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TECHNICAL NOTE

Osteochondral transfer using a transmalleolar approach for arthroscopic management of talus posteromedial lesions

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Summary Characterizing osteochondral lesions of the talus has enabled the strategies of surgical management to be better specified. The main technical problem is one of access for arthroscopy instruments to posteromedial lesions. A range of techniques and approaches has been described in ankle arthroscopy in general, and a transmalleolar approach provides reliable and efficient access in these cases. It is frequently used for transchondral drilling, but also enables satisfactory implant positioning in autologous osteochondral mosaicplasty procedures. We report our technique and results on five cases with a minimum 1.2 years' follow-up.

Introduction

Osteochondral lesions of the talar dome (OLTD) comprise various lesions of the talar articulation with the distal tibia. They associate cartilage and subchondral bone damage. Their etiology remains uncertain [1—3]. Berndt and Harty [4], studying the occurrence of OLTD in the ankle of a blocked foot of cadaver specimens according to stress applied to anatomic parts, were able to classify lesions according to the mechanical trauma involved. By systematizing lateral lesions and associating collateral lateral ankle ligament lesions, they produced an initial four-stage classification, also developed for medial lesions. Alterations were later made, to cover all of the types of lesion observed, and notably cysts [5]. There is a generally agreed distinction to be made between fracture-type or wafer-shaped lesions, located on the lateral or anterolateral side of the talar dome, and osteonecrotic or cup-shaped lesions, on the medial or posteromedial side [6].

Such osteochondral lesions have been described for other joint bearing surfaces. Osteochondral mosaicplasty techniques have been developed, especially for the femoral condyles, with encouraging results [7—12]. In the case of the ankle, such autologous transplantation runs up against the problem of talar lesion access with conventional approaches, whether open or arthroscopic, which provide only limited visualization of the talocrural joint. A posteromedial lesion site usually requires malleolar osteotomy [13—15,1], or ''plasty'' of the anterior edge of the tibia [16].

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Technical progress and refinements of indications have made ankle arthroscopy feasible [17,18]. Surgical management of OLTD by arthroscopy has emerged as an interesting attitude. A variety of surgical techniques is available, depending on both the lesion and the author [19]: simple excision [20], fixation of the osteochondral fragment [21], microfracture or transchondral perforation [22—25], osteochondral graft [16,14,15,26], or chondrocyte transplantation [27,28].

The present study sought to define the interest of a medial transmalleolar approach for autologous osteochondral grafts in posteromedial talar lesions. We report a short retrospective series, with a minimum 15 months' follow-up (FU), and detail our transmalleolar autologous osteochondral mosaicplasty technique.

Material and methods

Material

Between October 2001 and May 2006, five patients presenting with posteromedial OLTD underwent isolated autologous osteochondral graft by a transmalleolar approach. All were operated on by the same senior surgeon. Exclusion criteria were:

- lateral talar dome damage;
- associated chronic ankle instability;
- history of ankle surgery;
- signs of arthritic degeneration or inflammatory arthropathy;
- more than 10° impairment of plantar flexion with respect to the contralateral ankle;
- and advanced age (as relative criterion) and reduced functional needs.

There were three females and two males; mean age, 33.8 years [21—51.5]. Surgery was indicated for OLTD having evolved for more than 6 months despite medical treatment. The latter systematically comprised a period of immobilization and non-weight-bearing, functional rehabilitation, and analgesic and non-steroid anti-inflammatory medication. The modalities and chronology of this medical management were not systematized, and were not included in the analysis of the files.

Method

Preoperative clinical status was assessed on the McCullough scale [1]. Preoperative ankle and hindfoot scores of the American Orthopaedic Foot and Ankle Society (AOFAS) were not available. Lesions were classified from preoperative standard X-ray and three-dimensional (3D) imaging (MRI or arthroscan) on the fracture, osteonecrosis, cyst (FOC) system [29]. 3D imaging guided the indication of transmalleolar osteochondral autograft, the criteria being: a posteromedial lesion location; lesion type O (or, in one case, C); lesion size, with area limited to 5 mm × 10 mm (corresponding to three 4.5 mm-diameter pegs) and strictly less than 10 mm deep to enable satisfactory bone fixation under pressure.

