

Surgery for fracture of the calcaneus

5 (2–8) year follow-up of 20 cases

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20 displaced intraarticular fractures of the calcaneus were treated by open reduction and internal fixation. Results were evaluated according to a standardized protocol. With an average follow-up of 5 (2–8) years, results were excellent or good in 15 cases and fair or poor in 5 cases. An accurate radiographic study and CT scanning are essential for understanding these

fractures. We feel that restoring calcaneal shape as anatomic as possible, getting an appropriate reduction of the posterior joint surface by a surgical procedure with early mobilization, and delayed weight bearing would be a good option in treatment of these fractures.

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We present our results following open reduction and internal fixation for displaced intraarticular fractures of the calcaneus.

Patients and methods

From May 1983 to June 1990, 20 displaced intraarticular fractures of the calcaneus were treated by open reduction and internal fixation. 9 of the patients were males and 11 were females. The median age of the patients was 45 (19–66) years. 10 fractures had been sustained in a fall from a height, 6 were caused by traffic accidents and 4 as a result of accidental falls. The fractures were classified according to Essex-Lopresti: 13 cases were joint depression fractures and 7 had a tongue-type fracture (Table 1).

Plain radiographs in anteroposterior and lateral views of the foot and an axial film of the calcaneus were made. Brodén (1949) views were also carried out showing different planes of the subtalar joint. CT scans of the hindfoot were performed in coronal and transverse sections in order to see the posterior and middle facets and the calcaneocuboid joint, respectively. Using a CT scan classification (Sanders 1991), there were 9 Type II fractures, 6 Type III fractures and 1 Type IV fracture. In 4 cases CT scanning was not available.

The indications for surgical treatment were loss of congruence of the posterior subtalar joint with a variable degree of comminution and decrease in the Böhler angle. Fractures with great comminution were

also treated surgically trying to resolve severe deformities of the heel, notably widening, shortening and/or varus-valgus.

The operation was performed 10 (5–18) days after admission. We reduced the depressed articular fragments with elevators. Aided with a hook placed in front of the Achilles tendon, and coming down the posterior tuberosity, we restored the Böhler angle. We then compressed the calcaneus laterally with both hands. The obtained reduction was fixed with Kirschner wires and controlled with intraoperative fluoroscopic images. In Cases 5 and 11 we also made a medial approach as we failed to achieve an acceptable reduction of the medial wall.

For fixation we used a Sherman plate in 13 cases, cancellous screws in 2, and Kirschner wires in another 5, depending on fracture comminution and fixation of the device. When a plate was used, the screws were positioned towards the subchondral bone in the sustentaculum, posterior facet and calcaneocuboid area.

Bone grafts were not used to fill the defects after reduction. With manipulation, we tried to reduce the width of the body of the calcaneus, squeezing the fracture gap.

Postoperatively the leg was immobilized with plaster splints, and after 1 week a functional brace was applied, allowing partial weight bearing through the footrest, using crutches. When there was radiographic evidence of healing, usually after 8–14 weeks, full weight bearing with crutches was permitted.

The patients were followed with regular outpatient examinations, for a median of 5 (2–8) years after the injury. A standardized protocol based on Paley and Hall

Table 1. Observations in 20 patients with fracture of the calcaneus

Case	A	B	C	D	E	F	G	H	I	J
1	F	42	R	0	—	7	1	95	13	1
2	F	48	R	0	—	6	1	90	10	2
3	F	47	L	0	—	18	3	88	11	3
4	F	54	R	1	IIIC	6	3	81	11	4
5	M	36	L	0	—	11	1	78	11	2
6	F	38	L	1	IIA	8	1	72	13	1
7	F	29	R	1	IIB	7	1	72	14	2
8	M	66	R	0	IIIB	9	3	68	8	3
9	F	19	R	0	IIC	6	1	66	9	2
10	F	37	L	1	IIB	12	1	64	13	1
11	F	45	L	0	IIB	15	1	62	12	2
12	M	42	R	1	IV	7	3	58	12	3
13	F	50	L	1	IIIB	13	1	54	9	4
14	M	66	R	0	IIIC	11	2	48	9	2
15	M	44	R	0	IIA	7	1	40	10	1
16	M	46	L	0	IIIB	10	3	40	12	1
17	M	58	R	0	IIB	12	1	35	8	2
18	F	52	R	0	IIIB	7	2	30	13	1
19	M	38	L	1	IIA	10	1	28	14	2
20	M	58	R	0	IIA	15	1	24	12	1

A Sex	E Type of fracture (Sanders, 1991)	H Follow-up (months)
B Age at operation	F Timing of surgery (days)	I Weight bearing (months)
C Side	G Osteosynthesis	J Results
D Type of fracture (Essex-Lopresti, 1952)	1 Sherman plate	1 Excellent
0 Joint depression	2 Cancellous screws	2 Good
1 Tongue-type	3 Kirschner wires	3 Fair
		4 Poor

(1989) was modified by us, taking into account pain, work and sports activity, walking ability, distance and aids, limp and range of motion of ankle and subtalar joints.

Results

We had no complications such as wound dehiscence or infection. 3 patients complained of peroneal impingement which was resolved after removal of the osteosynthesis material. Radiographic consolidation took place after 10-16 weeks. There were no non-unions. Case 3 developed a malunion in valgus. Excellent results were obtained in 7 cases, good in 8, fair in 3, and poor in 2 (Table 1).

