

A Retrospective Evaluation of Operative Treatment of Ankle Fractures

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Abstract

Between 1990 and 1992, 89 patients with ankle fracture were treated by open reduction and internal fixation in accordance with the Arbeitsgemeinschaft fur Osteosynthesefragen (AO) principles and were available for evaluation with a mean follow-up period of 3.6 years (range 3 to 5 years). According to the AO classification, there were 21 type A, 37 type B and 31 type C fractures. The results were rated by the Olerud and Molander score. Excellent or good results were seen in 20 type A, 35 type B and 25 type C fractures. Fair or poor results in 1 type A, 2 type B and 6 type C fractures. Complications included screws in the joint in 2 cases and infection in 3 cases,

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Introduction

In displaced ankle fractures, the ankle mortise is often disrupted. Accurate reduction and restoration of the mortise is mandatory. It can sometimes be achieved and maintained non-operatively with manipulation and 6 to 12 weeks of immobilisation. However, prolonged immobilisation can lead to joint stiffness. Exact anatomical reduction and stable internal fixation in accordance with the AO principles is aimed at accurately restoring the ankle mortise and allowing early movement of the joint. We present our results of displaced ankle fractures treated by open reduction and internal fixation using the AO fracture classification¹ and the Olerud and Molander score.²

Materials and Methods

Between 1990 and 1992, 114 patients with ankle fracture were treated by open reduction and internal fixation in accordance with the AO principles. Twenty-two patients had left the country and 3 patients died, leaving 89 patients available for evaluation with a mean follow-up period of 3.6 years (range 3 to 5 years). There were 60 male and 29 female patients. The median age at injury was 32 years (range 13 to 75 years). Sixty-one patients were less than 40 years old. The causes of injury included road traffic accident in 27 patients, trip and fall in 23, industrial accident in 22 and sports accident in 17. Associated injuries included femoral fracture in 3

patients, metatarsal fracture in 2, radius and ulnar fractures in 1 and calcaneal fracture in one. The right ankle was affected in 49 patients and the left in 40. The fractures were classified using the AO classification¹ into 21 type A (6 A1; 14 A2; 1 A3), 37 type B (2 B1; 32 B2; 3 B3) and 31 type C (29 C1; 2 C2) fractures. Isolated medial malleolar fractures were excluded from the study because they could not be classified by the AO classification. There were 6 cases of open fractures (Gustilo's classification: 3 grade I and 3 grade II, AO classification: 2 type B2 and 4 type C1). Operation was performed within 6 hours after injury in 34 fractures, 6 to 24 hours in 15, 24 to 48 hours in 26 and 48 hours to 15 days in 14. The reasons for operation being carried out after 48 hours were to control hypertension in 2 patients, to stabilise head injury in 2 patients and 10 patients sought traditional treatment first.

Operative Technique

The aim was to achieve exact anatomical reduction and rigid internal fixation according to the principles recommended by the AO group. General anaesthesia was used in 32 patients and spinal anaesthesia in 57 patients. A single dose of 1 g cephazoline was given intravenously at induction of anaesthesia for closed fractures. In 6 open fractures, intravenous cloxacillin 500 mg and gentamycin 80 mg were given at admission and continued for five days. The patient was positioned

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in a semilateral position with a sand bag placed under the buttock of the affected side. A tourniquet was applied at the thigh. The affected leg was cleaned from the knee to the toes and draped. The leg was elevated for a minute and the tourniquet was inflated.

Lateral Side

A lateral incision was used. The fracture was reduced after the fracture site was cleaned and cleared of haematoma and soft tissues. Eight type A transverse avulsion fractures were fixed with tension band wire. The other 81 fractures were fixed with one-third tubular plate. The plate was bent and twisted to conform to the contour of the fibula so that 2 or 3 screws were holding the distal fragment. In 32 spiral and oblique fractures, an interfragmentary screw was also used.

