THE TREATMENT OF DUPUYTREN'S FRACTURE-DISLOCATION OF THE ANKLE

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The ankle is a complex, weight-bearing joint and is subject to many different types of injury. Testimony to this variety is the number of classifications of ankle fractures which have been proposed in the past (Bonnin 1950; Lauge-Hansen 1950; Phillips, Monk and Balmer 1968), many of which are still in current use. One of the more clearly defined of such injuries is the fracture-dislocation described in 1819 by Baron Dupuytren, and subsequently classified by Lauge-Hansen in 1950 as a pronation-eversion injury, stages III and IV. This injury

Fig. 1
An example of a Dupuytren's fracture-dislocation of the ankle joint.
complex consists in disruption of the medial structures (either a ruptured medial ligament or a traction fracture of the medial malleolus) together with total rupture of the inferior tibio-fibular joint and an indirect fracture of the fibula above that syndesmosis (Fig. 1). In most of the large follow-up series of the results of treatment of ankle injuries, the different fracture patterns have seldom been treated as separate entities or analysed individually; so confusion still remains over the correct treatment for any given type of ankle injury. Notable exceptions are the works of Biström (1952), Klossner (1962), Burwell and Charnley (1965) and Cedell (1967). Only the work of Klossner (1962), however, included a sizeable group of Dupuytren's fracture-dislocations—his series contained fifty-three such cases. This paper presents an analysis of the results of treatment of forty-six cases of Dupuytren's fracture-dislocation of the ankle.

MATERIAL

The series consists in all the traceable, adult cases of this injury from the Edgware General Hospital and the Royal National Orthopaedic Hospital presenting during the years 1960–68, together with all twelve cases treated at the Bristol Royal Infirmary in 1965–66. It is not possible to state what percentage this series represents of all the ankle fractures treated at these hospitals during the relevant periods, but this injury is not a common one: Burwell and Charnley (1965) reported twenty-four cases out of a total of 856 ankle fractures and Vasli (1957) reported twenty-five out of 497 cases of ankle fracture.

In twenty-one cases the right ankle was involved and in twenty-five cases the left ankle. There were twenty-six female and twenty male patients. Their ages ranged from eighteen to seventy-seven years, the average being thirty-seven years.

TREATMENT

Of the forty-six patients, twenty were treated by closed methods and twenty-six by internal fixation. Closed treatment entailed manipulative reduction under general anaesthesia followed by immobilisation in a toe-to-knee plaster for seven to sixteen weeks, the average being eleven weeks. Four patients had a second manipulative reduction within three days of injury. None had a third manipulative reduction but three of the patients included in the group treated by internal fixation originally had closed treatment which failed to achieve adequate reduction and had to have open reduction and internal fixation after twelve days, two months and three months.

In the group treated by open reduction the medial injury was a ruptured medial ligament in ten cases. None had the ligament sutured. Seven had fibulo-tibial screw fixation of the inferior tibio-fibular joint and three had internal fixation of the fibular fracture followed by fibulo-tibial screwing. The remaining sixteen patients had internal fixation of the fracture of the medial malleolus (fourteen with one screw, one with two screws and one with the traction-absorption technique of Weber and Vasey (1963)). Thirteen of these patients also had fibulo-tibial screw fixation of the inferior tibio-fibular joint, in three instances preceded by internal fixation of the fibular fracture (one with a plate, two with cerclage wires). Three patients had no fixation laterally.

All those treated by operation had the ankle immobilised in toe-to-knee plasters for six to eleven weeks, the average being eight weeks.

In all cases the treatment was carried out by an orthopaedic surgeon. There was no case of infection and all the surgical wounds healed by first intention.

FOLLOW-UP

Each patient was interviewed, a record was made of the amount of discomfort, pain and swelling, and both feet and ankles were examined clinically. Radiographs were taken of both
ankles in the antero-posterior projection, and in the lateral projection in full dorsiflexion and in full plantar-flexion. In this manner an assessment was made of the position of the fracture fragments, the state of union and the range of movement of the injured ankle compared with the normal uninjured side.

The length of follow-up ranged from forty weeks to nine and a half years, the average being five years three months.

