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Arthroscopic versus open ankle arthrodesis

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ABSTRACT

Background: It is thought that arthroscopic ankle fusion offers improved outcomes over open fusion in terms of functional outcomes, time to fusion, length of stay and fewer complications. However, there are doubts about whether correction of established severe deformity can be achieved using the arthroscopic approach.

Methods: A retrospective review of medical records and radiographs at our hospital identified consecutive tibio-talar ankle fusions between April 2009 and March 2014 with minimum 1 year follow up. Records were scrutinised for type of arthrodesis, demographics, length of stay (LOS), time to fusion (TTF), pre- and postoperative deformity, complications and unplanned procedures. Significant factors in the complication group were then compared, using multivariate binary logistic backward stepwise regression to see if any factors were predictive.

Results: There were 29 open and 50 arthroscopic ankle fusions (2 converted to open). Mean LOS was 1.93 versus 2.52 days ($p = 0.590$). TTF was shorter after arthroscopic fusion 196d versus 146d ($p = 0.083$). Severe deformity (>10°) was correctable to within 5° of neutral in the majority of cases (97% versus 96%, $p = 0.903$). Union occurred in 83% versus 98% ($p = 0.0134$). The open arthrodesis group had 9 (31%) complications (1 death-PE, 1 SPN injury, 5 non-unions, 1 delayed union and 1 wound infection) and 6 (25%) screw removals. The arthroscopic arthrodesis group had 4 (8%) complications (1 non-union, 1 reactivation of osteomyelitis and subsequent BKA, 1 wound infection, 1 delayed union) with 11 (24%) screw removals. After multi-variant regression analysis of all ankle fusions, low BMI was shown to be associated with complications ($p = 0.064$).

Conclusions: Open arthrodesis was associated with a higher rate of complications and a lower rate of fusion. However, there was no significant difference in terms of LOS and ability to correct deformity compared to arthroscopic arthrodesis. Overall, low BMI was also associated with more complications.

1. Introduction

Open ankle arthrodesis has been widely accepted as the "gold standard" for the surgical management of advanced osteoarthritis of the tibiotalar joint, for many decades. This has been challenged in recent years, through advances in total ankle arthroplasty and the development of arthroscopic techniques of joint preparation for fusion. Arthroscopic ankle arthrodesis has gained popularity over the last decade, as foot and ankle surgeons have gained experience in arthroscopic techniques. Whereas initially it was considered suitable only for minimally deformed arthritic ankles, the ability to correct more severe deformity has now been demonstrated [1,2]. By minimising soft tissue disruption, the arthroscopic technique offers potentially lower morbidity and mortality, quicker recovery, shorter hospital stay and time to fusion [2]. In addition, it may reduce the wound complication risk for patients with a poor soft tissue envelope or relevant co-morbidities (e.g. diabetes mellitus or peripheral vascular disease). These theoretical advantages have yet to be proven by current research.

In this retrospective study we compared two groups of patients undergoing open or arthroscopic ankle arthrodesis. Our hypothesis was that arthroscopic arthrodesis was associated with a higher union rate, reduced time to fusion, fewer complications and reduced length of stay in hospital. We also assessed the degree of deformity correction achieved by each technique and the patient or surgical specific risk factors which may lead to surgical complications.

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2. Methods

We conducted a retrospective analysis of every ankle fusion performed at our institution on patients with isolated tibio-talar arthritis between 2009 and 2014. Patients were selected for surgery with primary or secondary post-traumatic arthritis, or rheumatoid arthritis. All cases were performed by one of five fellowship trained foot and ankle surgeons, who were competent in performing arthroscopic arthrodesis. The choice of open versus arthroscopic ankle arthrodesis was according to surgeon's preference. The number of arthrodeses performed by each surgeon, including the proportion completed arthroscopically is included in Table 1. We identified 92 patients who underwent 95 ankle arthrodeses. All patients had a minimum follow up of 1 year. 16 patients were excluded from further analysis: 1 patient with incomplete radiographic or clinical follow up and 15 patients with ipsilateral subtalar arthritis.

2.1. Surgical technique

All procedures were performed under general or spinal anaesthesia with the patient supine on the operating table. Neutral positioning of the ankle was achieved with elevation under the ipsilateral buttock and a lateral thigh support attached to the operating table. A thigh tourniquet was applied and inflated. Peripheral nerve blocks were performed for intra- and postoperative analgesia. Intravenous prophylactic antibiotics were administered, at induction of anaesthesia, according to our institution's guidelines.

2.1.1. Open ankle arthrodesis

A dual incision (antero-medial and anterolateral) approach was used (Fig. 1). The antero-medial incision was sited medial to the tibialis anterior tendon whereas, the anterolateral incision, was either a trans-fibular approach with distal fibular osteotomy (used in 1 ankle) or, a fibular sparing approach, with the incision sited from the tibio-fibular syndesmosis region, lateral to the superficial peroneal nerve and towards the 4th metatarsal base (used in 28 ankles). Joint preparation (removal of residual cartilage and subchondral bone) was performed using osteotomes, curettes, bone rongeurs, burrs and multiple subchondral bone perforations, into cancellous bone, using 2.0 or 2.5 mm drill bits. Screw only (no plate) fixation was used in all cases. A "three or four screw technique" using large fragment partially threaded solid screws was used in 9 ankles, whereas 6.5 or 8.0 mm cannulated screws inserted from the medial supra-malleolar region was used in 20 ankles (Fig. 2).