Medial Side

Eight ankles had no medial malleolar fracture or torn deltoid ligament. In the other 81 ankles with the above injuries, an anteromedial incision was used. Torn deltoid ligaments were present in 5 ankles and repaired with 3/0 interrupted Vicryl sutures. Seventy-six ankles had associated medial malleolar fractures. Tension band wiring was used in 6 and two 4-mm cancellous screws were used in 70 ankles.

Following restoration of the ankle mortise, the syndesmosis was stable in 78 cases (21 type A, 37 type B, and 20 type C). In 11 type C1 fractures, the fibula was temporarily secured to the tibia1 notch by a syndesmotic cortical screw for 6 weeks. Before weight bearing, the syndesmotic screw was removed.

In 4 ankles (1 type A3 and 3 type B3), there were avulsions of the posterior fragment from the tibia. In 3 ankles where more than 25% of the articular surface was involved, the fragment was fixed with a cortical screw passed anteroposteriorly through a stab wound over the lower end of the tibia.

Active range of ankle motion and non weight bearing

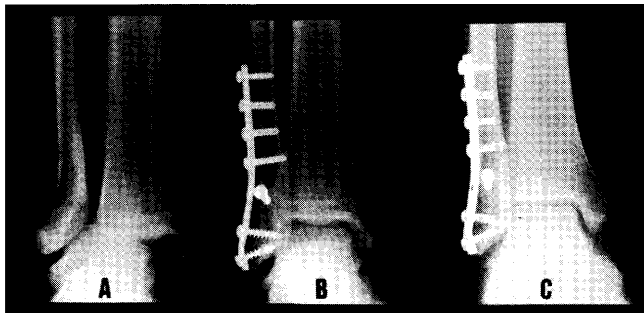


Fig. 1. A thirty year-old man sustained a type C1 fracture after a fall. Anteroposterior radiograph (A) showed a suprasyndesmotic diaphyseal spiral fracture of the fibula. The deltoid ligament was torn. Immediate postoperative radiograph (B) showed anatomical restoration of the ankle mortise. The fibular fracture was fixed with a one-third tubular plate and an interfragmentary screw. The deltoid ligament was repaired. The inferior tibiofibular joint was stable. At 39 months, the patient had excellent results and the radiograph (C) showed no sign of osteoarthritis.

ambulation with crutches or walking frame began on the first postoperative day. The average length of hospital stay was 7 days for closed fractures and 12 days for open fractures. Weight bearing ambulation began 6 weeks after operation.

At a mean follow-up of 3.6 years (range 3 to 5 years), the patients were reviewed by interview using a questionnaire and physical examination. Standard anteroposterior and lateral radiographs of the injured ankle were performed and compared with the preoperative and immediate postoperative radiographs (Fig. 1). The results were rated by the Olerud and Molander score (Table I).² Scores of 91 to 100 were graded as excellent results, 61 to 90 as good, 31 to 60 as fair and 0 to 30 as poor.

TABLE I: THE OLERUD AND MOLANDER SCORE

Parameter	Degree	Score	No. of patients
1. Pain	None	25	18
	While walking on uneven surface	20	62
	While walking on even surface outdoors	10	6
	While walking indoors	5	3
	Constant and severe	0	0
2. Stiffness	None	10	71
	Stiffness	0	18
3. Swelling	None	10	68
	Only evenings	5	15
	Constant	0	6
4. Stair-climbing	No problems	10	74
	Impaired	5	9
	Impossible	0	6
5. Running	Possible	5	65
	Impossible	0	24
6. Jumping	Possible	5	55
	Impossible	0	34
7. Squatting	No problems	5	75
	Impossible	0	14
8. Supports	None	10	70
	Taping, wrapping	5	18
	Stick or crutch	0	1
9. Work, activities of daily life	Same as before injury	20	76
	Loss of tempo	15	10
	Change to a simple job / part-time work	10	2
	Severely impaired work capacity	0	1

