ARTHROGRAPHY IN RECENT INJURIES OF THE
LIGAMENTS OF THE ANKLE

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There is no satisfactory definition of "sprained ankle". This study attempts to correlate
the results of arthrography and plain radiography under stress with the findings at surgical
exploration of injuries to the ligaments of the ankle.

Twenty-one patients between the ages of sixteen and forty-five years, presenting
consecutively at the Manchester Royal Infirmary with injuries of the ankle ligaments sustained
within the preceding twenty-four hours, were studied. All showed bruising, swelling and
tenderness around the ankle, but no fracture was seen in antero-posterior or lateral radiographs.

In all cases, under general anaesthesia, radiographs were taken of the affected ankle under
strain, the direction of the strain applied being indicated by the history of the injury and the
clinical findings. In the cases with lateral injuries, inversion strain was applied with the ankle
in plantar-flexion. Seven to ten millilitres of 25 per cent Hypaque were then injected into
the ankle, under image intensification radiographic control. If significant talar tilt or leakage
of the fluid out of the ankle at an abnormal site was demonstrated, the ankle was explored
surgically on the side indicated. The findings are shown in Table I.

The angle of talar tilt was measured by the method of Rubin and Witten (1960). Observer
error was tested by having independent measurements of the tilt angle made by other members
of the orthopaedic department. Measurements on any one film showed a variation of within
one degree. We were able to show, however, that different observers could produce widely
differing angles of talar tilt in the same patient. The normal anatomy of the lateral ligament
complex is illustrated in Figure 1.

We accepted the finding of a talar tilt of 5 degrees or less on inversion strain radiography
as being within normal limits (Lee 1957, Freeman 1965). Only three patients showed a tilt
of less than 6 degrees. In one patient (Case 9) a tilt of 4 degrees was demonstrated, and on
arthrography there was lateral leakage of opaque fluid (Fig. 2). Exploration was not done
because of the minor degree of the tilt. Another patient (Case 14) showed interosseous leakage
(Fig. 3) but a tilt of only 3 degrees, and no widening of the ankle mortise on straining; this
ankle was not explored. A third patient (Case 16) had no demonstrable tilting of the talus,
but arthrography showed leakage of contrast medium medially and in the interosseous space
(Fig. 4). The strain views had shown rupture of the inferior tibio-fibular ligament, with marked
widening of the interval between the talus and medial malleolus (Fig. 5). In this case
arthrography confirmed the expected rupture of the medial ligament, which was repaired
surgically.

Another patient (Case 19) showed 8 degrees of tilt and marked widening of the medial
talo-malleolar interval (Fig. 6). Arthrography showed rupture of the inferior tibio-fibular
ligament but an intact medial ligament (Fig. 7). The diastasis in this case was treated by
transfixion with a long screw.

CORRELATION OF ANGLE OF TALAR TILT WITH ARTHROGRAPHY
AND FINDINGS AT OPERATION

Leonard (1949) demonstrated that, in dissected specimens, section of the calcaneo-fibular
ligament alone permitted only very slight tilt, especially if inversion was tested while the ankle
was held in the neutral position. Section of the anterior talo-fibular band alone permitted a greater angle of tilt, especially with the foot held in equinus. Section of both components allowed marked tilting of the talus. We carried out dissections on four cadaveric ankles and

**TABLE I**  
**ARTHROGRAPHIC AND SURGICAL FINDINGS IN TWENTY-ONE CASES**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Side</th>
<th>Tilt (degrees)</th>
<th>Arthrograph leakage</th>
<th>Surgical findings: components ruptured</th>
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<tr>
<td>1</td>
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<td>21</td>
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<tr>
<td>9</td>
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<td>Not explored</td>
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<td>Anterior talo-fibular and calcaneo-fibular</td>
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confirmed Leonard's findings in all respects. We were unable to show that the posterior talo-fibular ligament had any limiting function in inversion strains of the ankle.

Bonnin (1949) stated that tilting of the talus of up to 15 degrees indicates rupture of the anterior talo-fibular ligament alone, that tilting from 15 to 30 degrees indicates rupture of
anterior talo-fibular and calcaneo-fibular ligaments, and that tilting of 30 degrees and over indicates rupture of anterior talo-fibular, calcaneo-fibular and posterior talo-fibular ligaments. Our results do not support these views.

Broström (1964) and Broström, Liljedahl and Lindvall (1965) showed that failure of injected contrast medium to enter the peroneal tendon sheaths indicates that the calcaneo-fibular part of the ligamentous complex is intact, but they suggested that blood clot could prevent the escape of fluid, giving the possibility of misleading results if arthrography was delayed. They also considered that rupture of the calcaneo-fibular ligament must necessarily involve the peroneal tendon sheath. Our studies show that this is not necessarily the case, and support the findings of Mehrez and El Geneidy (1970) that communication between the ankle joint and related tendon sheaths is to be found in a substantial proportion of uninjured ankles.

