INSTABILITY OF THE ANKLE AFTER INJURY TO THE LATERAL LIGAMENT

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Ligamentous instability of the ankle joint can be confirmed by radiographs taken in two planes. The place of the anteroposterior varus stress view is established, but the lateral view which shows anterior subluxation of the talus is frequently omitted. The anatomical significance of the two stress views has been determined by dividing different components of the lateral ligament of 20 cadaveric ankles and noting the subluxation that resulted from these procedures. A clinical assessment was then made of 54 ankles (46 patients) with radiological evidence of instability when subjected to varus and anterior stress. Anterior subluxation was found to be considerably more common than varus tilt, and it is therefore suggested that the lateral stress view should be an essential part of the investigation of the unstable ankle.

Acute inversion of the ankle commonly results in damage to the lateral ligament. First aid treatment only is required for a simple sprain, but this must be distinguished from the more serious problem of a rupture since failure to do so may cause a torn ligament to heal with lengthening. The penalty for such an error can be an unstable ankle (Ruth 1961).

Figure 1—Standard varus stress view with talar tilt. Figure 2—Lateral stress view demonstrating anterior subluxation of the talus. A gap of more than six millimetres between the posterior articular margin of the tibia and the dome of the talus was significant.

When either acute or chronic instability is suspected it is standard practice to take a varus stress view of the ankle (Fig. 1). Significant talar tilt is correctly taken to indicate rupture of the lateral ligament, but it is wrong to assume that when the varus stress view is normal the ankle is stable. Before reaching that conclusion the surgeon must exclude instability in the anteroposterior plane with a lateral stress view (Fig. 2).

The concept of anterior instability of the ankle with the talus subluxating forwards out of the mortice is not new. Lindstrand (1977) has summarised the details of an anterior draw sign for the ankle, akin to the test for anterior cruciate instability at the knee. We have not

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always found this physical sign easy to interpret unless the instability is marked, and rely more on radiological evidence as first described by Pennal (1943). In this paper we emphasise the importance of the lateral view in the assessment of instability of the ankle and relate the radiological findings to the anatomy of injuries to the lateral ligament.

ANATOMICAL CONSIDERATIONS

The lateral ligament of the ankle consists of three distinct bands (Fig. 3). The anterior talofibular ligament runs forwards almost horizontally to the neck of the talus; the rounded calcaneofibular ligament runs downwards and slightly backwards to the lateral side of the os calcis; and the posterior talofibular ligament runs downwards and medially behind the ankle joint to be inserted into the posterior tubercle of the talus.

One of the authors (AMJ) examined 20 cadaveric ankles in order to determine the functional instability resulting from division of the different components of the lateral ligament. The ligaments were divided both individually and in combination. The ankles were then examined for instability. The findings were in agreement with the anatomical observations of Leonard (1949), Anderson, Lecocq and Lecocq (1952), Chrisman and Snook (1969) and Dietschi and Zollinger (1977). If the lateral ligament complex was intact, anterior and varus stressing of the ankle did not produce subluxation except in the presence of idiopathic laxity of the joint. Division of the anterior talofibular ligament alone did allow anterior subluxation, the talus rotating medially as it came out of the mortice; the ankle remained stable to varus stress except at the extreme of plantar flexion when minimal talar tilt was apparent. When the calcaneofibular ligament was divided in isolation, a minor degree of varus instability could be demonstrated when the foot was plantigrade, but anterior subluxation did not occur. An ankle in which both the anterior talofibular and the calcaneofibular ligaments had been divided demonstrated marked talar tilt and anterior subluxation when the foot was plantigrade or in equinus.

