Instructional Course 205

The Diagnosis and Management of Osteochondral Lesions of the Talus: Osteochondral Allograft Update

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The management of osteochondral defects of the talus remains a clinical challenge as a result of the poor intrinsic healing potential of cartilage. Osteochondral lesions of the talus (OLT) is a relatively commonly cause of ankle pain and disability (Fig 1). Cartilage has very limited ability for repair or regeneration. A biologic solution to the repair of significant cartilage defects is the "holy grail." Some of the obstacles to cartilage repair are the fact that it is highly vascular, hypocellular, and the chondrocytes are "imprisoned" in a matrix (Fig 2).

General surgical strategies have consisted of inducing a repair response through microfracture-forming fibrocartilage. Autologous chondrocyte implantation (ACI) has also been used and has some promising results. We discuss repairing these lesions with an intact hyaline cartilage organ structure.

Osteochondral allografting is a surgical option for osteochondral lesions involving the talar dome in patients who have failed non-operative management. Allografts are particularly useful for avascular necrosis, for larger lesions with more extensive disease, or as a salvage procedure for failed autografting or subchondral perforation. Unlike other surgical strategies that attempt to stimulate the generation or regeneration of fibrocartilage through a repair response, the transplantation of an osteochondral allograft involves filling the defect with viable chondrocytes and an intact hyaline cartilage organ structure.[1-5]

The advantages of using allograft are a decrease in patient morbidity, shorter surgical time, smaller incisions, tissue flexibility, and the ability to resurface large lesions. The disadvantages are the potential risk of disease transmission as well as slower biologic remodeling and an immune response. The logistics in establishing a relationship with a tissue bank and procurement continue to create obstacles for many surgeons.

Both fresh and fresh-frozen osteochondral allografts are available. Studies have demonstrated, however, that cryopreservation results in a significant decline in chondrocyte viability.[6-9] For this reason, we prefer the use of fresh shell osteochondral allografts. The screening process for donors is extensive, but no tissue or blood type matching is performed. The immune response to osteochondral allografts has been documented.[10-12] Chondrocytes, which are embedded in a protective cartilaginous matrix, are considered relatively immunopriveleged. By depleting the allograft of its marrow component before implantation, the immune response is theoretically diminished. Although the role of histocompatability antigen-matching on the health of transplanted articular cartilage needs to be clarified, rejection has not been a clinical problem in hundreds of transplantations involving the knee and ankle.

SURGICAL TECHNIQUE

Before surgery, the size of the donor talus is matched to the host using radiography and a direct measurement of the donor tissue. Any mechanical axis malalignment or ankle instability must be corrected before allograft implantation. The chondral defect is prepared or machined into a geometric shape, and the base of the defect is abraded until healthy bone is encountered (Fig 3). Allograft procurement is done within the first 24 hours of death and transplantation for a fresh allograft is done within 7 days. The donor graft with the same dimensions is harvested from a

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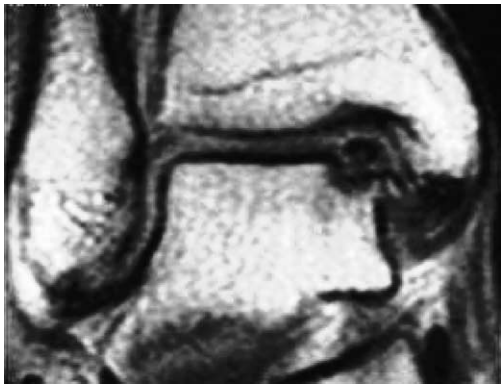

FIGURE 1. Magnetic resonance image of osteochondral lesions of the talus at the posteromedial talar dome.

similar site on the donor talus (Fig 4). The marrow elements are removed with high-pulse lavage, and supplemental bone graft might be necessary for large defects.

This procedure is done either through an anterior arthrotomy or a medial malleolar and/or fibular osteotomy. Graft fixation is achieved with an interference fit supplemented with bioabsorbable pins or interfragmentary screws.

Postoperative management involves early ankle range of motion for 3 to 5 days and no weight bearing for 6 to 12 weeks depending on the stability and the size of the transplantation.[13]

SUMMARY

Although multiple studies have demonstrated the success of osteochondral allografts for the treatment of osteochondral defects of the knee, there are few reports that document the results of allografts performed for talar lesions.[14-16] Gross et al. studied 9 patients with osteochondral lesions of the talus who were treated using fresh osteochondral allograft transplantation.[17] Six of the 9 grafts remained in situ with a mean survival of 11 years. In 3 cases, arthrodesis was required as a result of resorption and fragmentation of the graft. At our institution, the results of osteochondral allografting for focal talar dome lesions in a small number of patients have been encouraging, although follow up is short. Based on our experience in the knee, operative indications for the use of osteochondral allografts in the ankle have expanded.