Postoperative assessment was made by one of the authors, at 1.2 to 5.7 years' FU (mean FU = 2.5 years). Clinical assessment used the McCullough scale [1] and AOFAS ankle and hindfoot scores [30]. Particular attention was paid to the clinical status of the donor site (ipsilateral knee) and to complications associated with the transmalleolar approach (pain, fracture and instability). 3D imaging (MRI or arthroscan) was performed at FU to assess autograft aspect, transmalleolar route evolution, and talar and tibial joint surfaces. For the osteochondral implants, bone consolidation, normal or remodeled subchondral bone aspect and cartilage cicatrization were recorded.

Surgical technique

The osteochondral graft was obtained using a dedicated harvesting and impaction kit (Mosaicplasty System, Smith & Nephew, Andover, Mass).

Patients were installed in dorsal decubitus, under general or locoregional anesthesia, with a pneumatic tourniquet at the top of the limb. In the first of the cases, transcalcaneal traction was employed: a 3 mm-diameter K-wire was inserted transcalcaneally and placed on a stirrup for manual traction by the surgical assistant. This kind of traction was replaced by a Hempfling intra-articular distractor (ref. 28122EL, Karl Storz, Guyancourt, France) in the subsequent four cases. A 4 mm-diameter arthroscope with 30° angle of view was used.

The arthroscopy approach routes were classical: anteromedial and anterolateral. The first step consisted in ankle joint assessment, essential for detailing lesion location and size and fragment instability and to confirm autograft feasibility. After the anterior capsule chamber was cleaned, the osteochondral fragment was resected if unstable and with an open cartilage surface (three cases). The osteochondral defect was measured by the palpator probe graduations. If the lesion had a depressible but closed cartilage surface, the graft was pegged across the lesion without excision (two cases).

The second step consisted in harvesting the osteocartilaginous grafts. The donor site was the lateral trochlear edge of the ipsilateral knee. Anteromedial and superomedial arthroscopy checked donor site integrity. After site location by needle, a short lateral arthrotomy enabled the harvesting instrument to be introduced. Two or three 4.5 mm-diameter pegs were harvested over a length of 10 to 15 mm (Fig. 1). The joint was then closed over a Redon drain.

At the ankle, a 90° hook-drill guide for anterior cruciate ligament plasty was positioned on the distal tibial joint surface facing the talar substance-loss site. A 1.5 mm pin could thus be positioned to guide the transmalleolar approach. The pin was as vertical as possible, centered between the anterior and posterior edges of the medial malleolus. It exited into the joint at the junction between the distal articular surface of the tibia and the medial malleolus. The bone tunnel was first prepared with a 4.5 mm trephine to harvest a cancellous cortical bone graft. Transmalleolar drilling was completed with a bit guided by a 6 or 7 mm-diameter pin. Tunnel quality and positioning were checked arthroscopically. The tunnel served for recipient site preparation and peg impaction (Fig. 2).

The bone tunnel was partly filled with bone harvested from the transmalleolar approach site. Joint congruence

