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Technical note

An original fibular shortening osteotomy technique in tibiotalar arthrodesis

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ABSTRACT

Tibiotalar arthrodesis (TTA) is the gold-standard treatment for advanced ankle osteoarthritis. We describe an original fibular shortening osteotomy (FSO) performed during TTA, to allow complete talar ascension and reduce the nonunion rate. Forty-two FSOs were associated to TTA (19 fixed by cross-screwing and 23 by anatomic plates) and assessed clinically and radiographically. At 24.7 months' follow-up, fusion rates were 97.6% for TTA and 100% for FSO, with mean fusion time of 5.2 months. One infection and 1 nonunion (4.7%) required further surgery, with complete resolution. Radiological and clinical outcome in TTA, lack of specific complications of FSO and ease of implementation encourage us to publish the technique.

1. Introduction

Tibiotalar arthrodesis (TTA) is the gold-standard treatment for severe ankle osteoarthritis, despite the growth of total ankle replacement [1,2]. Many studies have demonstrated efficacy against pain and recovery of satisfactory quality of life [3–6]. However, the procedure is technically complex and incurs a non-negligible rate of skin and neurovascular complications and nonunion [7,8]. We serendipitously noticed that, after bone freshening with a sheer cut or by bone chisel in TTA, the talus and tibia were much easier to mobilize and juxtapose without the fibular "stick". In 2007, Smith and Wood described a technique of horizontal lateral malleolus shortening to facilitate correction of severe deformity by TTA, but this trick has not been widely adopted [9].

Using an anteromedial approach, we describe a fibular shortening osteotomy (FSO), systematically associated to TTA. The study hypothesis was that this technique facilitates reduction of deformity and joint surface juxtaposition, thereby reducing the rate of nonunion [10]. The study objective was to test this hypothesis, describe the technique, its advantages and possible complications and assess TTA fusion time.

2. Description of the technique

The patient is positioned supine, under general anesthesia with sciatic and popliteal block, with a cushion under the ipsilateral buttock and a pneumatic tourniquet on the thigh. An anteromedial approach is performed between the anterior tibial tendon and the extensor hallucis longus. The neurovascular pedicle is reclined laterally to allow complete visualization of the whole tibiotalar joint line and fibular joint surface. After resecting osteophytes, the tibia is freshened by en-bloc sheer resection of the tibial plateau, followed by talar dome resection using an oscillating reciprocating saw, taking care to achieve flat cuts parallel to the plantar sole.

FSO is performed by two cuts both parallel to the arthrodesis plane, removing a fibular ring, 5-10 mm thick depending on the degree of deformity (Fig. 1); the thickness should allow complete manual juxtaposition of the bone surfaces and a second cut may be made if necessary. No stabilizing fixation is used and the medial malleolus is untouched unless its tip constitutes an obstacle. Talar bloc ascension, translation and rotation are fixed by crossed K-wires. After an AP and lateral fluoroscopic check, definitive fixation is achieved using anatomic plates (Fig. 2) or cross screwing (Fig. 3). The removed fibular fragment can be morselized for complementary grafting to fill any bone defect.

Postoperatively, patients are immobilized in a resin-walking cast, with walking without weight bearing authorized for 6 weeks. Ankle X-rays are taken between weeks 6 and 12, with a follow-up consultation at 6 months reviewing X-rays taken between months