**TABLE I**

**CRITERIA USED IN ASSESSMENT OF RESULTS**

<table>
<thead>
<tr>
<th>Result</th>
<th>Clinical</th>
<th>Radiological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Completely symptom free. More than 75 per cent normal ankle range. More than 50 per cent normal subtalar range. No swelling</td>
<td>No residual displacement. No degenerative change</td>
</tr>
<tr>
<td>Fair</td>
<td>Pain only after (not during) prolonged use, or slight swelling only in the evenings, or less than 75 per cent but not less than 50 per cent normal ankle range. More than 50 per cent subtalar range, or less than 50 per cent subtalar range if totally pain free</td>
<td>Less than 3 millimetres lateral shift, or less than 5 degrees varus or valgus malunion of the lower fibula, or less than 3 millimetres upward displacement of a posterior tibial fragment (which bore more than 25 per cent of the tibial articular surface), or the presence of very early joint space narrowing and/or osteophytosis</td>
</tr>
<tr>
<td>Poor</td>
<td>The remainder</td>
<td>Any greater displacement or degenerative change than above</td>
</tr>
</tbody>
</table>

**TABLE II**

**COMBINED CLINICAL AND RADIOLOGICAL ASSESSMENT**

<table>
<thead>
<tr>
<th>Combined</th>
<th>Clinical</th>
<th>+</th>
<th>Radiological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Good</td>
<td>+</td>
<td>Good</td>
</tr>
<tr>
<td>Fair</td>
<td>Good +</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>Fair +</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>Fair +</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>Poor +</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>Poor +</td>
<td>Poor</td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS**

The clinical and radiological results were assessed as good, fair or poor according to the criteria set out in Table I. These criteria are stricter than those used by Magnusson (1944), Kristensen (1956), Vasi (1957), Klossner (1962) and Burwell and Charnley (1965).

The combined result was then graded according to the combination of clinical and radiological results (Table II).

The assessment has been deliberately strict in order that any conclusions drawn from the results should represent a high standard of treatment. Many authors have classified as “good”, results which in young active persons would constitute a degree of disability and which may indicate the possibility of increased symptoms in the future; for example patients with pain after prolonged use were classified as “good” by Burwell and Charnley (1965) (such cases in this series would only be classified as “fair”), and Frankel, McCue and Humphries (1963) included in their “good” group patients with chronic stasis oedema. Similarly the radiological
criteria are stricter than in previous series; for example, Wilson and Skilbred (1966) rated non-union of the medial malleolus as minimal radiographic change and bimalleolar non-union as moderate change.

Table III compares the final results of treatment by the two methods.

The figures in parentheses denote those ankles in which closed reduction failed and in which internal fixation was done later.

From this analysis it can be seen that the results of internal fixation are superior to those of closed treatment by the two methods described. Lateral rotation injury is generally accepted as being the cause of this fracture, so it seems desirable when closed reduction is done, to use a plaster extending above the slightly flexed knee in order to control rotation (Kleiger 1961). It is possible that the rather poor results of closed methods in this series could in part be blamed upon the fact that these patients were all treated in toe-to-knee plasters, although Frankel and colleagues (1963) regarded this as the method of choice for the closed treatment of ankle fractures.

### TABLE III

**Overall Results of Open and Closed Treatment**

<table>
<thead>
<tr>
<th>Result</th>
<th>Open reduction</th>
<th>Closed reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of ankles</td>
<td>Percentage</td>
</tr>
<tr>
<td>Good</td>
<td>11 (1)</td>
<td>46</td>
</tr>
<tr>
<td>Fair</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Poor</td>
<td>6 (2)</td>
<td>31</td>
</tr>
</tbody>
</table>

### TABLE IV

**Relation of Quality of Final Radiological Appearance to the Clinical Results**

<table>
<thead>
<tr>
<th>Clinical results</th>
<th>Radiological results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>16</td>
</tr>
<tr>
<td>Fair</td>
<td>7</td>
</tr>
<tr>
<td>Poor</td>
<td>5</td>
</tr>
</tbody>
</table>

### TABLE V

**Relation of Quality of Reduction of the Bony Fragments to the Final Clinical Result**

<table>
<thead>
<tr>
<th>Clinical results</th>
<th>Position of fracture fragments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>16</td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
</tr>
<tr>
<td>Poor</td>
<td>3</td>
</tr>
</tbody>
</table>

**Timing of operation**—With three exceptions, all ankles treated by open operation were fixed within forty-eight hours of injury, twenty-one of them within nine hours of injury. Three ankles were operated on twelve days, two months and three months after injury because of failure to achieve or maintain adequate reduction by closed methods. In all three of these cases perfect reduction was achieved, but in only one, a young man of twenty-one years, operated on eight weeks after injury, was the final result assessed as good.

