No arthrosis of the ankle 20 years after malaligned tibial-shaft fracture

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We interviewed 92 patients with nonoperatively treated tibial-shaft fractures with a minimum of soft-tissue injury 20–39 years after the injury. Seventeen fractures had healed with an angular deformity exceeding 10°. Seven patients with and 15 without symptoms, but with an angular deformity exceeding 10°, were examined clinically and radiographically. None of these 22 patients had arthrosis of the ankle. We concluded that angular deformity within 15° will not lead to restricted motion, pain, or arthrosis of the ankle.

It is generally feared that a malunited tibial fracture will cause arthrosis of the ankle; but since Böhler (1953), no real evidence had been offered to support this. These speculations have been essential in the debate concerning internal fixation versus nonoperative treatment of tibial-shaft fractures (Karlström and Olerud 1974, Rommens and Schmit-Neurerburg 1987). Rosemeyer and Pförringer (1979) considered varus deformity exceeding 6° and a valgus deformity exceeding 12° to be "prearthrotic."

We have reexamined patients with a tibial-shaft fracture after low-energy trauma, with a minimum observation period of 20 years; we directed special reference to angular deformity and arthrosis of the ankle.

Patients and methods

During the period 1949–1968, 1,374 tibial-shaft fractures were treated at our hospital. To reduce other factors that might influence ankle function, 1,255 fractures were excluded based on the following criteria: open fractures, moderate or severe soft-tissue damage, transfixation, open treatment, skeletal traction followed by a plaster cast, death, age over 69 years at follow-up, a new trauma, systemic disease, and remote domicile. Of the remaining 92 patients, 79 were men and 13 women with a median age of 20 (15–49) years at the time of the accident. The median follow-up period was 28 (20–39) years. Four fractures were situated in the proximal, 55 in the middle, and 33 in the distal third of the tibial shaft. Fifty-one fractures were longitudinal and 41 were transverse (Edwards 1965). The maximum angular deformity exceeded 10° in 17 fractures (Table 1). The patients were interviewed (62 by telephone and 30 by questionnaire); the subjective result was classified according to Cedell (1967). The 7 patients with symptoms and the 15 patients without symptoms, but with an angular deformity exceeding 10°, were examined clinically and radiographically (knee standing, ankle and tibia in two projections). Magnusson's (1944) criteria for arthrosis of the ankle were used.

Results

Eighty-five patients were asymptomatic and 4 had negligible symptoms of pain and fatigue after extra exertion. Three patients complained of moderate pain

Tabell 1. Maximum angular deformity at the time of healing of 92 healed tibial-shaft fractures

Degrees	0	1–5	6–10	11–15	≥16
Anterior		9	6	2	
Dorsal		4	1	2	
Varus		17	8	7	1
Valgus		4	1	4	1
Total	25	34	16	15	2

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after exertion, but none had reduced capacity for unprotected work or exercise (Table 2). The 7 patients with symptoms had less than 10° limited ankle motion, and the 3 patients with moderate symptoms had limited subtalar joint motion as well. The 15 asymptomatic patients with angular deformities exceeding 10° had a normal range of joint motion. None of the 22 patients examined at the follow-up had radiographic signs of ankle or knee arthrosis.

Table 2. Late subjective results according to Cedell (1967)

Deformity (degrees)	Good symptoms		Medium	Poor
	–	+		
0	24		1	
1–5	34			
6–10	12	3	1	
11–15	14	1		
≥16	1		1	
Total	85	4	3	0

Discussion

In a cadaveric study, Tarr et al. (1985) simulated angular deformities in all planes to maximally 15° for proximal, middle, and distal third levels. They found no substantial alternation in the pressure distribution of the ankle joint for the proximal and the middle third tibial levels. Distal tibial deformities showed a substantial change in only 1 of the 2 cadavers of as much as a 40 percent decrease in contact area for an anterior and a posterior deformity of 15°, whereas a varus and a valgus deformity of 15° only had a decrease of 15–20 percent.

In studies of Stage II supination-eversion fractures of the ankle (Yde and Kristensen 1980, Kristensen and Hansen 1985, Bauer et al. 1985), it had been demonstrated that union with displacement of the lateral malleolus will not lead to arthrosis, as had been claimed for several years. According to these studies and our present one, the ankle seems more resistant to developing arthrosis than has been generally assumed. There is no evidence that an angular deformity within 15° alone will lead to restriction of motion, pain, and arthrosis of the ankle.

References

Bauer M, Jonsson K, Nilsson B. Thirty year follow-up of ankle fractures. Acta Orthop Scand 1985;56(2):103–6.

Böhler L. Unterschenkelschaftbrüche. Langenbecks Arch Klin Chir 1953;276:192–217.

Cedell C A. Supination outward rotation injuries of the ankle. A clinical and roentgenological study with special reference to the operative treatment. Acta Orthop Scand 1967:(Suppl 110).

Edwards P. Fracture of the shaft of the tibia: 492 consecutive cases in adults. Importance of soft tissue injury. Acta Orthop Scand 1965; (Suppl 76).

Karlström G, Olerud S. Fractures of the tibial shaft; a critical evaluation of treatment alternatives. Clin Orthop 1974; (105):82–115.

Kristensen K D, Hansen T. Closed treatment of ankle fractures. Stage II supination eversion fractures followed for 20 years. Acta Orthop Scand 1985;56(2):107–9.

Magnusson R. On the late results in non operated cases of malleolar fractures. Acta Chir Scand 1944;(Suppl 84).

Rommens P, Schmit-Neuerburg K P. Ten years of experience with the operative management of tibial shaft fractures. J Trauma 1987;27(8):917–27.

Rosemeyer B, Pförringer W. Basic principles of treatment in pseudarthroses and malunion of fractures of the leg. Arch Orthop Trauma Surg 1979;95(1):57–64.

Tarr R R, Resnick C T, Wagner K S, Sarmiento A. Changes in tibiotalar joint contact areas following experimentally induced tibial angular deformities. Clin Orthop 1985;(199): 72–80.

Yde J, Kristensen K D. Ankle fractures. Supination eversion fractures stage II. Primary and late results of operative and non-operative treatment. Acta Orthop Scand 1980;51(4): 695–702.