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Conversion of Painful Ankle Arthrodesis to Bipolar Fresh Osteochondral Allograft: Case Report

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INTRODUCTION

Ankle arthrodesis has been used successfully for end-stage arthritis of the ankle for more than a century and has remained the gold standard for end-stage post-traumatic arthritis against which other surgical options for ankle arthritis are compared for clinical and functional benefits.[2,12,14]

Nevertheless, degenerative changes in the adjacent joints following an ankle arthrodesis have been reported and may lead to additional fusion surgery over time.[9,10]

When performing an arthrodesis, variations from the ideal positions of fixation (90 degrees or up to 10 degrees of dorsiflexion in case of midtarsal joint arthritis, 5 to 10 degrees valgus, and 5 degrees to 10 degrees of external rotation),[3] could be labeled as malpositions and may be a cause of pain or cause flexion or extension deformities of the knee leading to gait disturbances.[13]

Ankle arthroplasty is considered to be a salvage option for those patients who are not satisfied with an ankle arthrodesis which has been shown to be capable, in selected cases, to give the patient a satisfactory restoration of function.[6]

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Bipolar fresh osteochondral allografts (BFOA) have been used for the treatment of end stage arthritis in the ankle joint and represent a fascinating option for biological joint reconstruction.[1,4]

The aim of this paper is to describe a case of total BFOA used for salvaging a problematic ankle fusion and to report the clinical and radiographic results obtained at more than 3 years followup.

CASE REPORT

A 45-year-old woman with a painful ankle arthrodesis in 10 degrees of equines received BFOA. Arthritis at the midtarsal joint due to overload developed over time as a consequence of the equinus position of the fusion, and the patient had persistent pain in the midtarsal area which was not controlled by anti-inflammatory drugs and insoles. Since she refused a corrective osteotomy and she firmly requested to regain ankle motion, a BFOA was proposed in order to restore ankle motion and relieve the midtarsal overload.

The entire ankle joint was harvested "en bloc" from the donor taking care to leave intact the capsule and the synovial membrane. Once harvested, the joint was placed in a sterile container with L-glutamine, $NaHCO^3$ and an antibiotic solution and stored at 4°C. An MRI was performed to verify articular cartilage integrity while the adequacy of the allograft size was verified through a CT scan.

Allograft implantation was performed 10 days after harvest.

The surgical session consisted of two steps: the first for the graft preparation and the second for the graft implantation.

Step 1

On a separate surgical table, all soft tissues were carefully removed from the harvested ankle, taking care not to damage the cartilage surfaces. Then, the articular surfaces of the tibia and talus were accurately cut with a pneumatic saw with the jigs for the BOX ankle prosthesis (BOX®, Finsbury

Orthopaedics, UK), maintaining the whole articular surface intact and about 10 to 12 mm of subchondral bone (Figure 1). The prepared articular surfaces were then temporarily placed in a container with saline solution.

Step 2

The patient was placed in supine position under general anesthesia. Following the same surgical access used for the ankle fusion a standard anterior longitudinal incision was performed to approach the ankle between the extensor hallucis longus and the tibialis anterior tendons. The original position of the ankle joint was marked with two Kirschner wires as planned on the basis of the preoperative radiographs and under fluoroscopic control, in order to define the plane for the bony cut. The cut was then performed parallel to the Kirschner wires by using a pneumatic saw taking care to preserve the external wall of the medial malleolus and a bony block 2 cm in thickness was removed. After the bone segment was removed, the medial and lateral gutters were mobilized with an osteotome until the talus became mobile within the mortise (Figure 2).

A Z lengthening of the Achilles tendon was performed through a second posterior open incision. The allograft surfaces were then inserted and fixed in place with screws into the tibia and twist-off screws (Citieffe, Calderara di Reno, Bo, Italy) into the talus (Figure 3).

The osteophytes of the dorsal aspect of the talonavicular joint were removed.

Fluoroscopy was performed to verify the correct placement of the graft and assess the range of motion of the ankle.

One drain was placed and routine closure was performed. Postoperative X-rays were taken and a cast was applied for 15 days (Figure 4).

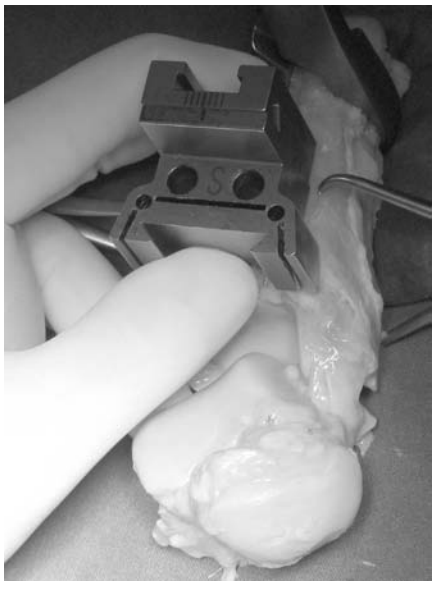

Fig. 1: The donor articular surfaces were prepared with the help of the BOX ankle prosthesis jigs (BOX®, Finsbury Orthopaedics UK), maintaining the whole articular surface intact and about 10–12 mm of subchondral bone.

