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PLATE OSTEOSYNTHESIS FOR SHAFT FRACTURES OF THE TIBIA

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Out of 46 tibial shaft fractures treated by the AO method 42 healed primarily and four had delayed union. Otherwise no serious complications were encountered.

Key words: dynamic compression plates; osteosynthesis; tibial shaft fractures

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Out of 171 tibial shaft fractures in patients admitted over a period of 6 years, 46 (27 per cent) were treated operatively by the AO method. This survey presents the results obtained by using Dynamic Compression Plates (DCP).

The method was used primarily when it was impossible to achieve or maintain a satisfactory position of the fracture without open reduction and internal fixation. Furthermore this treatment was preferred when a well-positioned stable fracture (without cumbersome external support) was an obvious asset in the total care of the patient with multiple injuries. Of course the surgeon's individual preference also played a role.

PATIENTS AND METHODS

The series consisted of 46 patients, 27 males and 19 females operated on in the period from April 1974 to June 1980. The average age at operation was 44 years (range 16–77 years), the same in both sexes. The most common causes of injury were traffic accidents and falls. Half of the fractures were caused by direct high energy violence (Table 1). Over one-third of the fractures were classified as open, comminuted or segmental (Table 2). Of the 29 single closed fractures, 18 were transverse and 11 oblique or short spiral.

The average interval between accident and operation was 3.6 days (range 0–42 days). Two-thirds of the patients (31) were operated on within a period of 2 days after the injury, 11 of them on the day of admission.

Primary treatment consisted of preliminary reduction and temporary fixation in plaster or calcaneal traction. Great importance was attached to the prevention and alleviation of swelling by elevation, compressive bandages and diuretics.

Operation was deferred until swelling, impaired circulation and large skin lesions had been brought under control. Prophylactic antibiotics were not used routinely.

Atraumatic handling of the tissues was facilitated by the use of a traction table with support for the lower leg. Reduction was then easily obtained by calcaneal traction. By obviating the traction boot, space was gained and draping made easier in distal fractures. Rotation of the distal fragment was controlled by a special locking device connecting the stirrup to the traction table (Figure 1).

After reduction the DCP was contoured and applied to the anteromedial surface of the bone (Figure 2a, b). Stable osteosynthesis in an anatomical or near-anatomical position was obtained in all cases. In four-fifths of the cases external support was provided only by a posterior toe-to-knee plaster slab. The average operation time was 62 minutes (range 30–130 minutes). The operations were carried out by seven differ-

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Table 1. Causes of fractures and type of violence (according to Olerud & Karlström 1972)

		Indirect violence	Direct violence	Total	Percentage
Traffic accidents	Pedestrians	–	8	8	
	Cyclists	1	2	3	
	Moped and motorcycle riders	–	3	3	
	Automobile drivers	–	1	1	
	Automobile passengers	–	1	1	
	Total traffic accidents	1	15	16	34
Accidents at work	Forestry work	1	3	3	
	Industrial and building work	–	2	2	
	Other work	–	1	1	
	Total accidents at work	–	6	6	13
Sports accidents	Football	–	2	2	
	Skiing	1	–	1	
	Other sports	5	1	6	
	Total sports accidents	6	3	9	20
Miscellaneous	Fall at same level, indoors	4	–	4	
	Fall at same level, outdoors	6	1	7	
	Fall from a height (parachute, ladder)	–	2	2	
	Other causes of injury	1	1	2	
	Total miscellaneous accidents	11	4	15	33
Total		18 (39%)	28(61%)	46	100

Table 2. Type of fracture

Localisation	Closed			Open		
	Double	Single	Commin.	Single	Commin.	
Proximal			1		2	3
	5					5
Middle		11		3		14
		18				18
Distal			6			6
Total	5	29	7	3	2	46

ent surgeons. Post-operatively the patients were mobilized as soon as the swelling had subsided and were discharged as soon as they could walk with the aid of crutches. The stitches were removed 2 weeks after operation and then daily active exercises of the ankle joint were encouraged. Intermittent weight-bearing when standing still was often allowed after 6–8 weeks but walking was deferred until radiographic signs of union were apparent. The plate was removed in most cases about 1 year after operation.

RESULTS

Forty-two of the 46 patients attained full radiographic and clinical bone healing within 3–5 months whereas four had delayed union (*vide infra*). The position obtained at operation was maintained until full union in all cases and normal range of movement was quickly regained by all

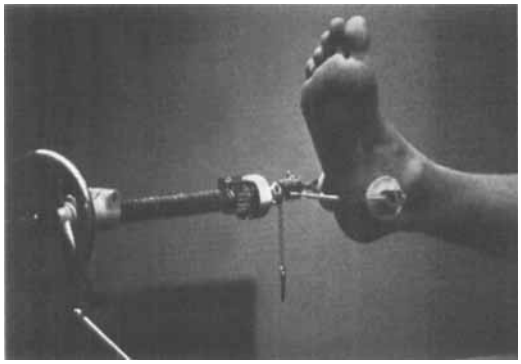

Figure 1. The special locking device connecting the stirrup to the traction table to control rotation of the distal fragment.

those who had only a removable plaster slab for external support.

The average hospitalization time for those patients without other serious injuries was 12 days (range 2–52 days). Seven patients with concomitant injuries (Table 3) stayed an average of 58 days (range 9–130 days) in hospital. Two-thirds (30) of the total number of patients were discharged within 10 days of injury (average 5–7 days). The duration of incapacity was from 6–38 weeks for 33 working patients, average 19 weeks.

There was no mortality. Delayed union from 8–24 months occurred in four cases. All four had comminuted fractures, two of which were open. One of them contracted a postoperative infection. The infection healed promptly when the plate was removed 4 months after osteosynthesis. All four cases proceeded to bony union without further operations to promote healing. In no case did osteomyelitis or pseudarthrosis occur. Refractures have not been observed so far.