A common injury to the ankle is that caused by forced inversion of the plantar-flexed foot (Coltart 1951; Anderson and Lecocq 1954; Burch 1977; Spier and Henkemeyer 1977). The first ligament to rupture is the anterior talofibular ligament and at this stage only anterior instability can be demonstrated. With increasing force the rupture extends both posteriorly to involve the calcaneofibular ligament and medially across the anterior capsule towards the deltoid ligament (Figs 4 and 5). Once this has occurred the talus can be seen to subluxate forwards, rotate medially and tilt into varus as a synchronised movement if the mechanism of injury is repeated. Both varus and anterior instability will be
apparent. It should be noted that the two types of instability are not separate entities but different views of the same subluxation as seen from the front and from the side. From a clinical point of view, if the plantar flexion element of the injury is excessive and the rupture has extended the whole way across the anterior capsule to involve the anterior fibres of the deltoid ligament, swelling and tenderness at this site indicate the extent of injury (Bonnin 1944).

![Fig. 6](image)

A pure adduction can result in an isolated rupture of the calcaneofibular ligament.

Much less commonly the plantigrade foot may be subjected to an adduction force which results in an isolated rupture of the calcaneofibular ligament (Francillon 1962; Fig. 6). In such a case the patient would have varus instability alone. Colton (1976) pointed out that an avulsion fracture of the lateral malleolus was the usual result of this injury.

MATERIAL AND METHODS

Forty-six patients with radiological evidence of instability of the ankle have been studied in order to assess the importance of the anterior stress view in addition to the standard one with varus stress. There were 28 males and 18 females and the average age of the patients was 30 years (range 12 to 69 years). The instability was demonstrated in 23 patients immediately after injury and in an equal number who were being investigated for the symptoms of recurrent sprain, pain and instability (Table 1). In eight of the patients with chronic instability both ankles were involved so that there was a total of 54 unstable ankles.

The radiographic techniques for demonstrating instability of the ankle are of some importance. In all the acute cases a local anaesthetic was infiltrated around the injured ligaments to eliminate pain when the ankle was subjected to stress. Where possible, a radiograph of the normal ankle was taken as a control. The varus stress view was obtained by forcibly inverting the foot in approximately 20 degrees of plantar flexion; the leg was medially rotated 20 degrees so that the radiograph was taken at right angles to the bimalleolar axis. The anterior stress view was taken with a horizontal beam, the patient being seated and resting his heel on a small sandbag on the edge of the x-ray table (Fig. 7). For a true lateral view of the talus in the mortice the leg again had to be medially rotated 20 degrees. In this position the foot came to lie in slight equinus and inversion (Fig. 8). The knee was extended since in practice we have not found it necessary to flex the knee and relax the gastrocnemius muscle in order to demonstrate talus subluxation. Downward pressure was then applied to the lower end of the tibia using a lead-gloved hand or sandbags weighing approximately 15 kilograms. The radiograph was taken after maintaining the pressure for at least 30 seconds. This technique does not require special apparatus and can therefore be performed in any radiographic department.

Significant varus laxity was diagnosed when the talar tilt was in excess of six degrees. We used the criteria of Noesberger, Hachenbruch and Muller (1977) for diagnosing anterior subluxation of the talus: a gap of more than six millimetres between the posterior lip of the tibia and the articular surface of the talus or a difference of more than three millimetres in this measurement for each ankle was taken to be abnormal (Fig. 2).

RESULTS

The radiological assessments of the acute and chronic groups are shown in Table II. On the basis of our anatomical studies, the presence of anterior instability alone has been taken to indicate laxity or rupture of the anterior talofibular ligament. When combined with

![Fig. 7](image)

A simple method of obtaining the lateral stress radiograph without special equipment. Note the position of the foot (Fig. 8).

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varus instability the damage was more severe and extended backwards to involve the calcaneofibular ligament as well. The six patients with varus instability alone had probably sustained the less common injury caused by adduction of the plantigrade foot in which the calcaneofibular ligament is ruptured in isolation.

The incidence of anterior subluxation alone seen in 26 ankles (10 acute; 16 chronic) was much greater than that of varus instability alone, which was present in only six ankles (five acute; one chronic). Furthermore, if we had relied only on varus stress views for the diagnosis of ligamentous instability 26 cases (48 per cent) would have been missed. Conversely, if anterior stress views alone had been used only six cases (11 per cent) would have been undiagnosed. The figures indicate that while both stress views are important the lateral radiograph is the more important of the two.