Results

Anatomical reduction was achieved in 86 ankles and poor reduction in 3 cases (2 type C1 and 1 type C2). The Olerud and Molander scores were summarised in Table I. Excellent or good results were seen in 20 type A, 35 type B and 25 type C fractures. Fair or poor results were seen in 1 type A, 2 type B and 6 type C fractures. Complications included screws in the joint in 2 cases

(type B2) and infection in 3 cases (1 type B2 and 2 type C1). The average time to fracture union was 8.2 weeks (range 6 to 10 weeks). The 3 cases of poor reduction and 3 cases of infection were associated with poor results. One ankle with poor reduction developed osteoarthritis.

Discussion

The significance of achieving anatomical reduction in the treatment of displaced ankle fractures has been recognised by various investigators.³⁻¹¹ However, the results are difficult to compare as classification systems are not universal.

We used the AO classification* in this study. This simple anatomical classification is based on the localisation of the fracture at the fibula and its relation to the tibio-fibular syndesmosis.

Anatomical restoration of the ankle mortise is mandatory. Lewis and Graham³ reported that arthrosis was related to incongruity of the ankle. Cedell⁴ proposed that the best objective would be to achieve anatomical reduction which is essential for optimal joint function and prevention of arthrosis. In fact, Muller et al⁵ found arthrosis in every case if accurate anatomical reduction was not achieved. Muller et al⁵ also suggested that anatomical reduction could not be expected in closed reduction as interposition of minor fragments and periosteal tissue occurred.

Full anatomical restoration of the lateral malleolus without widening of the ankle mortise and restoration of the distal tibio-fibular syndesmosis are essential. Ramsey and Hamilton showed that only a 1 mm displacement of lateral malleolus reduces tibio-talar contact area by 42%. Yablon et al⁷ concluded that the lateral malleolus was crucial in the anatomical reduction of the ankle joint. Fibular shortening disturbs the skeletal attachment of the lateral collateral ligament and results in instability. Mitchell et al⁸ believes that anatomical reduction of displaced fibular fractures is impossible by closed reduction. Burwell and Charnley⁹ reported that accurate reduction can be achieved and maintained, and the other advantages of open reduction and internal fixation include early active exercise preventing dense adhesions, evacuation of haemarthrosis, and possible early full weight bearing reducing disability and osteoporosis. Muller et al⁵ also advocated rigid fixation to provide immediate pain-free postoperative ankle exercises giving the patients the benefits of functionality after treatment.

Mitchell et al⁸ noticed that frequent interposition of fibrous tissue between fracture sites was likely to provoke pseudoarthrosis of medial malleolus even in only slightly displaced fractures. Hughes¹⁰ suggested that the strongest argument for fixing the medial malleolus

was the frequent finding of bony fragments within the joint in type B and C fractures. Klossner¹¹ reported that if a big posterior malleolar fragment (more than one-quarter of the distal tibia articular surface) was not fixed, it would result in early development of articular lipping and pain.

We reviewed our results of operative treatment of displaced ankle fracture using the Olerud and Molander score.² It was shown to correlate well with the patient's own subjective evaluation, range of motion in loaded dorsal extension, and presence of osteoarthritis and dislocation. Excellent or good results were seen in 80 ankles and all had anatomical reduction. Fair and poor results were seen in 9 fractures. Poor results were seen in 3 ankles with poor reduction and 3 cases of infection. Fair results were seen in 3 cases with anatomical reduction (1 had associated calcaneal fracture and two had no other reasons). Two ankles had a problem of screw in the ankle joint and required revision. They had good results. Routine intraoperative radiographs should be taken to prevent this complication.

Conclusion

The results of operative treatment of ankle fractures are presented. Anatomical reduction of the ankle mortise with regards to fibula, medial malleolus and posterior malleolus is essential. Excellent and good results were seen in 80 (89.9%) ankles. Three cases had poor reduction and were associated with poor outcome.

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