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TARSOMETATARSAL FRACTURE-DISLOCATION

Late results in 26 patients

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The anatomy and mechanism of fracture-dislocation of Lisfranc's joint, or the tarso-metatarsal articular complex, have been extensively described in the literature (Quenu & Kuss 1909, Holstein & Joldersma 1950, Jeffreys 1963, Aitken & Poulson 1963). The treatment was previously conservative (Quenu & Kuss 1909, Grunert 1910, Weber 1933), but more recently open reduction has been advocated (Geckeler 1949, Del Sel 1955, Granberry & Lipscomb 1962, Cassebaum 1964, English 1964). Comprehensive analyses of late results are not available, however, owing to the small number of cases in most reports. For this reason the present study was undertaken.

MATERIALS AND METHODS

The series consist of 26 patients with fracture-dislocation of Lisfranc's joint treated at the Department of Orthopaedics and Traumatology during the period 1955-1967. Of these patients 21 were male and 5 female. The age range was from 14-60 years, average 32 years. The follow-up time was 2-10 years, average 5 years.

The cause of injury was twisting of the foot in slipping or falling in 11 cases, a crush injury in 8 cases, and a traffic accident in 7 cases.

The cases were classified according to which metatarsal bones (= M) the dislocated segment of the foot comprised (Table 1). The first metatarsal was dislocated in either the medial or (dorso)-lateral direction, the other metatarsal bones invariably in the dorsolateral direction. The second to fifth metatarsals remained fixed to each other and were dislocated as one block. The first metatarsal either remained in place or was dislocated together with the remainder or moved in the opposite direction (diverging dislocation). Often a wide diastasis occurred at the base between the first and the second metatarsals, but distally the bones always remained fixed so that no spreading of the forefoot resulted. In addition, the tarsal bones, most usually the cuneiforms, often showed fractures and dislocations which have not been separately considered in the classification. Concomitant fractures of the metatarsal bones were present in 18/26 patients. Chip fractures in the area of



Lisfranc's joint, which are often not definitely diagnosed until operation, have not been considered in the table. A compound injury was involved in 6 cases.

Table 1. Different types of dislocation of Lisfranc's joint and concomitant fractures of the foot. (M = metatarsal bone).

Dislocated segment	Total	Digitus	Meta-tarsal	Other fractures			
				Cunei-form	Cuboi-deus	Calca-neus	Malle-olus
M 1	1	1	1	—	—	—	—
M 2-3	1	—	1	—	1	1	—
M 3-5	1	—	—	—	1	—	—
M 2-5	12	1	7	3	—	—	—
M 1-5	9	—	5	4	3	—	1
M 1 & M 2-5 (divergent)	2	—	2	—	—	—	—
	26	2	16	7	5	1	1

METHOD OF TREATMENT

Open reduction and internal fixation were carried out in 8 patients. Seven were operated on within 24 hours from the accident while in one case open reduction was carried out on the ninth day from injury. A longitudinal incision between the first and the second metatarsals was carried to the dorsum of the foot. These bones are in a key position in reduction. When they were accurately aligned, the remainder easily fell in place, in correspondence with the segmental dislocation pattern described above. Reduction was difficult in two cases owing to interposition of the tendon of the tibialis anterior in the first cuneometatarsal joint, and in another two cases owing to severe comminution of the cuneiform bones (Figures 1 and 2). In two patients a second longitudinal incision was made more laterally. For fixation Kirschner wires were inserted through the proximal portion of the metatarsal bones transarticularly to the tarsal bones. The first cuneo-metatarsal joint was fixed by one wire. The segment formed by the other metatarsal bones was fixed with one to three wires. In one case the first and the second cuneiforms were in addition fixed by a staple. The Kirschner wires were cut subcutaneously. In one patient the base of the second metatarsal was fixed to the first cuneiform with chromic catgut inserted through a drill hole in the bone. Postoperatively the foot was always placed in a plaster boot.

Figure 1. (A-B) Dorsolateral dislocation of all metatarsals. Interposition of the tendon of tibialis anterior in the first cuneometatarsal joint. Dorsal artery of the foot ruptured and the posterior tibial artery in spasm, which was relieved by reduction. (C) After internal fixation with Kirschner wires. (D-E) After 4½ years. Patient satisfied.





