A PROSPECTIVE TRIAL COMPARING OPERATIVE AND MANIPULATIVE TREATMENT OF ANKLE FRACTURES

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A series of 42 ankle fractures have been randomised into two groups respectively undergoing either open reduction and internal fixation or manipulative reduction and plaster. Their progress after removal of all external splintage has been followed using simple gait analysis techniques. There appears to be no difference in the outcome of treatment of the two groups in the early recovery period (up to 20 weeks).

Ankle injuries are common; most resolve satisfactorily and few patients return with late sequelae, irrespective of the method of treatment. A small number of patients, however, do have significant late problems including osteoarthritis of the ankle and others have short-term problems, mainly discomfort and stiffness.

In the past few years techniques of internal fixation have improved and become widely available, but the availability of a good technique does not, in itself, justify its use. Ankle fractures are now widely treated by elective internal fixation, based on the philosophy that accurate restoration of anatomy must result in perfect return of function. There is no direct evidence to support this contention, although there are many papers providing data which imply that internal fixation may be superior.

It is helpful to have a simple objective measure of ankle function which correlates well with the patient's symptoms. In the present study the function of the ankle has been assessed by measurement of the range of ankle movement during weight-bearing and the position of the foot during walking. An earlier three-year follow-up of 54 ankle fractures, treated by either open reduction and internal fixation or by manipulation and plaster, showed a close correlation between, on the one hand, the loss of weight-bearing range of movement and the angle the foot makes with the ground during walking and, on the other hand, the patient's symptoms of pain and stiffness (Rowley, Norris and Duckworth 1983).

Accepting this correlation, these simple objective investigations have been used in a randomised trial of a series of ankle fractures, comparing the short-term results of open reduction and internal fixation with those of manipulative reduction and plaster immobilisation.

TECHNIQUE OF ASSESSMENT

Range of movement. Weight-bearing range of movement was measured using the moving platform shown in Figures 1 and 2. Non-weight-bearing goniometric measurements were avoided for two reasons: (a) the ankle functions as a weight-bearing joint and so static, weight-free movement is not necessarily relevant; and (b) it is difficult to take non-weight-bearing measurements of ankle range with a goniometer, and these are difficult to interpret, because of distortions produced by forefoot and subtalar movement (Figs 3 and 4). Measurements of the range of ankle movement were recorded as the difference in degrees between the affected and unaffected sides.

Simple gait parameters. The patient was asked to walk barefoot along a 5 m sheet of black Neoprene, the first metre of which was impregnated with talcum powder (Figs 5 and 6). From the footprints it was possible to measure accurately the angle which the foot made relative to the line of progression (Fig. 7).

CLINICAL MATERIAL

Forty-two consecutive patients, aged between 16 and 70, were entered into the trial. They had all sustained displaced ankle fractures requiring reduction and admission to hospital. With Ethical Committee approval, they were randomised into two treatment cohorts according to the last digit of their Accident and Emergency number.

(a) Patients with a last digit of zero or an odd number underwent manipulation under general anaesthesia. The position of the fracture was subsequently maintained in a long-leg plaster for six weeks and early weight-bearing was encouraged. If manipulation was not successful they underwent immediate open reduction and internal fixation. The intention was to handle the data from this latter group separately, but this secondary treatment was only necessary for two fractures.

The criteria of a good reduction were defined as the correction of talar shift on the anterolateral radiograph and of posterior talar subluxation on the lateral film. On
Device for measuring weight-bearing ankle movement. The lateral malleolus must be positioned opposite the null point of the goniometer and the limb must be perpendicular to the ground.

This illustrates the difficulties in obtaining repeatable measurements of non-weight-bearing movements of the ankle. Both pictures show attempts to measure plantar flexion but in the second picture an alteration in foot posture gives a misleading result.

Figure 5 - A patient walking down the Neoprene sheet after the feet have been impregnated with talcum powder. Figure 6 - Detail of a footprint shows that the impression is well-defined; the cross-markings on the Neoprene act as handy reference points. Figure 7 - A diagram of footsteps recorded on the walkway illustrating the points from which the measurements were made. The outer border of the foot was chosen because it left a consistently clear impression.
In both views, the fibula had to be fully corrected in terms of rotation and length. The medial malleolus had to have a smooth articular profile, although a small step on its medial aspect was acceptable.

Further radiographs were taken at one and two weeks from injury; if there was a significant loss of position the patient was re-admitted and open reduction and internal fixation carried out. Again, the intention was to handle the data from this group separately in the subsequent analysis.

(b) Patients with even digits underwent open reduction and internal fixation, under general anaesthesia, using the standard AO technique (Müller et al. 1979), fixing the fibula with compression screws and a buttress plate, and the medial malleolus with screws or tension bands according to the fragment size. No attempt was made to institute any ligamentous repair. After fixation, the limb was placed in a below-knee backslab; early active movement was started on the first day after operation and continued for five days until a reasonable range of ankle movement was established. The ankle was then placed in a below-knee plaster for six weeks and early weight-bearing was encouraged. The criteria for a good reduction were the same as with closed treatment.