**Relation of radiological to clinical results**—Table IV demonstrates a close correlation between the quality of the final radiological picture and the clinical results, and this agrees with the results of Vasli (1957) and Klossner (1962). All the patients with a good final radiological appearance had a good clinical result, and all but one of the patients with a poor final radiological result had a poor clinical result.

The final radiographs were also reviewed purely from the point of view of the position of the fracture fragments and a comparison made between the quality of the reduction and the clinical results (Table V).
There was a close correlation between the final clinical results and the quality of reduction of the fracture fragments. Whereas a good reduction did not necessarily guarantee a good final result (five ankles with a good reduction had fair or poor clinical results), no ankle with a fair or poor reduction achieved a good clinical result. This agrees with the opinion of many authors that it is of paramount importance when dealing with ankle fractures to secure anatomical reduction of the fracture fragments (Lewis and Graham 1940, Burgess 1944, Desenfans and Evrard 1952, Vasi 1957, Braunstein and Wade 1959, Devries 1959, Willenegger 1961, Klossner 1962, Cedell 1967). Of the three patients with a good reduction but a poor clinical result, one had rheumatoid arthritis and two had delayed open treatment after twelve days and three months.

Table VI records the quality of reduction of the fracture fragments achieved by both the open and closed methods of treatment.

These results clearly show that in the present series treatment by open reduction and internal fixation produced a better quality of reduction in more cases than did the closed methods employed.

**TABLE VI**

**Efficacy of Method of Treatment in Achieving Reduction**

<table>
<thead>
<tr>
<th>Quality of reduction</th>
<th>Open treatment</th>
<th>Closed treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>18 (70 per cent)</td>
<td>8 (40 per cent)</td>
</tr>
<tr>
<td>Fair</td>
<td>4 (15 per cent)</td>
<td>—</td>
</tr>
<tr>
<td>Poor</td>
<td>4 (15 per cent)</td>
<td>12 (60 per cent)</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>20</td>
</tr>
</tbody>
</table>

**TABLE VII**

**Influence of Type of Medial Injury on Final Result**

<table>
<thead>
<tr>
<th>Combined result</th>
<th>Ruptured deltoid ligament</th>
<th>Fractured medial malleolus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open treatment</td>
<td>Closed treatment</td>
</tr>
<tr>
<td>Good</td>
<td>6 (1)</td>
<td>4</td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Poor</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Table VII compares the results of treatment by both methods in ankles with a ruptured deltoid ligament, with ankles with a medial malleolar fracture.

The figures in parentheses denote those ankles treated by delayed open methods after failure of closed reduction.

These figures are too small to draw any firm conclusions but it seems that the results of treatment of ankles in which the medial injury was a fractured medial malleolus were not so good (18/30 poor results), especially with closed treatment, as those of treatment of ankles with a ruptured deltoid ligament (4/16 poor results).

*Posterior tibial fracture*—Only one ankle in this series had a posterior tibial fragment which bore more than 25 per cent of the lower tibial articular surface. This fracture was treated by closed reduction with a poor result.

The presence of a large posterior tibial fragment in association with Dupuytren's fracture-dislocation is not common (Klossner 1962, Burwell and Charnley 1965).
Initial displacement—The results have not been analysed with reference to the degree of displacement on the initial radiographs because this is an extremely unstable injury complex which requires a considerable degree of displacement at the moment of injury for its production. It is felt, therefore, that the radiographs normally taken on admission to hospital do not necessarily represent the maximum degree of displacement which has occurred and so constitute an unreliable parameter. Routine stress radiography on admission would be the only method of assessing this but it has not been carried out in this series.