Figure 2. (A-B) Compound dorsolateral dislocation of all metatarsals. Distal articular surface of the first cuneiform included in the loose fragment. (C-D) After reduction and internal fixation with Kirschner wires. Necrosis of wound margins developed which later required skin grafting. (E-F) After three years. Patient is satisfied. Slight limitation of twist movement of the tarsometatarsal joints.

The treatment was conservative in 18 cases. Closed reduction and immobilization in plaster were used in 14 cases. In one of these skin traction was transiently applied. Four patients were treated by skeletal traction in conjunction with immobilization in plaster.

All procedures were carried out under general or spinal anesthesia. The operations were performed with the help of a tourniquet. The length of immobilization in plaster was 4-14 weeks, average 8 weeks. Skeletal traction was used for 3-7 weeks, average 4 weeks. The duration of non-weight-bearing was 1-12 weeks, average 6 weeks. The Kirschner wires were removed under local anaesthesia after an average of 12 weeks, the range being from 8-25. The patients were unable to work for 2-15 months, average 6 months. Skin necrosis, requiring skin grafting, developed in three cases of compound injury including one that was internally fixed. In one compound case the fifth metatarsal bone had to be amputated owing to osteitis.

Circulatory disturbances: In one patient showing dislocation of all metatarsal bones and compound fracture of the medial malleolus, the foot was cold, pale and pulseless before operation. The dorsal artery of the foot was ruptured and the posterior tibial artery was in spasm. After reduction the circulation started again and no sequelae occurred.

LATE RESULTS

The results were classified as follows:

Functional results

Good: only slight subjective complaints not influencing the ability to work, not more than slight limitation of movements, no local tenderness or painful movements in the foot, standing on the toes not difficult. *Fair*: moderate pain on exertion, considerable discomfort under particularly stressing conditions, moderate limitation of movements in the foot, definite pain on palpation or movement, standing on the toes difficult. *Poor*: marked continuous pain affecting the ability to work, pain invariably in walking, considerable limitation of movements in the foot, definite local tenderness or painful movements, standing on the toes difficult.

Table 2. Late results in Lisfranc's fracture-dislocations.

Dislocated segment and treatment	Total number of cases	Functional result			Anatomical result		
		Good	Fair	Poor	Good	Fair	Poor
<i>Operative treatment</i>							
M 2-5	2	—	1	1	1	—	1
M 1-5	6	4	1	1	4	1	1
<i>Conservative treatment</i>							
M 1	1	1	—	—	1	—	—
M 2-3	1	—	1	—	1	—	—
M 3-5	1	1	—	—	1	—	—
M 2-5	10	3	4	3	3	2	5
M 1-5	3	—	2	1	1	—	2
M 1 & M 2-5	2	—	—	2	—	—	2
	26	9	9	8	12	3	11

Anatomical results (based on clinical and radiological examinations).

Good: good total shape of the foot, diastasis at the base between the first and the second metatarsals not more than 5 mm, perhaps slight arthrosis. *Fair*: like the foregoing except that separation between the first and the second metatarsals was 6-9 mm, possibly slight or moderate arthrosis. *Poor*: marked deformity (cavus, abduction or adduction, shortening, first metatarsal dislocated), diastasis between the

first and the second metatarsals 10 mm or more, perhaps moderate or severe arthrosis.

The distribution of the results according to the type of injury involved is shown in Table 2. The results were better when only one to three metatarsals were dislocated than in the cases involving injury to four or five of these bones. In the former case good results were attained by conservative treatment. In the case of more extensive dislocation the results of open reduction were better. The subjective state sometimes continued to improve for four or five years. In many cases an arch support was prescribed after removal of the plaster boot. At follow-up five patients stated that they still needed an arch support. All of these had functionally poor results.