Thirty-two patients were considered to have a normal foot on the opposite side which could be used as a control. The radiographs of five of these feet suggested ligamentous laxity of a lesser degree than that in the symptomatic ankle (one varus; three varus plus anterior; one anterior). These findings emphasise the importance of interpreting the stress views in the light of the clinical findings.

DISCUSSION

Radiography for every case of acute sprain that is seen may not be practical and the severity of injury can often be estimated with confidence after clinical examination alone (Lettin 1963). This attitude does not apply to the patient with symptoms of chronic instability, when failure to take radiographs with varus and anterior stress of the ankle frequently leads to the true nature of the disability being missed. The long-term consequence of untreated chronic instability is degenerative arthritis of the ankle joint (Coltart 1951; Harrington 1979). A recent review of patients submitted to arthrodesis of the ankle revealed that in almost 30 per cent of the patients with post-traumatic osteoarthritis the cause had been an acute injury to a ligament followed by symptoms of recurrent sprains and the ankle giving way (Jackson and Glasgow 1979). If these symptoms had been fully assessed with appropriate stress radiographs, prolonged disability and eventual arthrodesis might have been prevented.

The value of the anterior stress radiograph in the diagnosis of ankle instability has been questioned by Bonnin (1944), by Watson-Jones (1955), who had only ever seen two patients with anterior subluxation of the talus, and by Freeman (1965). Possibly due to the observations of these authors it is common practice in many centres to take only the standard varus stress view when investigating instability. However, Landeros, Frost and Higgins (1968) have emphasised the importance of the view which shows anterior subluxation of the talus. Staples (1975) described the operative findings in 27 cases of acute injury to ligaments, as demonstrated by arthrography, and noted definite abnormal anteroposterior movement of the talus in every case. Our findings suggest that anterior subluxation can be demonstrated more frequently than varus laxity both after acute injury to a ligament and in the patient with chronic instability of the ankle.

Instability of the ankle is a clinical diagnosis based on symptoms of recurrent sprain and instability during activity. This diagnosis should not be made solely from static stress, the basis on which radiography indicates abnormal ligamentous laxity or rupture. The hypermobile ankle may remain asymptomatic unless the age, weight, musculature or activity of the patient is such as to uncover the symptoms of instability to which it is prone. Bonnin (1944), Rubin and Witten (1960) and Inman (1976) all described a variation in the angle of talar tilt in the normal population, but there was no agreement as to the incidence of hypermobility in asymptomatic ankles. Nor was there agreement on the exact angle above which an ankle might be termed hypermobile. We have arbitrarily accepted a talar tilt of more than six degrees as being excessive and a contributory cause of instability in the symptomatic ankle. If we had accepted a higher figure, the number of patients with varus instability would have been reduced. Consequently an even greater dependence would then have been placed on the lateral view in making the diagnosis of ligamentous instability. In addition, a talar tilt of more than six degrees has clinical significance in that it can be reduced or even eliminated by surgical treatment (Chrisman and Snook 1969).

Our anatomical study of the lateral ligament of the ankle demonstrated that when the anterior talofibular ligament is divided, the instability produced is a forward subluxation of the talus in the mortice. We have also indicated the mechanism of the common injury to the lateral ligament which ruptures first the anterior talofibular ligament and, with increasing severity, the calcaneofibular ligament as well. These anatomical observations explain why anterior subluxation was found clinically so much more commonly than varus.
instability in the patients that we studied. For this reason the radiological assessment of instability of the ankle must include views taken in two planes, the anterior stress view being the more important of the two.

We should like to thank the consultant staff of the Royal National Orthopaedic Hospital, The Whittington Hospital, Battle Hospital, Reading, St Mary’s Hospital and University College Hospital for allowing us to review their patients. In particular we are grateful to Dr P. Bretland and the staff of the Radiology Department at The Whittington Hospital for their help with radiological effects of this study. We also wish to express our thanks to Mr E. L. Trickey, Mr J. N. Wilson and Mr H. B. Kemp for their advice in preparing the paper and to Mrs U. Boundy and Mr Terry Davis for the illustrations.

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