INJURIES OF THE TIBIO-FIBULAR LIGAMENTS

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The ligaments that hold together the lower ends of the tibia and fibula are often damaged by forces transmitted through the ankle. These forces may, at the same time, cause fractures of the malleoli or of the fibular shaft and subluxation or dislocation of the ankle. Lesions of the tibio-fibular ligaments may not be recognised because attention is directed towards the bony injury. The objects of this paper are firstly to draw attention to the significance of tibio-fibular ligament injuries, and secondly to suggest a method of establishing the degree to which they have been damaged.

HISTORY

Maisonneuve (1840) was the first to draw attention to lateral rotation of the talus in the ankle mortise as a mechanism of the production of fractures in the region of the ankle. He found that lateral rotation may also cause a fracture in the middle or upper third of the fibula associated with damage to the tibio-fibular ligaments. This injury is still known as the Maisonneuve fracture. His work is especially interesting when we realise that he made these observations about fifty years before the discovery of x-rays.

The anatomy and the effects of isolated sections of the tibio-fibular ligaments have been reported by several workers, especially Close (1956) and Grath (1960). Most of the writers on the clinical syndromes of tibio-fibular ligament damage recommend fixation with screws as the treatment of choice (Alldredge 1940, Lee and Horan 1943, Costigan 1953, and Mullins and Sallis 1958).

Watson-Jones (1955) stressed the relationship of high fracture of the fibula with tibio-fibular and medial ligament injuries and recommended screw fixation combined with a plaster-of-Paris cast as the method of immobilisation.

Bonnin (1957) drew attention to these injuries and to the difficulty in assessing their severity radiologically. He suggested examination under anaesthesia to assess the degree of separation of the lower tibia and fibula.

ANATOMY OF THE TIBIO-FIBULAR LIGAMENTS

These ligaments pass from the lower end of the tibia to the fibula. Their fibres run in the coronal plane and constitute the ligaments of the tibio-fibular syndesmosis. They are a necessary element in the stability of the tibio-fibular mortise (Fig. 1).

Standard textbooks describe three main components of this ligament complex. 1) The anterior tibio-fibular ligament. The fibres of this ligament pass obliquely downwards and laterally from the tibia to the fibula. The lower fibres are more robust than the upper. 2) The interosseous tibio-fibular ligament. This consists of short thick fibres passing directly across from the lateral aspect of the lower tibia to the adjacent medial surface of the lower fibula. 3) The posterior tibio-fibular ligament. The fibres of this ligament pass from the postero-lateral border of the lower tibia to the postero-medial border of the lower fibula. The most inferior fibres of this ligament are stronger and thicker than the upper and their attachment to the tibia extends medially along the posterior edge of the articular surface. These fibres are referred to as the inferior transverse tibio-fibular ligament.
Two facts have emerged from our dissections. Firstly, the height to which the tibio-fibular syndesmosis extends varies greatly in different individuals. It varies in height from about 2 centimetres to about 6 centimetres above the ankle joint. Secondly, the strength of the interosseous ligament varies greatly in different individuals. In some it is tough and fibrous and in others virtually non-existent.

**INJURIES SUSTAINED**

From a study of experimentally produced injuries in amputation specimens and of strain-view radiographs and operation findings in patients we have concluded that two main types of injury occur: 1) tearing of the anterior and interosseous tibio-fibular ligaments ("anterior type") which allows the joint to be opened like the covers of a book, the hinge being the posterior tibio-fibular ligament (Fig. 2); and 2) tearing of the anterior, interosseous and posterior tibio-fibular ligaments ("total type"), which allows the fibula to be abducted.
away from the lower end of the tibia (Fig. 3). In all significant injuries of the tibio-fibular ligaments we have found a fracture of the fibula. This may occur at any point from the upper limit of the inferior tibio-fibular joint to the head of the fibula. There is usually also some damage to the medial side of the ankle joint—either a tear, partial or complete, of the medial ligament, or a fracture of the medial malleolus.

The mechanisms by which these injuries are caused have also been ascertained by experiment and strain-view radiographs. Tear of the anterior fibular ligament is produced, most probably by a lateral rotation strain applied to the ankle, and a total tear of all three ligaments by an abduction strain.

Often there is a fracture of the posterior surface of the tibia—the so-called posterior malleolar fracture. The mechanism of this fracture is uncertain; the fragment is either pulled off by the posterior tibio-fibular ligament or knocked off by the talus at the time of injury (Fig. 4).

**Lateral rotation fractures of lateral malleolus**—So far no mention has been made of the minor damage to the inferior fibres of the anterior tibio-fibular ligament that may accompany the common oblique fracture of the lateral malleolus. This particular ligament injury is insignificant and is usually, quite rightly, disregarded in treatment. The fracture line in the fibula usually passes between the attachments of the anterior and posterior tibio-fibular ligaments and they therefore escape serious injury (Fig. 5).

**CLINICAL PICTURE OF THE TIBIO-FIBULAR LIGAMENT INJURIES**

There may be abduction or lateral rotation deformity of the foot caused by subluxation or dislocation at the ankle joint. Often, however, the displacement has become reduced spontaneously or has been reduced by the first-aid attendants during the application of splintage at the site of the accident. In these cases the only physical signs will be swelling and tenderness over the tibio-fibular ligaments, the fibular fracture site and the medial side of the ankle.

