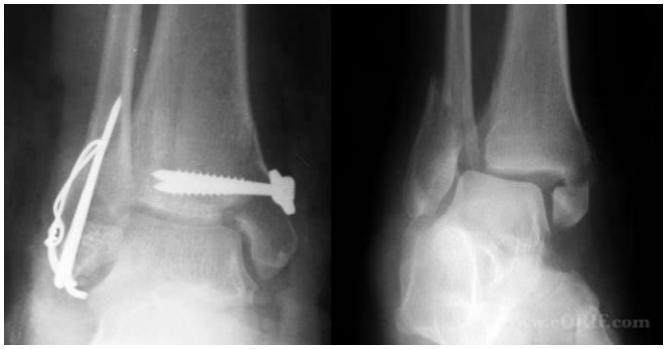
Small number, single institution study.

Case 1: post operative xray



Case 1: functional results

Case 2: Post-operative xray



Case 2: Functional results

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