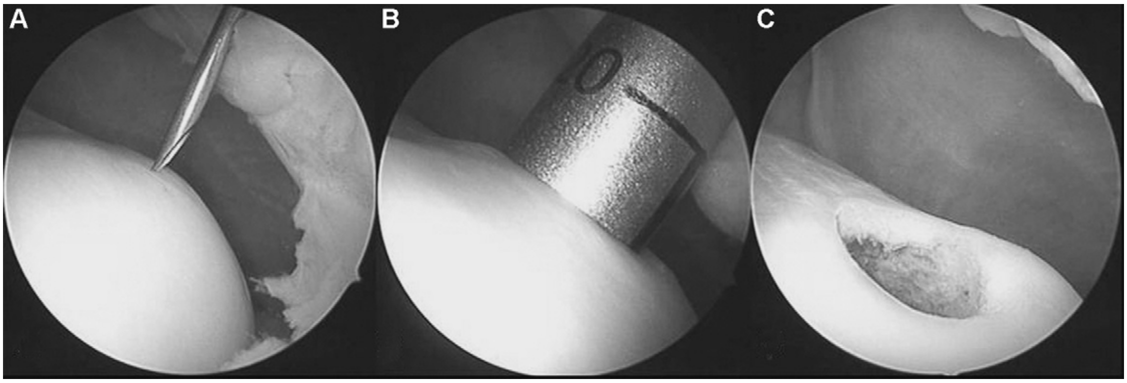

Figure 1 Osteochondral peg harvesting. A. Location by needle. B. Trephine harvesting by short arthrotomie. C. Donor site after peg harvesting.

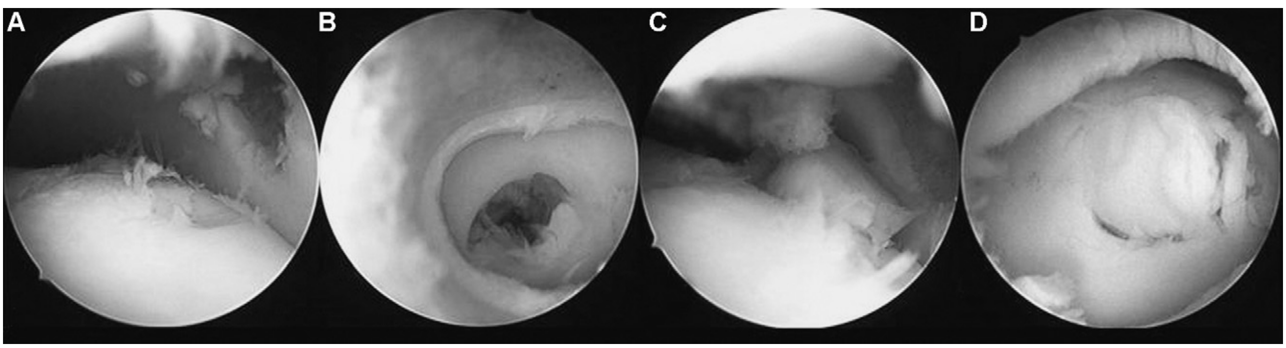

Figure 2 Recipient site. A. Endoarticular orifice of the transmalleolar approach facing talar lesion. B. View inside bone tunnel after recipient site preparation for peg. C. Endoarticular view of peg positioning before complete impaction. D. Transmalleolar graft check after impaction.

was checked, and the ankle joint was closed over a Redon aspiration drain for the first 24 hours postsurgery. There was no postoperative immobilization. Passive ankle mobilization was initiated immediately; weight-bearing was resumed at 4 to 6 weeks postoperatively, depending on the degree of pain.

Results

The immediate postoperative course was free of complication for all five patients. No medial malleolar fractures occurred.

Patient 3 was the first to undergo this technique and the only one in whom transcalcaneal traction was applied. At 15 days postsurgery, he presented reflex sympathetic dystrophy (RSD) which resolved in 4 months under analgesics with avoidance of any pain-inducing movements during functional rehabilitation. X-ray and clinical evolution was favorable for 5 years. At end of FU (5.7 years), there was functional deterioration of the ankle (AOFAS functional score, 38/50; talocrural amplitude $< 15^\circ$) with arthritic lesions on standard X-ray.

For patient 5, osteochondral autograft was indicated only after long discussion, given the type of lesion (cyst) and context of considerable overweight (1.57 m, 85 kg, BMI > 34). Disabling ipsilateral knee pain persisted long after surgery, without objective radioclinical signs, with considerable pain in the operated ankle — notably along the transmalleolar approach site — without radioclinical signs of transmalleolar ballooning [22] or of RSD.

In patients 1 and 4, the functional result was imperfect due to occasional pain and moderate talocrural impairment (AOFAS functional score, 43/50; talocrural amplitude 15° to 29°). The three patients (no. 1, 2 and 4) with good or very good results resumed sports or work at the same level or in the same job as before the onset of the peak symptomatology leading to surgery.

