Ankle Arthrodesis Using an Anterior AO T Plate

SAMEER M. SULLIMAN, M.D., KHALED S. SALAMA, M.D. and MOHAMAD A. RADWAN, M.D.
The Department of Orthopedic Surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt.

Abstract

Fracture-dislocation of the talus is one of the most severe injuries of the ankle. Opinion varies widely regarding the proper treatment of this injury.

We used a surgical technique for ankle arthrodesis using an anterior approach to the ankle and internal fixation with an anteriorly-placed AO T plate. The present study reports the results of tibiotalar arthrodesis with a technique which was developed by the Davey KJ.

Eleven cases were retrospectively studied. The average age was 32 years (range, 26-51 years). Six patients had posttraumatic avascular necrosis; five had neglected fracture-dislocation of the talus.

10 out of eleven of the ankles fused although one patient developed tibial stress fractures. 2 patients had a superficial infection which did not prevent union. The surgical technique is simple, easily reproducible and gives excellent clinical results with a high rate of union.

Key Words: Ankle arthrodesis – AO plating.

Introduction

ANKLE replacement has not so far been consistently successful and arthrodesis is still a common surgical procedure for the control of severe pain from a variety of conditions. It may, however, be complicated by nonunion, delayed union, malunion, infection, neurovascular injury, reflex sympathetic dystrophy or tibial fractures. The rate of union varies according to the surgical technique and the type of patient. To date, at least 30 different methods have been reported, [1] including the use of external compression devices combined with open or arthroscopic debridement of joint surfaces, fixation by fibular strut grafts, interposition grafting and various forms of internal fixation with or without interposition grafting [1].

Clinical and biomechanical trials have shown that rigid internal fixation leads to increased rates of union in ankle arthrodesis [2,3]. Internal fixation is also associated with a reduced infection rate, a decreased time to union, earlier mobilization, and less discomfort for the patient when compared with external fixation [2].

We used a technique which was developed by the Davey (1999).

Internal fixation with an anteriorly placed T plate was developed because of dissatisfaction with external devices and a desire for stable fixation that would enhance the rate of union and minimize postoperative immobilization. Our aim was to assess the rate of fusion and complications using this technique.

Patients and Methods

Between 2004 and 2007 we performed ankle arthrodesis on 11 patients by this method. There were 10 men and one woman with a mean age at operation of 32 years (25 to 54).

All patients had only one ankle arthrodesed.

Follow-up was retrospective and consisted of a review of all preoperative, perioperative and postoperative medical records and of pre- and postoperative radiographs for each patient. They were not seen outside their normal clinical follow-up.

Operative technique:

Through a longitudinal incision placed 1 cm medial to the midline, a zig-zag incision is made through the extensor retinaculum, which facilitates repair when closing the wound. The joint surfaces are removed with osteotomes to expose the cancellous layer of subchondral bone. Most of both the medial and lateral malleoli are then excised with an osteotome. This is essential to allow the talus to be pushed into close contact with the tibia. A
small amount of both malleoli must be left intact to prevent medial or lateral displacement of the talus.

Table (1): Postoperative plaster immobilisation for the 11 patients.

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<thead>
<tr>
<th>Plaster immobilisation (wk)</th>
<th>Number of patients</th>
<th>Percentage</th>
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<tr>
<td>6 to 8</td>
<td>7</td>
<td>64</td>
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<tr>
<td>10 to 12</td>
<td>2</td>
<td>18</td>
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<td>16 to 18</td>
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![Fig. (1): Radiographs taken three months after arthrodesis showing the typical position of internal fixation and sound union.](image)

Both malleoli can be removed through the anterior incision, but it is often easier to remove the distal part of the lateral malleolus through a separate small longitudinal incision over the distal fibula; this was done in 4 cases. The anterior incision is placed medial to the midline to allow an adequate bridge of tissue between these two incisions.

The talus is then manually compressed under the tibia and held by a standard AO tibial T plate with two screws into the talus. The first screw to be positioned is the central tibial screw, through the slot in the plate. It is placed proximally in the slot to allow additional compression of the talus under the tibia. Two cancellous screws are placed into the talus. The other tibial screws are then positioned. An intraoperative radiograph is required to ensure correct placement of the screws.

The talar screws must be passed horizontally. If they are directed inferiorly there is risk of penetration of the subtalar joint. In most cases the original shape of the AO T plate is correct, and it does not require further contouring, which would tend to direct the talar screws inferiorly and sublux the body under the tibia. If there are large osteophytes or relative flattening of the body of the talus it is necessary to cut a slot in the neck to seat the T portion of the plate.

Our preferred plate is the AO tibial T plate, AO/ASIF catalogue number.

If there is incomplete bony apposition between the tibia and talus, bone graft is used as an adjunct. Local graft from the excised malleoli was used in 70% of cases and iliac-crest graft in 30%.