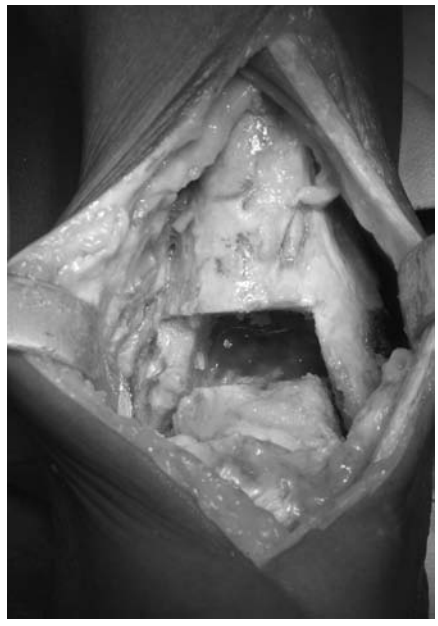

Fig. 2: The host recipient site is prepared and a bone segment was removed in order to permit the implantation of the allograft surfaces.

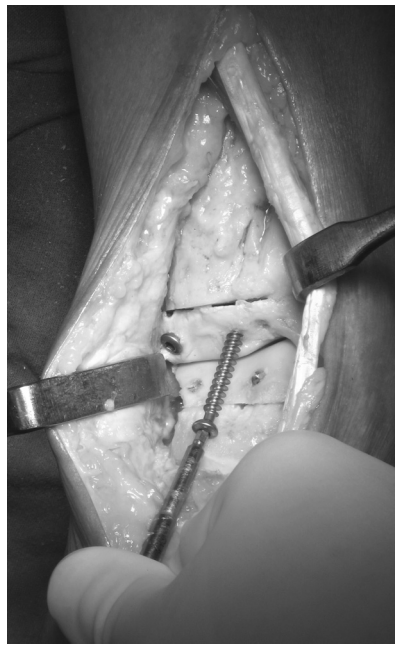

Fig. 3: Once inserted, the allograft surfaces were fixed in place with traditional screws for the tibia and twist-off screws (Citieffe, Calderara di Reno, Bo, Italy) for the talus.

Dalteparin sodium was advised for 6 months postoperatively until full weightbearing was allowed. Antibiotic prophylaxis was dispensed preoperatively and for 10 days after the operation.

From 15 to 45 days CPM was performed. From 45 days to 4 months nonweightbearing active and passive mobilization of the ankle and swimming were performed. The patient

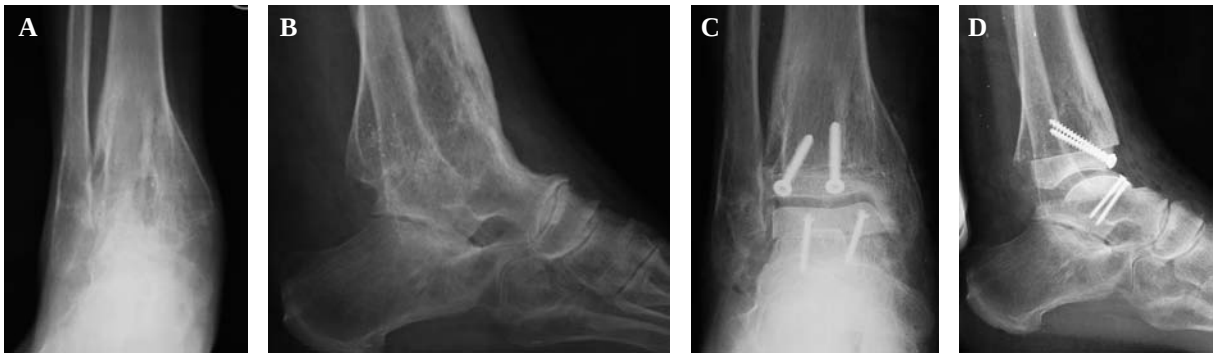

Fig. 4: Preoperative AP (A) and lateral (B) X-rays showing the ankle arthrodesis. Postoperative AP (C) and lateral (D) X-rays showing the allograft in place.

was advised to start cycling and partial weightbearing in a walking boot after 4 months. Full unprotected weightbearing was allowed only after 6 months.

The patient was checked at 1, 3, 6, 12, 24, and 44 months after surgery. Postoperative evaluation was carried out clinically (AOFAS score)[8] and radiographically by X-rays, CT scans (at 6 and 24 months), and MRI (at 6 and 24 months).

RESULTS

No intraoperative nor postoperative complications occurred.

At 44 months followup, the patient had 20 degrees of painless ROM of the ankle with no additional complaints of rest pain or pain related to activities; the AOFAS score increased from 28 to 86 points. Integration of the graft with bone consolidation was evident at 5-month X-rays followup.