Imaging assessment of graft cicatrization found dissociation of the subchondral bone and cartilage in three cases (Fig. 3). The three cases with good or very good results showed recovery of a satisfactory interline with cicatrized cartilage. The other two cases showed cartilage lesions. The subchondral bone consolidated in two cases and showed remodeling in the other three (Table 1).

Discussion

OLTD are an anatomopathological group associating a chondral lesion and subchondral bone damage, in varying proportions. Classically, traumatic lateral fractures are distinguished from osteonecrotic medial lesions. Trauma, however, can be found in more than 60% of medial lesions [1]. The FOC classification [29] further includes a category of cysts, as described by Anderson et al. [5]. This represents

Table 1 Radioclinical assessments.

	Sex Side Age at surgery	Context of trauma	FOC type	Preoperative McCullough score	Postoperative imaging	Postoperative AOFAS score	Postoperative McCullough score
Patient 1	Male Right 23.1 years	Yes	Type O	Poor	Bone consolidation Cartilage cicatrization	83 *[30 − 43 − 10]*	Good
Patient 2	Female Right 26.5 years	Yes	Type O	Poor	Bone remodeling Cartilage cicatrization	97 *[40 − 47 − 10]*	Very good
Patient 3	Male Right 51.5 years	No	Type O	Poor	Bone consolidation Cartilage lesion	68 *[20 − 38 − 10]*	Medium
Patient 4	Female Left 21 years	Yes	Type O	Poor	Bone remodeling Cartilage cicatrization	83 *[30 − 43 − 10]*	Good
Patient 5	Female Right 47 years	Yes	Type G	Poor	Bone remodeling Cartilage lesion	33 *[0 − 28 − 5]*	Poor

FOC: fracture, osteonecrosis, cyst.
The AOFAS score is on 100 points with three components (in brackets): pain (/40), function (/50), alignment (/10).

the limits of our knowledge of the etiology of osteonecrotic and cystic forms [3]. Repeated microtrauma is probably part of the explanation: the recent trauma discovered on diagnosis of osteonecrotic OLTD is merely the revelatory event [5]. OLTD management should take the type of the lesion into account. The FOC classification is of greater interest here in indications for surgery [29,31]. In chronic forms, including overlooked fracture, first-line treatment should be medical. This comprises immobilization, non-weight-bearing and functional rehabilitation. It provides benefit in 5% of cases; symptomatology remains unchanged in 62.5% of cases; secondary surgery is required in 37% of cases [32]. Medical management does not appear to impair the result of secondary surgery [2,22].

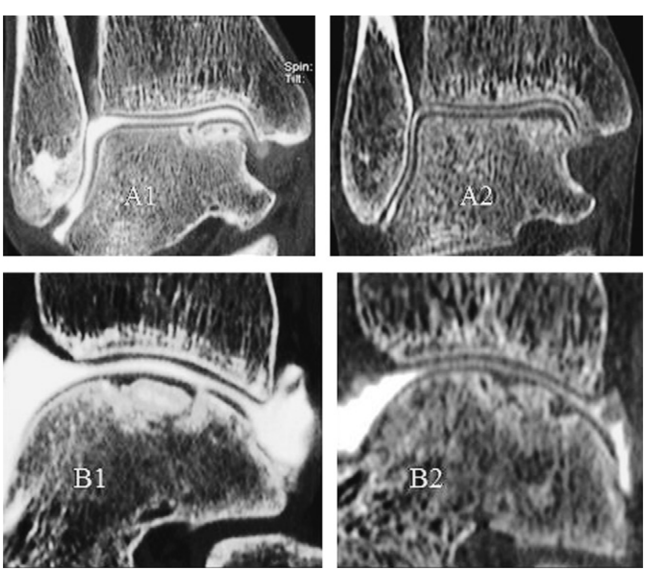

Figure 3 Evolution of autograft: preoperative and follow-up (FU) (2.6 years) arthroscans for patient 2. The preoperative aspect (A1, B1) was of a type O lesion. On FU (A2, B2), the aspect was of remodeled grafted bone but with a satisfactory interline and continuous cartilage.