At six weeks patients in both cohorts were mobilised out of plaster, and weight-bearing was encouraged as soon as possible. No formal physiotherapy was offered. At eight weeks from injury or following weight-bearing, whichever was the later, the tests of function were performed.

RESULTS

Forty-two patients entered the trial, 20 of whom underwent primary internal fixation. The remaining 22 underwent manipulation under anaesthesia and, of these, two required open reduction. In view of the fact that there were only two failures these have been excluded from further analysis except to emphasise that they remain, per se, failures of manipulative treatment.

The remaining 40 patients underwent gait analysis and measurement of weight-bearing range of movement. The distribution of fracture-type between the two groups was similar (Fig. 8). The fractures have been classified according to the height of the fibular fracture, which is much simpler than the Lauge–Hansen system.

The time to normal weight-bearing (Fig. 9) is an expression of the general rate of recovery and, clearly, meaningful gait tests are not possible any earlier. Once weight-bearing had been established then the rate of return of the normal foot angle and range of dorsiflexion as compared to the normal side was measured for each group (Figs 10 and 11).

It can be seen that, in general, patients with manipulated fractures were able to bear weight earlier and also
regained normal movements and foot position sooner than the operated group. At 20 weeks from injury (the end of the trial period) more of the manipulated group than of the operated group were back to normal. Beyond 20 weeks poor patient compliance made longer follow-up impracticable.

**DISCUSSION**

The results of this study bring into question a number of well-accepted beliefs concerning the assessment and treatment of ankle injuries. The scale of this prospective trial is relatively small, mainly because of the large amount of work involved in the gait analysis. The follow-up is as yet short because the principal aim of the study was to assess the rate of recovery in the early weeks after removal of splintage.

The prospective trial demonstrates that if a good reduction can be achieved and maintained then closed treatment is as good as operative treatment in the short term and, indeed, seemed to result in a quicker return to normal gait.

The operated group were treated according to a generally accepted regime of delaying the application of plaster until after a reasonable non-weight-bearing range of movement had been regained. This delay did not seem to confer any advantage and the results must call this practice into question. It is a very expensive addition to operative treatment if patients are retained in hospital solely for this purpose. Although not the prime aim of this trial, this observation seems worthy of further study.

In this controlled trial there were only two failures of manipulation which probably reflects the expertise of the authors in manipulative techniques. However, the results do suggest that a high standard of closed manipulation is possible and, in particular, if fibular length and rotation can be maintained then results at least as good as those obtained by open reduction can be achieved. In the short term, recovery is faster after manipulation and it remains to be seen whether at longer follow-up the advantage is preserved. The prospective trial will continue in order to assess whether, in the long-term, degenerative arthritis develops.

Most of these observations depend on an acceptance of the simple techniques we used in assessing the function of the ankle during rehabilitation after the fracture. There is no standard scoring system yet established and much of the confusion in management of ankle fractures arises from the lack of an agreed method of assessment. The method described here has been established as a result of the study of a large number of patients, comparing their symptoms with various aspects of gait. The parameters of (a) the range of dorsiflexion and (b) the foot angle relative to the line of progression, were those found to correlate best with symptoms in patients with good and bad results, irrespective of the method of treatment.

It is possible to speculate why loss of dorsiflexion is associated with a tendency to walk with the foot turned outwards. Mann (1985) has shown that there are approximately 20° of dorsiflexion and 45° of plantarflexion available at the ankle, but that proportionately much more dorsiflexion than plantarflexion is actually used during walking. Possibly, therefore, even small decreases in the range of dorsiflexion will affect gait significantly, whereas much more plantarflexion might be lost without any need for compensation.

The key to understanding function in this region lies in appreciating that the ankle joint normally functions in close association with the subtalar joint. Together these two structures have aptly been termed a torque converter (Hicks 1953). They convert forces axially generated at the limb girdles into horizontally orientated forces that act about the foot, so obviating any need for the body to pivot round during gait.

Wright, Desai and Henderson (1964) have demonstrated that normal individuals walking with a consciously out-turned gait generate more dorsiflexion and plantarflexion at the subtalar joint than during normal walking. It may be that by turning the foot out the ankle becomes, to some extent, isolated and so is required to move less and the subtalar joint proportionately more, so making walking less painful. The explanation may be more straightforward than this: the out-turned foot may simply be acting as a pivot over which the body may pass with the ankle/subtalar complex held completely rigid.

There were no complications in this relatively small operative series, but others (Beauchamp, Clay and Thexton 1983) report significant problems, particularly in the elderly. This also seems to be a reason for preferring manipulative treatment. Clearly there will be fractures that will require fixation if reduction cannot be achieved or maintained. However, from this series, there is no prima facie case to be made for electing to fix fractures about the ankle without a trial of conservative treatment.

At this stage the trial has only tested the rate of recovery from injury in the two treatment groups. It remains to be seen whether fixation offers any long-term advantages in reducing the incidence of late pain, stiffness and arthritis.

**REFERENCES**