Rubin and Witten (1960) found that 56 per cent of normal ankles showed tilting of the talus on inversion strain of between 3 and 23 degrees, whereas of “sprained” ankles, 74 per cent had a talar tilt angle of between 3 and 17 degrees. They concluded that an angle less than 23 degrees did not necessarily indicate rupture of the fibular collateral ligament. Our findings led us to the conclusion that there is no angle of tilt below which the fibular collateral ligament must necessarily be intact, subject only to the findings of Lee (1957) and Freeman (1965).

Of the twenty-one patients who underwent arthrography, seventeen showed leakage of contrast medium on the lateral side of the ankle; three showed interosseous leakage with, in one of them, medial leakage in addition; and one (Case 8) showed no leakage.

FIG. 2—Arthrograph showing lateral leakage of contrast medium. Figure 3—Arthrograph showing interosseous leakage of contrast medium.
Seventeen ankles were explored on the lateral side, including one (Case 8) which showed 20 degrees of talar tilt but no leakage on arthrography. This man was known to have had a previous ankle injury although presenting with a fresh injury to the same joint; he gave a history of persistent and frequent instability. At operation, an old rupture of both anterior
talo-fibular and calcaneo-fibular components was found and repaired. His ankle has since been stable.

In the remaining sixteen cases, rupture of the anterior talo-fibular ligament was found in six and of the calcaneo-fibular ligament as well in ten. Those with anterior talo-fibular
ligament rupture alone showed a talar tilt angle under stress of from 8 to 21 degrees. On arthrography, these cases all showed lateral leakage, with leakage into the peroneal tendon sheath in two and into the posterior subtalar joint in one. Those with rupture of the anterior talo-fibular and calcaneo-fibular ligaments showed tilt under stress of from 7 to 34 degrees. On arthrography, all showed lateral leakage, eight showed leakage into the peroneal tendon sheath and three showed leakage into the subtalar joint. Leakage in all three regions was seen in two cases in this group, and one showed lateral leakage only.

Although the greatest angle of tilt measured, 34 degrees, occurred in a patient in whom both components of the lateral ligament complex were disrupted, we could not confirm Bonnin’s view (1949) that an angle of more than 15 degrees meant that both were torn, or that an angle of 15 degrees or less meant that only the anterior band was torn. Four cases in whom the anterior talo-fibular and calcaneo-fibular ligaments were torn showed an angle of tilt of 15 degrees or less, and two in whom only the anterior tibio-fibular ligament was torn showed an angle of tilt of more than 15 degrees.

In one patient (Case 9) in whom a tilt of only 4 degrees could be produced on stress radiography, arthrography showed lateral leakage of contrast medium in a pattern in no way different from that of other cases in which exploration revealed extensive tearing of ligaments and in which stress radiography revealed much more significant instability.

We were unable to confirm the findings of Broström (1964) and of Broström et al. (1965) that leakage into the peroneal tendon sheath must necessarily indicate rupture of the calcaneo-fibular ligament. In two patients (Cases 5 and 18) in whom this ligament was demonstrably ruptured, such leakage did not occur, and in two patients (Cases 7 and 13) in whom it was not ruptured, leakage was demonstrated.

Ashhurst and Bromer (1922) stated that the radiographic appearance of a space between the tibia and fibula at the level of the inferior tibio-fibular joint in an antero-posterior radiograph signifies diastasis of that joint. They did not state, however, that ligamentous rupture at that level need not show such a space. Arthrography was able to demonstrate such a lesion in three of our cases when plain radiography did not.

CONCLUSION

Although the series is small, we believe that it shows that the appearances at arthrography are not sufficiently specific to justify the use of this technique in elucidating injury to the lateral ligament complex. Although leakage, and therefore ligamentous damage, is easily shown in such cases, the extent of the damage is not revealed, the contrast medium often giving the appearance of leaking from a pinhole when an extensive rent is, in fact, present. We suggest that this is not necessarily because blood clot is present, but to the tendency of the fluid to leak at the weakest point of the lesion, and, in accordance with the principles of fluidics, to maintain the pattern of flow once established.

In our opinion, arthrography of the ankle is most useful in demonstrating inferior tibio-fibular damage and the damage to the medial ligament which, in the absence of fracture, may be associated with it.

SUMMARY

1. A series of patients with recent ligamentous injuries of the ankle is presented. Stress radiography and arthrography were carried out in all cases, with surgical exploration where indicated. The findings are correlated.
2. Both stress radiography and arthrography are unreliable in the diagnosis of injuries to the “lateral ligament” of the ankle.
3. Arthrography may be useful in the demonstration of injury of the inferior tibio-fibular joint and of the medial ligament.
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REFERENCES