The number of different surgical techniques recommended points to the difficulty of defining one which will be effective in all cases [21]. OLTD techniques derive from femoral condyle osteochondritis surgery [7,12]. Gudas et al. [8] reported that, in femoral condyle lesions, osteochondral graft gave better results than microfracture at a mean 3 years' FU. It enables earlier and higher-level resumption of sports in young players. For talar lesions, Gobbi et al. [33], in a randomized comparative trial of chondroplasty, microfracture and osteochondral autograft, found no significant difference between the techniques. Their study had, however, a major limitation inasmuch as posteromedial lesions were excluded due to technical difficulty, whereas it is precisely posteromedial lesion accessibility that poses the managerial problem. Kouvalchouk et al. [34] recommended a specific debridement and bone-graft treatment for cystic forms, stressing the need for arthrotomy in order to obtain a satisfactory graft. Arthroscopic techniques seem to entail lower morbidity for comparable long-term results [35]. The main limiting factor remains lesion size, which also has a negative impact on arthroscopic surgery results. Conversion to open surgery seems preferable for large lesions requiring bone graft Franck [3]. In osteochondral talar mosaicplasty, arthrotomy remains mandatory, according to Hangody et al. [14].

According to Baker and Morales [35], classical arthroscopic anterior approaches give limited instrument access to posterior lesions. Schuman et al. [3] found an anteromedial arthroscopic approach to be adequate, but were only performing curettage and subchondral abrasion. The attack angle required for reconstruction is not sufficiently perpendicular to the talar surface: a para-Achilles posteromedial approach could improve access. Several variants have been suggested to secure the technique [36—38]. In our own experience, these approaches fail to provide sufficiently broad access to enable mosaicplasty instruments to be introduced, and always entail a risk of neurovascular lesion. Assenmacher et al. [16] advised notching the anterior edge of the anterior extremity for lesions inaccessible to an anteromedial approach. We have no experience with this technique. A transmalleolar approach seems more suitable to us for posteromedial talar lesions, especially when mosaicplasty is being undertaken. Sasaki et al. [39] recommended a similar technique, with a transmalleolar approach, for osteochondral mosaicplasty. Using this approach to perforate lesions with fixation pins is straightforward and provides a satisfactory talar joint surface attack angle [17]. The tibial mirror lesion, at the junction between the distal tibial joint surface and the lateral side of the medial malleolus, is slight in perforation surgery [40] $-0.4\,cm^2$ in the present series. Our short experience found moderate pain in a single case, and no secondary fracture with a 6—7 mm-diameter bone tunnel. The access zone remained dependent on talocrural mobility, especially in plantar flexion. The transmalleolar approach is not the sole attitude for arthroscopic management of posteromedial OLTD. Talocrural amplitude and sagittal accessibility have to be assessed. The alternative to pure arthroscopy in posteromedial OLTD is still arthrotomy with medial malleolus osteotomy [13,14,24].

The lateral face of the femoral trochlea is the donor site of choice, its cartilage thickness adapting well to that of the medial part of the talar dome [15]. The functional consequences for the donor knee are a matter of debate [41,8]. In cartilage harvesting for chondrocyte autograft, the negative impact seems to be temporary [42]. The suggested alternative is to harvest from a less weight-bearing part of the talus itself [43]. The advantages of surgery without arthrotomy or malleolar osteotomy, however, precludes this attitude. In the present series, ipsilateral knee harvesting caused secondary pain in one patient. X-ray FU found no joint deterioration (notably femoropatellar) at 2 years postsurgery. Given the quality of the cartilage and the limited functional risks involved, the optimal osteochondral donor site is, in our view, the lateral face of the trochlea of the ipsilateral knee.

The transmalleolar approach provides satisfactory and reliable access to posteromedial talar lesions. The approach angle is well-suited to osteochondral autograft.

The transmalleolar approach does not in itself resolve all problems of access to very posterior lesions and remains dependent on talocrural mobility.

Osteochondral autograft with a transmalleolar approach is technically feasible. It remains one technique among many, and requires comparative assessment to determine its real advantages for the patient.

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