15 patients returned to the same job, while 4 patients changed to a less strenuous job and 1 patient did not work. 6 patients had pain while walking or standing after healing, but all of them resolved 1 year after surgery.

In the 3 patients with fair results we had used Kirschner wires due to great comminution. 1 of them had a traffic accident and also suffered ipsilateral fractures of the femur and the talus. Subtalar joint motion was less than 80 percent (compared with the opposite side) developing arthrosis of subtalar and calcaneocuboid joints. 2 patients with fair results had some prob-

lems with normal footwear.

One of the poor cases had a bad reduction, developing a gait with the foot in dorsal flexion because of pain, needing an arthrodesis later. The other poor result had no motion of the subtalar joint and occasional pain, walking with crutches for a long time; a triple arthrodesis was also done.

There were no calf muscle atrophy or ankle stiffness in our series, due, we think, to use of functional bracing. We did not find any correlation between patients' age (quality of bone) and the final results.

In most cases, we found a relation between anatomic reduction of the joint surface and restoration of the lateral wall, demonstrated by postoperative radiographs and CT scans (Figures 1-2) and final outcome. Subsequently, cases with great comminution (Types III and IV) had a more difficult fracture reduction and fixation, and showed worse results.

Discussion

Closed treatment of intraarticular fractures of the calcaneus with early motion and delayed weight bearing has been reported to give satisfactory results (Pozo et al. 1984), but residual pain secondary to incongruity of the subtalar joint and peroneal tendon impingement commonly persists.

Figure 1. Case 11. A 45-year-old woman sustained a calcaneal joint depression after a fall from a height.

Preoperative.

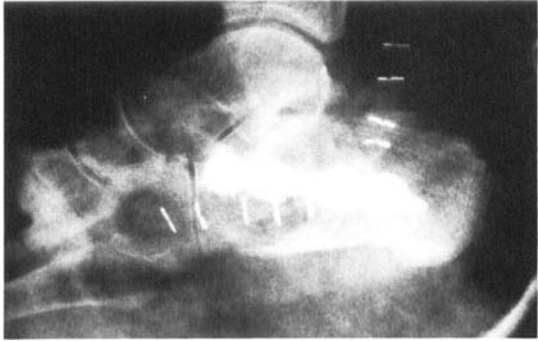


Type II B fracture.

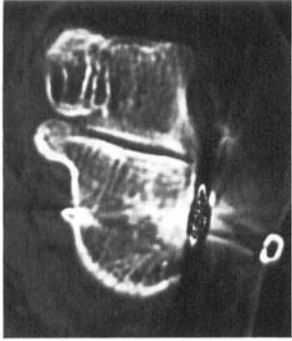


Disruption of the articular surface.

Postoperative.



Good reduction.



Restored articular surface and width of the calcaneus.

Figure 2. Case 15. A 44-year-old man with calcaneal joint-depression, avulsion of the posterior tuberosity and damage of the calcaneocuboid joint. At the 2-year follow-up the result was excellent.

Preoperative.



Type II A fracture.



Disruption of the articular surface.

Postoperative.



Good reduction.



Restored posterior joint surface and lateral wall of the calcaneus.

Essex-Lopresti (1952) described the mechanism of injury classifying displaced intraarticular calcaneal fractures into joint depression and tongue types. McReynolds (1982) and Stephenson (1987) reported further about patterns and displacements based on plain radiographs which sometimes are difficult to understand. We found the use of preoperative CT scans very useful.

Whittaker (1947) and Palmer (1948) first reported good results of surgical treatment of displaced intraarticular fractures of the calcaneus. In recent years, more intraarticular fractures of the calcaneus have been treated with operations (McReynolds 1982, Burdeaux 1983, Harding and Waddell 1985, Ross and Sowerby 1985, Stephenson 1987, Hammesfahr 1989, Melcher et al. 1991) obtaining satisfactory results in 50-83 percent of the cases. Excellent or good results were achieved in three quarters of our patients. It is, however, difficult to compare the results because of different criteria for evaluation (Sanders 1991).

Proper timing of the operation has been pointed out as important for final outcome (Harding and Waddell 1985, Melcher et al. 1991). We favor surgery within the first 10 days.

We believe that with a posterolateral approach we can usually obtain a better reduction of the posterior articular facet. In some cases, the thin sustentacular spike may be difficult to reduce, and an additional medial approach is helpful.

When only feasible, we preferred the Sherman plate or a screw for osteosynthesis, but if comminution hindered this choice, we used Kirschner wires. Usually screws were placed through the 3 major fragments (sustentaculum, posterior tuberosity and calcaneocuboid area) into the subchondral bone (Ross and Sowerby 1985, Hammesfahr 1989), in order to avoid the insufficient holding power in the comminuted calcaneus.

The necessity of bone grafting has been debated by many authors (Stephenson 1987, Melcher et al. 1991). In our experience bone grafting of the defect was not necessary and we did not find at follow-up any fracture collapse.

We observed that our technique improved with time, getting better fracture reductions and repairing of damaged soft tissues. Furthermore, we have seen that anatomic reduction of intraarticular fractures corresponded to better functional results. Our poor results were in direct relation with great comminution and also poor surgical technique.

We conclude that open reduction and rigid fixation are a good option in treatment of displaced fractures of the calcaneus.

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