2.1.2. Arthroscopic ankle arthrodesis

The patient was positioned in the standard fashion used for ankle arthroscopy. Non-invasive distraction was used (Fig. 3). Standard antero-medial and antero-lateral ankle arthrosocpy portals were used, avoiding the superficial peroneal nerve branches. The arthroscopies were performed using a standard 4.0 mm ("knee") arthroscope. A 4.0 mm or 5.5 mm soft tissue shaver and a 5.0 or 5.5 mm barrel burr were used for preparation of the tibio-talar surfaces for fusion. Care was taken to remove osteophytes (anterior tibia, antero-medial talar neck, medial malleolus), loose bodies and to debride the medial and sometimes, the lateral gutter of the ankle, so as to allow adequate mobilisation of the talus, in order that it be sited correctly, under the tibial plafond, in all planes and so as to allow deformity correction if needed. In cases where severe varus deformity was present, more bone was resected from the lateral tibial plafond to allow deformity correction and congruity between the talar and tibial surfaces. Percutaneous cannulated 6.5, 7.3 or 8.0 mm partially threaded compression screw fixation was used. The screws were inserted from the medial supra-malleolar region into the talus, in a posteromedial to anterolateral direction (Fig. 4).

Postoperatively, a below knee plaster back slab was applied and wound inspection (±suture removal) was performed at approximately 2 weeks. At that stage a below knee cast was applied. Following open arthrodesis the patient was instructed to remain non weight bearing using crutches or a walking frame for 6 weeks after surgery. Following arthroscopic arthrodesis, most patients

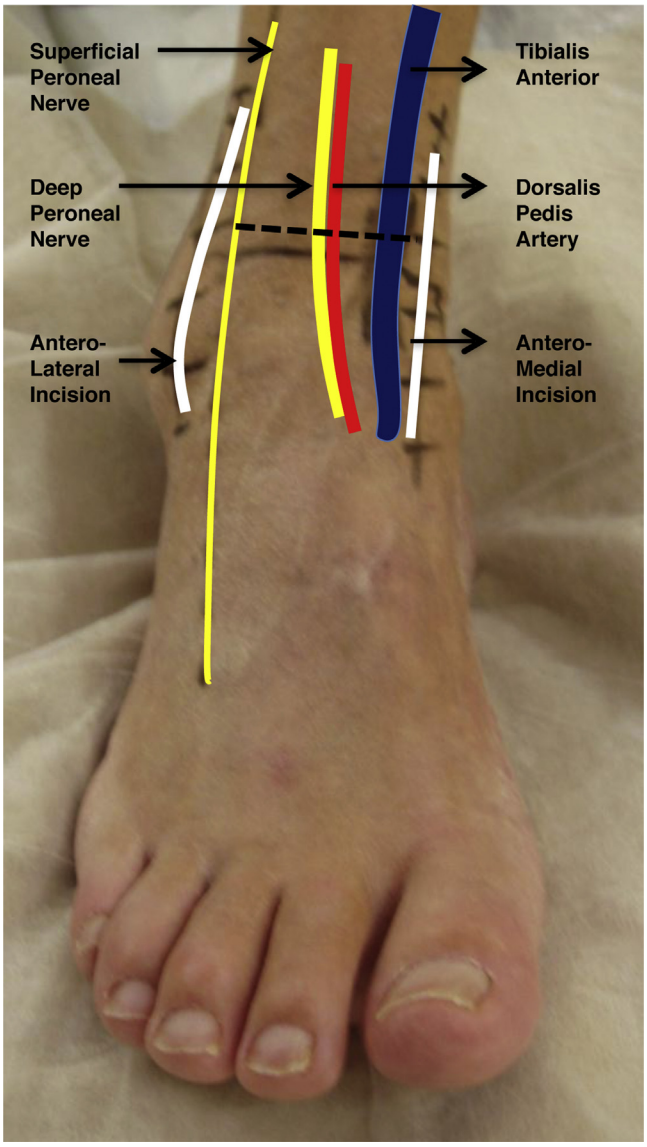

Fig. 1. Open arthrodesis incisions.(For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.) (Lines: White = incisions, Yellow = superficial and deep peroneal nerves, Red = dorsalis pedis artery, Blue = tibialis anterior, Dotted = joint line).

Table 1
Surgeon data.

Surgeon	Total arthrodeses	Open	Arthroscopic	Proportion arthroscopic
1	9	1	8	89%
2	12	7	5	42%
3	21	14	7	33%
4	18	5	13	72%
5	19	2	17	89%

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