ARTHRODESIS OF THE ANKLE JOINT

Experiences with the Transfibular Approach

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The transfibular approach for arthrodesis of the ankle joint has in recent years been adopted as the standard procedure at a number of orthopaedic centres. At the London Hospital it has been employed in every case requiring ankle fusion during the last four years. The time may thus be opportune to record the technique of the operation and to form an estimate of its value.*

TECHNIQUE OF TRANSFIBULAR ARTHRODESIS

An incision, five inches in length, is made over the lower third of the subcutaneous surface of the fibula (Fig. 1). It is prolonged downwards to a point half an inch distal to the tip of the lateral malleolus. The fibula is exposed subperiosteally and divided three to four inches from its lower end (Fig. 2). The distal fragment is removed and prepared for use as an onlay graft by splitting off the inner cortex throughout its length. After stripping ligamentous tissues from the lateral aspect of the lower end of the tibia the ankle joint is clearly exposed in the lower half of the wound. The articular cartilage of both tibia and talus is then erased down to vascular bone, working from the lateral side with a gouge or osteotome. Trimming of the bones is carried out in such a manner that when the intervening gap is closed the foot rests in the optimal plantigrade position with a few degrees of equinus. Small spaces remaining between the bone ends are filled with cancellous bone chips. A bed is prepared for the fibular graft by freshening the lateral aspect of the tibia and astragalus (Fig. 3). The cancellous aspect of the graft is applied to the graft-bed, bridging the joint space. The graft is secured by three screws, two of which grip the tibia and one the astragalus (Fig. 4). The wound is closed and a plaster is applied. Weight-bearing in plaster is encouraged within a few weeks of operation. After twelve weeks, the plaster is removed for clinical and radiographic tests of fusion.

ANALYSIS OF THE RESULTS

Thirty cases have been studied. In twenty-eight there was successful primary fusion in an average period of thirteen weeks. Illustrative series of radiographs in typical cases are shown in Figs. 5 to 8.

[* The technique of arthrodesis of the ankle joint by the transfibular approach, with grafting of the fibula to the tibia and talus (or in the case of tibio-calcaneal fusion, with grafting of the fibula to the tibia, talus, and calcaneus) was developed six or eight years ago in the orthopaedic service of the Royal Air Force. That service was characterised by a magnificent team spirit in which exchange of ideas was so constant, that to this day none of us knows with certainty who first conceived the brilliant idea of this simple and effective operation. Neither does any one of us believe that it is important to attach the name of a single surgeon to a particular operation. But if credit must be attached it should be shared by James C. Scott of Oxford, James Armstrong of London, and John Crawford Adams of London, all of whom served as orthopaedic specialists in the Royal Air Force Orthopaedic Service.—EDITOR.]
Technique of transfibular arthrodesis of the ankle joint. A five-inch incision is made over the lower third of the fibula (Fig. 1). The fibula is exposed. It is divided in its lower shaft, and removed (Fig. 2).

Articular cartilage is removed from the joint. The bone spaces are packed with cancellous chips, and the lateral surfaces of the tibia and talus are freshened (Fig. 3). The fibular fragment, after being split to expose its cancellous surface, is screwed in close contact with the tibia and talus (Fig. 4).
Radiograph of old unreduced backward dislocation of the ankle joint.

The joint has been arthrodesed by the transfibular approach, using the lower third of the fibula as an onlay graft.
Another example of incongruity of the ankle joint surfaces due to old fracture-dislocation.

Arthrodeseis has been performed by the trans-fibular approach, the fibular graft being secured in this case by two, instead of three screws.
Disorganisation of an ankle joint after a gunshot wound. Arthrodesis of the subastragaloid joint had already been performed (Fig. 9). Attempted fusion of the ankle joint by means of fibular grafting failed (Fig. 10).

At a second operation rigid immobilisation was secured by means of a three-flanged nail driven across the joint from below (Fig. 11). The nail was removed after fourteen weeks, by which time there was sound fusion (Fig. 12).
In two cases there was failure of fusion and secondary operations were required. These two failures are instructive in that they illustrate important practical considerations.

**Case report**—A man, aged 36 years, was admitted for treatment of a painful and disorganised ankle joint resulting from an old gunshot wound (Fig. 9). Arthrodesis of the subastragaloid joint had previously been performed and there was impairment of mid-tarsal movement. Four months after arthrodesis of the ankle joint there was no radiographic evidence of bone fusion (Fig. 10). At a secondary operation the bone surfaces were freshened, cancellous bone chips were packed around the joint, and a long three-flanged nail was driven up from the lower surface of the os calcis into the tibial shaft (Fig. 11). After immobilisation in plaster for fourteen weeks there was sound bone fusion.

This case illustrates the importance of providing rigid immobilisation after arthrodesis of the ankle joint in patients whose subastragaloid or mid-tarsal joints have previously been fused. The probable cause of failure of primary fusion of the ankle was that rigidity of the subastragaloid joint, and associated stiffness of the mid-tarsal joint, permitted the transmission of slight forefoot movements to the ankle during walking, with consequent shearing strain at the site of arthrodesis. In three subsequent cases in this series, in which subastragaloid fusion had previously been carried out, particular care was taken to prevent shearing movements by applying a closely moulded plaster extending well forward under the forefoot, and by deferring weight-bearing until twelve weeks from the time of operation. These cases showed satisfactory bone fusion on removal of the plaster at the fourteenth week.

The other failure in this series was due to an error of technique.

**Case report**—A female patient weighing sixteen stones (224 pounds) was admitted for treatment of painful osteoarthritis of the ankle resulting from an old fracture with malunion. Arthrodesis was performed but post-operative radiographs showed that the apposition of bone surfaces was poor. The transplanted fibula had not been applied in close apposition to the tibia and talus, and an appreciable gap was obvious in the radiographs. Six months after operation there was no evidence of bone fusion. A secondary operation was performed; the bone ends were freshened and cancellous bone chips were packed firmly between and around the joint surfaces. Satisfactory fusion was then obtained after five months of plaster immobilisation.

There is little doubt that in this case the failure to secure primary fusion was due to inadequate apposition of the bone surfaces. This failure emphasises the importance of careful technique in shaping the bones in such a manner that there is close contact over a wide area. It suggests also the advisability of packing cancellous bone chips firmly around the joint and into any small spaces that may be left between the bones.

**DISCUSSION**

With careful technique the transfibular approach for arthrodesis of the ankle joint can be relied upon. It is a method which has the merit of simplicity. Clear exposure of the articular surfaces is readily obtained. The onlaid fibular graft gives sound stability and affords a scaffolding for the formation of a stout bone bridge across the joint. Close contact between the tibia and astragalus is essential, and the packing of cancellous bone chips around the bones is an advantage.

When arthrodesis of the subastragaloid-mid-tarsal joint has previously been performed, or is performed at the same time, particular care is necessary to ensure that shearing strains are not transmitted from the forefoot. This demands rigid immobilisation. The plaster should extend well forward beneath the forefoot, and weight-bearing should be deferred until ten or twelve weeks after operation. An alternative procedure which gives adequate fixation is the use of a long three-flanged nail driven upwards from the lower surface of the calcaneus into the shaft of the tibia.

**SUMMARY**

The technique of the transfibular approach for arthrodesis of the ankle joint is described. The results of this operation in a series of thirty cases shows that the procedure is reliable if the technique is carried out faithfully. The two cases in which a first operation failed can both be explained by errors of technique or after-treatment.