**RADIOLOGICAL FINDINGS**

Conventional antero-posterior and lateral radiographs show the fracture of the fibula, which may be at any level from the top of the inferior tibio-fibular joint upwards. The fracture line is usually oblique in the rotational type of injury (the “ anterior ” type). Damage to the medial side of the ankle may be evident as a fracture of the medial malleolus or widening of the medial joint space of the ankle indicative of medial ligament damage. No reliance should be placed on the finding of an undisplaced ankle joint.

**Strain-view radiographs**—We have found these to be essential for a correct assessment of injuries of the tibio-fibular ligaments in most cases.

**Method**—With the patient anaesthetised, the foot and ankle are placed in the normal plantigrade position, at a right angle to the leg. The x-ray tube is set up as for a conventional antero-posterior radiograph of the ankle. With one hand the operator grasps the tibia to fix it and with the other he subjects the ankle and inferior tibio-fibular joints successively to abduction, adduction and lateral rotation strains. Care must be taken not to dorsiflex or plantarflex the ankle. Antero-posterior radiographs are taken when the greatest displacement had been produced in each direction.
**Interpretation**—If the lower end of the fibula can be abducted away from the lower end of the tibia, all three ligaments have been torn—"total" tibio-fibular ligament tear (Figs. 6 and 7). If the lower end of the fibula cannot be abducted from the lower end of the tibia but can be rotated around its own long axis, as shown on the rotation film, there has been a tear of the anterior and interosseous tibio-fibular ligaments but not of the posterior tibio-fibular ligament ("anterior type" lesion). The lateral rotation film in this case is classical: it shows an anter-posterior projection of the tibia but a lateral projection of the fibula. The lower fibular fragment may also tend to swing behind the tibia (Fig. 8). The presence of a rotatory deformity of the lower fragment may also be recognised by the discrepancy in width of the two fragments at the level of the fibular fracture (Fig. 9).
TREATMENT

If it is established that there has been either an anterior tear or a total tear of the tibio-fibular ligaments, one's natural inclination is to fix the lower end of the fibula to the tibia by means of screws as suggested by Alldredge (1940). However, this is by no means always necessary; if the ankle can be held in its normal position by external splintage, the inferior tibio-fibular joint will also be held immobilised. For external splintage of these joints to be satisfactory it is necessary that the ankle is stable to adduction straining—that is, that the medial malleolus is intact. If this is so, these injuries may be satisfactorily treated by immobilisation in plaster (Figs. 10 to 12). The plaster should be retained until the ankle and subtalar joints are once again stable. It may take eight or ten weeks for the fractures to unite and the ligaments to undergo repair.

It is particularly important that the plaster should protect the ligaments against displacement by lateral rotation strains. For this reason we use a plaster which extends from toes to groin and which holds the knee flexed at least by 20 degrees. This ensures that any rotational force applied to the limb will act at the hip joint and not at the site of injury.
Figure 10—Conventional antero-posterior and lateral radiographs showing a fracture of the fibula above the inferior tibio-fibular joint and a "posterior malleolar" fracture of the tibia. Figure 11—Abduction and lateral rotation strain-view radiographs showing rotation of the inferior fragment of the fibula indicating "anterior type" of tibio-fibular ligament injury. Figure 12—The same ankle a year later. Treatment was by manipulative reduction and immobilisation in an above-knee plaster.
If the medial malleolus is fractured and the ankle is unstable to adduction straining, operation is necessary. Our practice is to reduce the medial malleolus and to immobilise it by means of a single oblique screw and then to fix the inferior tibio-fibular joint by means of two horizontal screws. It would also be justifiable to fix the medial malleolus with a screw and then to rely on a plaster-of-Paris cast to hold the ankle and inferior tibio-fibular joints in position.

**POST-OPERATIVE CARE**

When both the medial malleolus and the inferior tibio-fibular joint have been fixed by screws, a pressure dressing is applied at the conclusion of the operation and the foot and ankle are immobilised on a right-angled foot splint. The patient is kept in bed for two weeks, at the end of which the sutures are removed and a full leg plaster applied. The patient is then allowed to walk with crutches. The plaster is retained for eight to ten weeks.
OTHER INDICATIONS FOR OPERATION

Soft-tissue interposition may prevent adequate reduction of the displacement of the ankle and may necessitate operation. For example, the tendon of the tibialis posterior muscle may come to lie lateral to the medial malleolus in the ankle joint. Sometimes the posterior marginal fragment (the "posterior malleolus") may include a significant part of the inferior articular surface of the tibia and may necessitate open reduction and fixation. We favour operating with these patients in the prone position and fixing the fragment with a screw passed from behind forwards (Figs. 13 and 14).

Some surgeons favour operative repair of tears of the medial ligament of the ankle. We do not feel that these tears, of themselves, constitute an indication for open reduction but prefer to immobilise the ankle in a reduced position and allow spontaneous repair to occur.

SUMMARY

1. Attention is drawn to lesions of the inferior tibio-fibular ligaments. Two main types are described: the anterior type and the total type.
2. The clinical and radiological characteristics are described.
3. The value of strain-view radiography is stressed.
4. A plan of treatment is suggested.

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REFERENCES