The results of reduction were separately evaluated. *Open reduction* resulted in a permanently good shape of the foot in 5/8 patients. In two cases poor alignment and poor anatomical result were attributed to technical failures in the operation. In one patient, in whom chromic catgut was used for fixation, an initially good result ended in being classified as fair. *Closed reduction* resulted in a permanently good shape of the foot in 4/18 patients. In 2/18 a fair result was obtained. In 3 the alignment could be classified as primarily good. In 7/18 patients, in whom closed reduction was attempted, the shape of the foot remained poor. This group includes the cases treated by skeletal traction. In two patients good alignment was attained by closed reduction, but later the result deteriorated into poor.

Table 3. Anatomical and functional end results in tarsometatarsal fracture-dislocations.

		Functional results			Total
		Good	Fair	Poor	
Anatomical results	Good	9	3	—	12
	Fair	—	3	—	3
	Poor	—	3	8	11
Total		9	9	8	26

Table 3 shows the distribution of the patients according to the anatomical and the functional end results. The conclusion is drawn that the two are correlated. Fractures of the foot concomitant with the injury to Lisfranc's joint did not seem to influence the end results.

Limitation of motion in the foot and toes was noted in both opera-

tively and conservatively treated patients (in a total of 12/26), though in more marked form in the latter. Hallux rigidus (dorsal flexion less than half of the normal) was observed in 6 patients. Two of these were treated by open reduction. Passive twisting of the tarsometatarsal joint was limited in 8 patients including one treated by open reduction. Motion of the subtalo-mid tarsal joints was limited in 8 patients including 3 operatively treated cases. The lesser toes showed limitation of motion in 4 conservatively treated patients. Limitation of motion was observed in 9/18 of the conservatively treated and 3/8 of the operatively treated cases. Considerable limitation of motion was observed in 5/11 patients with anatomically poor results. Slight limitation of motion was noted in 1/12 patients with anatomically good results.

Considerable deformity (anatomically poor result) was noticed in 11 patients. Seven of these showed malposition of cavus type and one showed abduction deformity of the forefoot. Separation of the first and second metatarsal bones by 10 mm or more was present in 5 cases. Three patients showed marked hammer toes. Pes planus did not occur.

Arthrosis of the tarso-metatarsal and the tarsal joints was observed in 15/26 patients. The most severe changes were noticed in patients with marked deformities. Slight arthrosis occurred irrespective of a good shape of the foot.

DISCUSSION

When the metatarsal bones are dislocated at the tarso-metatarsal joints, the first metatarsal is separated from the remainder, which often dislocate as one block. Moreover, there may be concomitant fractures of the cuneiform bones (Quenu & Kuss 1909, Collet et al. 1958). The deep transverse ligament keeps the distal ends of the metatarsal bones together, despite their separation at the base and fracturing of the diaphyses. This segmental dislocation pattern must be kept in mind in the choice of technique for reduction.

Gissane (1951) emphasized the risk of gangrene if reduction is delayed. Before reduction one patient in the present series showed grave circulatory disturbance in the foot. The relief of vascular spasm requires prompt reduction.

Patients able to use their feet despite persistent dislocation have been described (Cotton 1924, Aitken & Poulsen 1963). Of the present patients even those who had markedly deformed feet (Figure 3) were able to work, although not in heavy occupations. On the other hand, a good anatomical result was no guarantee for a symptom-free foot. In