Postoperatively, the patients are immobilized in a below-knee plaster cast until there is radiological evidence of fusion (Table 1). They are allowed partial weight-bearing for the first six weeks, increasing to full weight-bearing as tolerated from six weeks onwards.

After removal of the plaster, 50% of patients were then placed into a bivalved plastic ankle brace for a period of six to eight weeks.

**Results**

A rate of fusion of 91% was achieved.

Only one patient developed nonunion and required another procedure. After 14 months both talar screws were found to be broken and the ankle had not arthrodesed. At 15 months, the metalware was removed and the ankle was fused using a non-instrumented graft. There were no technical difficulties or obvious surgical errors associated with the primary surgery.

One patient developed stress fracture occurred nine months after operation at the level of the most superior tibial screw. It healed in two months with immobilization and internal fixation was not removed.

There were two cases of superficial wound breakdown or infection. They were in patients in whom two incisions had been used. Infection involved the bridge of tissue between incisions. In one patient, Staphylococcus aureus was isolated and skin grafting was required eight weeks after operation. The other had a small area of wound breakdown which did not require surgical intervention or admission to hospital.
In seven patients, radiographs suggested that the talar screws may have penetrated the subtalar joint, but only one patient had pain at this site.

In one patient, there was some mild residual pain over the plate which was removed two years after the initial arthrodesis.

**Discussion**

The rate of fusion of ankle arthrodesis has varied significantly between different series, some having a rate of nonunion of 35% or greater [4,5].

Charnley popularized ankle arthrodesis using fixation with an external compression clamp. Reported rates of nonunion with these devices have ranged from 10% to 38%, [4] and this method has been associated with a high rate of other complications, including pin-track infections [2]. External fixation devices do not give rigid fixation, [6] and are cumbersome and unpopular with patients.

To overcome the problems associated with external fixation a number of techniques using internal fixation have been developed. To date, the most consistent clinical results for ankle arthrodesis have been obtained by using crossed screws, although not all series have shown excellent results. Dohm et al. [5] had a rate of union of only 40% in a small series, although several have achieved 95% to 97% [2,7-9].

Fixation with a T plate can also give excellent results. Scranton et al. [6] and Scranton [10] reported two series with a total of 33 patients who had ankle arthrodesis using lateral or medial fixation with a T plate which gave a rate of union of 100%. Wang et al. [11] showed a rate of fusion of 91% in 11 patients treated with a lateral T plate.

In general, more secure fixation is associated with increased rates of fusion. Scranton et al. [6] have shown that fixation with a medial plate is more rigid than Charnley clamps or fibular strut grafts, except when an anterior shear force is applied. In this situation, the external fixator appeared to be more secure because of the lack of lateral fixation with only a medial plate.

This can be overcome by using bilateral T plates, which give more secure fixation than crossed screws. [3] although this does increase the complexity of the procedure.

Mears et al. [12] showed a rate of fusion of 82% in 17 patients treated with an anterior two-hole tension plate. They also suggested that the pull of the tendo Achillis posteriorly adds to the compression across the ankle when combined with anterior fixation [12].

These results using a T-plate and an anterior two-hole plate are comparable to those obtained with crossed-screw fixation.

We chose to use an anterior T plate because it gives more secure fixation than a two-hole plate, and the anterior approach described is more straightforward than either the lateral or medial approaches.

Rigid fixation is not the only factor which influences the rate of union. Excessive soft-tissue stripping will theoretically reduce the blood supply to this relatively avascular joint and decrease the rate of healing. The high rate of union in our study suggests that this is not an important problem with this technique.

Attention to detail will minimise complications. Care must be taken when placing the talar screws to ensure that they pass horizontally and not inferiorty, as inferior placement risks penetration of the subtalar joint. The use of two anterior incisions is not recommended because it creates a narrow and potentially ischaemic skin bridge. It is unnecessary since the medial malleolus can be easily excised through the central longitudinal anterior incision.

The technique can be extended to include fusion of the subtalar joint. The talar screws are then angled inferiorly across the subtalar joint into the calcaneus and the joint exposed through an Ollier incision. If the talus is very comminuted after trauma, or is avascular, all or part of the body can be excised and replaced with packed cancellous bone graft.

We could find no other series of ankle arthrodesis using an anterior T plate. Most surgeons are familiar with the anterior approach to the ankle which allows a better view than either medial or lateral approaches. This allows easier correction of deformity and more accurate placement of the internal fixation. The surgical technique which we have described is simple and easily reproducible, as shown by the fact that five different general orthopaedic surgeons were involved. In many other series with excellent results the surgery has been performed by a single surgeon or in a specialised unit [8,9]. Similar techniques performed by other surgeons have shown less reliable results.
We gained a rate of fusion of 91% with anterior AO T-plate-fixation for ankle arthrodesis. Our complication rate was relatively low. This is a simple, reproducible technique which gives stable internal fixation and excellent clinical results.

References