Three patients had superficial postoperative infection. Four other patients had transient swelling, tenderness or redness in the area of the wound several months after osteosynthesis. This was interpreted as a reaction to the metal ("metallosis") and no evidence of bacterial infection was found. These signs disappeared without any specific treatment.

Table 3. Concomitant injuries in seven patients

Fracture of the femur	3
Fracture of the patella	1
Fracture of the ankle	1
Fracture of the contralateral tibia and humerus	1
Fracture of the base of the skull	1
Total	7

DISCUSSION

Very satisfactory results were obtained by the use of DCP osteosynthesis. Compared to many other comparable reports (see References) complications in this small series have been few. We believe this has been due mainly to the fact that careful attention was paid to the state of the skin and the limb circulation both before and after operation. In addition we like to believe that our efforts to apply an atraumatic technique in the handling of the tissues was a contributory factor.

Although opinions on the treatment of fractures of the tibial shaft remain far from unanimous (Bauer & Hulth 1973, Karlström & Olerud 1973, 1974, Sarmiento 1974, Mattson 1975, Önnerfält 1978, Linden et al. 1979) the current trend appears to be towards more conservative solutions. This is also reflected in the management of these injuries at our clinic where the number of operations decreased from 13 in 1974–1975 to 7 in 1979–1980.

We are still of the opinion that in spite of the advent of useful alternative methods, open reduction and stable osteosynthesis of these fractures are occasionally required if shortening, angulation and rotatory deformity are to be avoided. In such cases DCP osteosynthesis by the AO method, if correctly applied, is a good choice.

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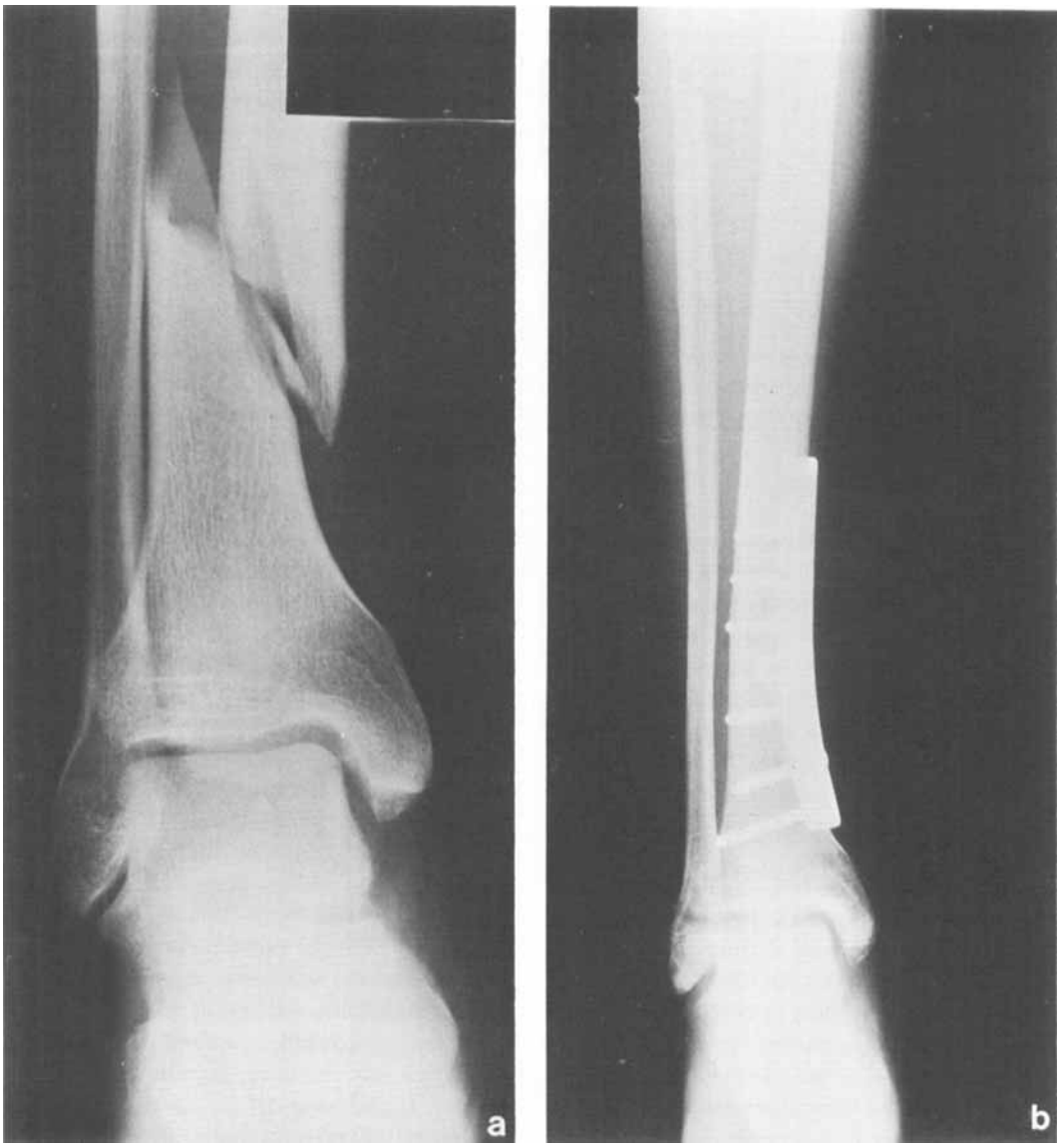

Figure 2. a, Short spiral fracture of the distal third of the right tibia; b, After osteosynthesis by interfragmentary compression screw and DCP.

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