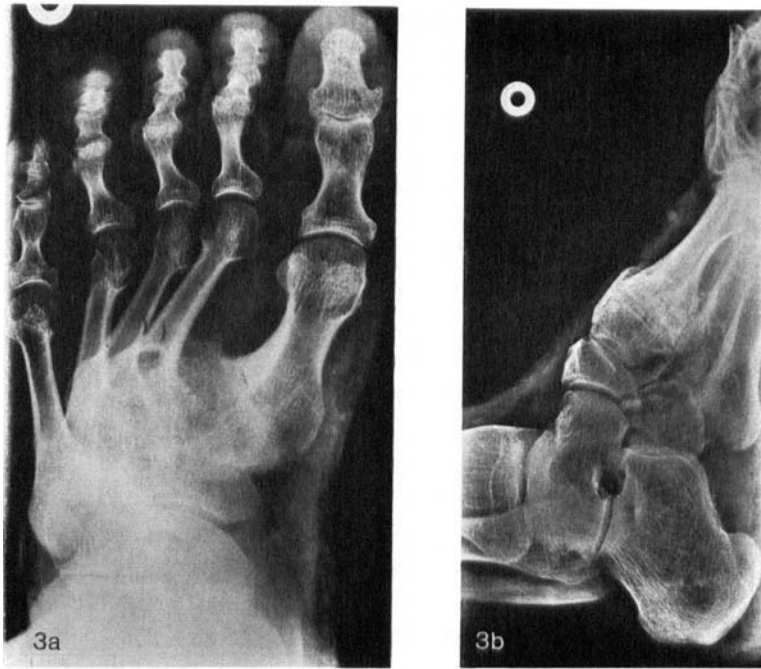


Figure 3. Unreduced divergating dislocation after 10 years. Cavus deformity. Considerable pain in daily activities, but patient can manage with the help of an arch support.

general, however, a good anatomical result also meant a good functional result. We therefore agree with those investigators who have emphasized the importance of good alignment (Novotny 1953, Granberry & Lipscomb 1962, Cassebaum 1964). However, slight separation (about 5 mm) at the base between the first and the second metatarsal bones may be accepted, if the shape of the foot is otherwise good. In some cases good alignment is certainly obtained by closed reduction and immobilization in plaster (Morrison 1937, Allan 1947, Holstein & Joldersma 1950). However, the present analysis offers evidence of the inadequacy of conservative treatment, since reduction was a complete failure or only transiently successful in 9/18 patients. The results of conservative treatment were best in those cases in which only one, or a maximum of three, metatarsal bones were dislocated or the dislocation was so slight that the alignment as such could be considered as good. In severe cases a plaster boot alone is not sufficient to keep the bones in alignment, and if the foot is swollen the pressure implies a

hazard. The present results support the view that open reduction and internal fixation are more reliable (Allan 1947, Del Sel 1955, Granberry & Lipscomb 1962) and that reduction may be hindered by small fragments detached from the metatarsal and tarsal bones (Allan 1947, Collet et al. 1958, Cassebaum 1964) by dislocation of the cuneiform bones (Holstein & Joldersma 1950) or by interposition of the tendon of tibialis anterior (Holstein & Joldersma 1950, Jeffreys 1963). For internal fixation Kirschner wires proved useful, which is in agreement with previous recommendations (Geckeler 1949, Holstein & Joldersma 1950, Del Sel 1955, Collet et al. 1958, Lange 1967).

In the case of traumatic arthrosis of the tarso-metatarsal joints, arthrodesis has been recommended (Compere et al. 1963). Primary arthrodesis has also been suggested in the treatment of dislocation injuries, on the ground that this procedure is often nevertheless indicated later (Granberry & Lipscomb 1962). Niederecker (1956) recommended primary arthrodesis in dislocation fractures of the first cuneo-metatarsal joint in particular. Arthrodesis was not performed in any of the present patients. The symptoms tended to subside gradually during a period of several years. In some instances it is possible that arthrodesis would have accelerated the recovery, and in the presence of protracted disabling symptoms it seems wise to consider cuneo-metatarsal arthrodesis.

The average duration of immobilization in plaster was 8 weeks, and the average duration of non-weight-bearing was 6 weeks. This corresponds to the recommendations of previous authors (Morrison 1937, Allan 1947, Aitken & Poulson 1963, Cassebaum 1964). Limitation of motion in the foot and toes was present in 12/26 patients. It seems likely that persistent limitation of motion could be reduced by cutting down the duration of immobilization and by intensifying the mobilizing exercises during after-treatment. The postoperative prevention of oedema is certainly important from the outset when either the feet or the hands are involved.

SUMMARY

The late results in 26 fracture-dislocations of Lisfranc's joint are presented. The average follow-up time was 5 years. In the majority of cases (23/26) four or five metatarsal bones were dislocated. Eight patients were treated by open reduction and internal fixation with Kirschner wires, and 18 patients were conservatively treated. Good

alignment is worth striving for, and operative treatment gave good results. The usefulness of postoperative mobilization is emphasized.

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