The patient was satisfied with the results. Radiographically, moderate arthritis of the implanted surfaces were evident at final followup (Figure 5). At the last followup, the patient was able to perform her daily life activities without limitations and to walk without pain. She cycled and was advised against jogging or other high-impact sports activities.

DISCUSSION

Arthrodesis of additional joints or arthrodesis revision are the most frequently treatments necessary for patients who are unsatisfied with an ankle arthrodesis and have pain. Arthritis in adjacent joints is not a rare occurrence in patients with a fused ankle, in particular, if an ankle is fused in equines. Arthritis of the midtarsal joint can develop due to overload, and surgical treatment may be required.

Revision surgery for sagittal or coronal plane deformities through realignment osteotomies performed through the fusion mass, which can be done through closing wedge or opening wedge realignment procedures, may be a viable solution.[13] Nevertheless, some patients may require a different solution which restores movement to the fused ankle.

Few studies describe the use of an ankle prosthesis for the takedown of problematic ankle arthodesis. Greisberg et al. was the first to describe the takedown of a problematic ankle fusion with conversion to total ankle replacement with the use of a semiconstrained two-component ankle design but had a 42.1% failure rate in his series.[5] Subsequently, Hintermann et al.[6] reported on the use of an unconstrained three-component total ankle design in a series of 30 ankles with overall good patient satisfaction and a failure rate of 13.3%.

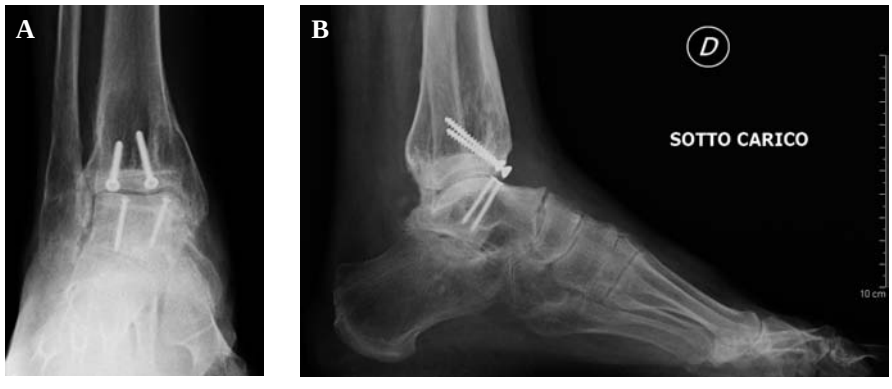

Fig. 5: Followup AP (A) and lateral (B) X-rays showing complete integration of the allograft.

The BFOA is aimed to biologically resurface a degenerated joint in young and active patients and represents a fascinating possible alternative to traditional prosthetic substitution.[4] The applicability of BFOA has been described for the treatment of end stage ankle arthritis and was able to provide satisfactory clinical results although with a high rate of complications.[1,4,7,11,15] Meehan et al.[11] in 2005 reported on a series of fresh ankle osteochondral allografts for tibiotalar joint arthritis. Nine out of 11 patients underwent a bipolar allograft transplantation. The AOFAS score improved from 55 to 73 at a mean 33 months followup; the patients' pain, gait, and walking surface scores were all significantly improved. Five grafts were reported as failures, while radiographs revealed moderate and severe joint degeneration in an additional six ankles, not necessarily correlating with a poor clinical outcome. In a series reported by Giannini et al.[4] on 32 ankle allografts, the overall clinical results were satisfactory with a significant improvement of the AOFAS score from a preoperative of 33.1 $\pm$ 10.9 to 69.5 $\pm$ 19.4 at 31 months followup. Nevertheless, six failures were described and radiographic signs of degeneration of the graft were evident in all cases and remained cause of concern.

To our knowledge this is the first report on the use of a bipolar fresh osteochondral allograft for the conversion of a painful ankle fusion; the results were satisfactory both clinically and radiographically. The use of an allograft in fact, salvaged an ankle fused in an equinus position, with arthritis and pain in the ipsilateral midlateral joint, into a mobile ankle in a patient of an age unsuitable for a total ankle arthroplasty. Removal of the osteophytes at the talonavicular joint was performed through the same surgical incision. The range of motion at followup was limited to 20 degrees but still adequate for relieving the overload of the midtarsal joints. Even with degenerative joint changes evident in the radiographs, this procedure was able to give the patient a satisfactory result, which will hopefully last long enough to get the patient to an age when a total ankle arthroplasty might be considered.

Taking down an ankle arthrodesis and performing a BFOA is clearly a technically demanding procedure and the use of a fresh allograft requires cooperation with a bone bank. We are aware that this is not a technique possible in some institutions. Still, BFOA may be considered as a surgical alternative to a prosthesis when the patient is dissatisfied with an ankle arthrodesis and asks for a surgery to restore movement at the ankle joint.

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