DISCUSSION

Dupuytren’s fracture-dislocation of the ankle joint is generally regarded as an eversion-lateral rotation injury (Lauge-Hansen 1950, Golterman 1964). Some authors believe it also to be produced by pure abduction forces (Ashhurst and Bromer 1922, Kleiger 1956, Phillips and colleagues 1968), but the studies of Grath (1960) on experimental widening of the ankle mortise demonstrate the remarkable resistance of the inferior tibio-fibular ligaments to a force exerted laterally in a coronal plane. Pure abduction normally produces the fracture type illustrated in Figure 2, although the rare variation of the Dupuytren injury where the anterior and posterior inferior tibial tubercles together with the incisura fibularis are avulsed en bloc (Fig. 3), instead of syndesmotic rupture, is probably an abduction injury. In those works which separately analyse the results of the treatment of individual ankle injury types, the Dupuytren fracture-dislocation gives consistently the worst results and so constitutes a major therapeutic problem.

It is clear from Tables IV and V in this series that production and maintenance of an anatomical reduction
of the fracture fragments give the best chance of achieving a good final result. This should be the prime aim of treatment of this, and probably every, type of ankle injury.

Table VI demonstrates that in this series this ideal has been more frequently realised by the use of operative reduction and internal fixation than by the closed methods used. Biström (1952) reported that in only half his cases of this injury treated conservatively was a good reduction achieved. It seems, therefore, that the treatment of choice is open reduction and internal fixation.

If the medial injury is a fracture of the medial malleolus it should be screwed firmly after precise anatomical reduction. In the event of the medial malleolar fragment being too small to drill and screw without fear of its comminution, a useful method of fixation is that described by Weber and Vasey in 1963 (Fig. 4).

If the medial injury is a rupture of the deltoid ligament many surgeons attempt to suture this with expectation of increasing the stability of the repair (Dziob 1956, Braunstein and Wade 1959, Frankel and colleagues 1963, Crabbe 1969) but others maintain that this procedure is of no practical value (Staples 1960, Kleiger 1961, Monk 1969). In all such cases, however, where full closure of the medial malleo-talar space cannot be achieved, soft-tissue interposition—either deltoid ligament or tibialis posterior tendon (Lee and Horan 1943, Coonrad and Bugg 1954)—must be assumed and a medial exploration performed.

This series leaves unanswered the vexed question of whether or not it is harmful to insert a screw across from the fibula into the tibia across the syndesmosis. Twenty-three patients had a transverse or oblique fibulo-tibial screw fixation of the syndesmosis, all but one having the screw removed at intervals varying from eight to fourteen weeks after injury. One patient retained the screw in the fibula and tibia for three and a half years after injury and had no complaints whatsoever; the radiograph showed evidence of loosening of the screw in the fibula (Fig. 5).

None of the patients had synostosis of the inferior tibio-fibular joint. Grath (1960) has shown that screw fixation of the syndesmosis, or even the abolition of
its normally small range of movement by synostosis, does not cause symptoms in the vast majority of cases. This view is supported by many workers (Lee and Horan 1943, Mullins and Sallis 1958, Smith 1963, Golterman 1964), although a number advocate removal of fibulo-tibial fixations after fracture union (Braunstein and Wade 1959, Hodgkinson 1967). It seems, therefore, that if it is necessary in order to secure and maintain anatomical reduction of the fibula in the incisura fibularis, it is reasonable to insert a screw across the syndesmosis. It is, however, probably prudent to remove the screw at a later date.

Close and Inman (1952) and Grath (1960) have demonstrated that with an intact medial joint complex, even after excision of the lower fibula, more than 2 millimetres of lateral shift of the talus is not possible, and so in those cases of Dupuytren’s fracture-dislocation of the ankle in which a large medial malleolar fragment has been securely fixed back into position, the need for screwing of the syndesmosis is lessened, especially if there are other contra-indications such as lateral skin damage or a worsening general condition of the patient. The author firmly believes that a prerequisite of transverse fibulo-tibial fixation in this injury is open reduction and, if necessary, internal fixation of the fibular fracture (Denham 1964). It is particularly important to avoid shortening at the fibular fracture site because, as the lateral malleolus is normally in a position of 15 to 20 degrees of valgus relative to the fibular shaft, this shortening would result in widening of the ankle mortise (Fig. 6).

**SUMMARY**

1. A retrospective clinical and radiological study has been undertaken of forty-six cases of closed Dupuytren fracture-dislocation of the ankle joint in adults.
2. The final results are analysed with reference to the methods of treatment employed.
3. The problems of this injury are discussed referring both to the results of this investigation and to the past literature.

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**REFERENCES**


THE TREATMENT OF DUPUYTREN'S FRACTURE-DISLOCATION OF THE ANKLE