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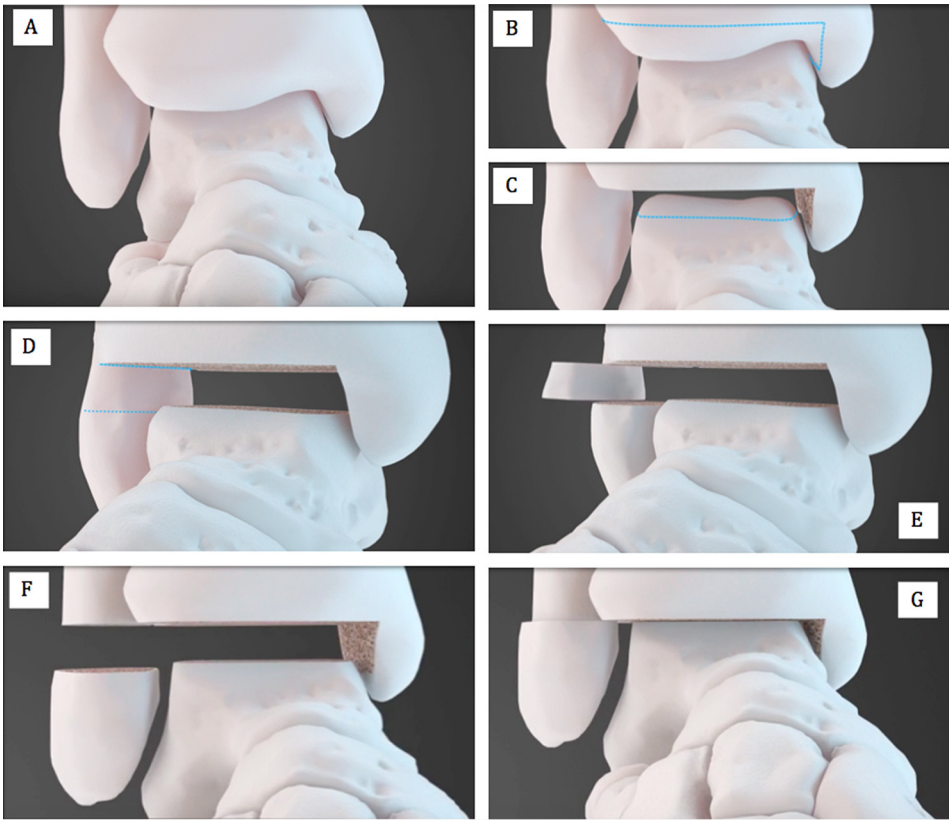

Fig. 1. Diagram of fibular shortening osteotomy. After exposing the tibiotalar joint (A), tibial (B) and talar cuts (C) are performed, followed by fibular shortening osteotomy (D). Removing the fibular fragment (E and F) allows free ascension of the talus and complete contact with the tibia (G).

5 and 6. Physiotherapy is initiated at 6 weeks, with progressive resumption of weight bearing at one-third body-weight per week; full weight bearing is usually resumed between weeks 7 and 10.

For the present study, two independent observers analyzed radiographic consolidation, according to the criteria used in the literature [11–13].

3. Results for the preliminary series

We report results in a series of patients operated on between May 2007 and July 2014, with TTA indicated for severe osteoarthritis of the ankle. Clinically, they showed disabling pain and very restricted passive ranges of motion. All had received previous nonoperative treatment. The continuous series of TTA, all with associated FSO, comprised 42 cases: 12 female, 30 male; mean age at surgery, 49.3 years (range, 23–75 years); 23 right and 19 left ankles. Preoperative assessment comprised clinical and radiographic examination with AP and lateral weight-bearing ankle views and Méary views, plus either CT-arthrography or MRI.

Mean surgery time was 115 min (range, 55–150 min). Definitive fixation was by cross screwing in 19 cases and by anatomic plates in 23. Corticocancellous graft was required in 16 cases: 14 anterior and 2 posterior iliac crest grafts. Consolidation rates were 97.6% (41/42) for TTA and 100% for FSO. Overall, mean fusion time was 5.2 months (range, 1.8–15.9 months).

Two complications (4.7%) required revision surgery. In one case, sepsis due to superficial skin infection required early revision at 3 months, for wound care and anterior tibial tenodesis and directed healing by negative pressure (VAC system); due to persistent effusion, the material was ablated as soon as bone consolidation was obtained. One case of nonunion of screw-fixation was managed by bone graft, with consolidation at 13 months; the patient was a smoker and obese, with multiple ankle surgeries in a context of multiple trauma, with several comorbidities and history possibly contributing to the failure of the first operation.

FSO was found to enlarge the ankle mortise, although this caused no discomfort, malunion or cutaneous impingement.

4. Discussion

Forty-one of the 42 arthrodeses (97.6%) showed primary fusion. This was very satisfactory compared to literature reports, where nonunion rates range between 10% and 40% depending on the accumulation of risk factors [14–16]. There was in the present series no significant difference in nonunion rates according to fixation technique, suggesting indirectly that the FSO accounts for the results; moreover, FSO showed 100% consolidation without any internal fixation, making the technique even easier to implement.

Several mechanical factors contribute to arthrodesis fusion. In 1948, Adams highlighted the importance of the quality of contact between the tibial and talar surfaces [17]. Fibular malleolar relief through the joint facet constitutes an obstacle to the ascension of the prepared talus into the tibial mortise. Release of the lateral fibular malleolus combined with shortening of the lateral fibular bone allows easy impaction in the tibial mortise. Talar motion is entirely free in all 3 dimensions, facilitating good 3D positioning of the arthrodesis and thus correction of any deformity. The talus, released from the ankle mortise, can easily be compressed. Bone

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