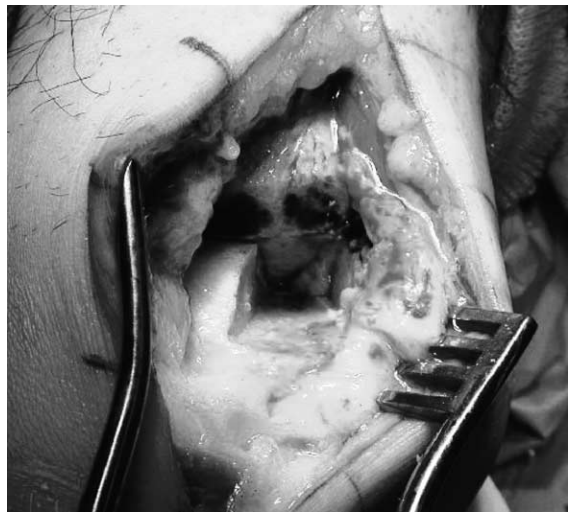

FIGURE 3. The recipient site on the talus is prepared through an anterior arthrotomy.

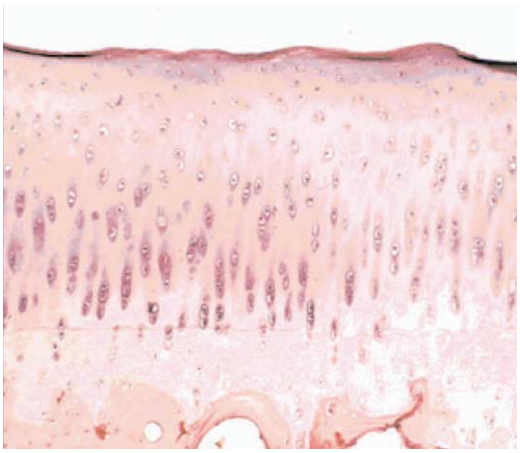

FIGURE 2. Cross-section of articular cartilage shows chondrocytes imbedded in matrix.

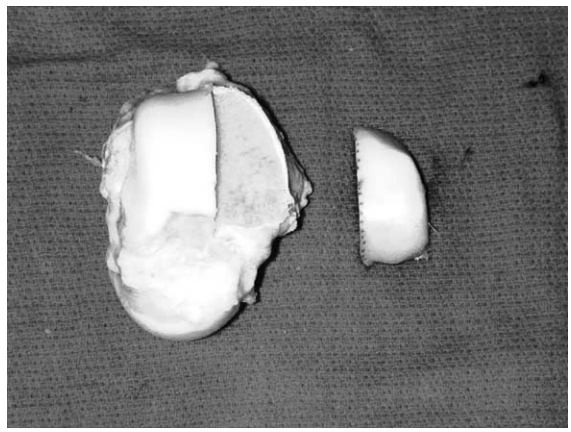

FIGURE 4. Donor graft is harvested from a similar site on the allograft talus.

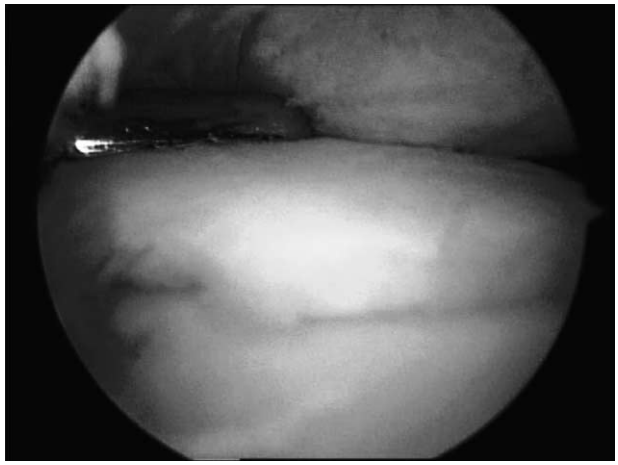

FIGURE 5. A large osteochondral lesion of the talus seen at the time of arthroscopy.

Kim et al. recently presented data evaluating the treatment of post-traumatic ankle arthrosis with bipolar tibiotalar osteochondral shell allografts with an average 10-year follow up.[18] Four of 7 patients reported good or excellent results. Failure did not preclude successful ankle arthrodesis.

The use of an osteochondral allograft is a surgical option for chondral defects of the talar dome. This technique is particularly useful for larger lesions with more extensive talar disease or for diffuse arthrosis requiring anatomic grafts. Early results are encouraging, but studies evaluating this procedure are limited. With advances in surgical technique, tissue banking, and cartilage storage technology, allograft tissue should become more readily available for more widespread use and study.

ARTHROSCOPIC ALLOGRAFT WITH PLATELET-RICH PLASMA (ARTHROSCOPIC ALLOGRAFT/AUTOGRAFT PROCEDURE)

An alternative, less invasive allograft technique that has been developed could provide the surgeon with a minimally invasive technique for primary lesions that appear to be large enough to warrant treatment without requiring extensive allograft procurement techniques. This procedure is called AAP (arthroscopic allograft/autograft) with platelet-rich plasma (PRP). This is designed to be a one-step procedure when a defect is encountered that appears to require immediate treatment (Fig 5). The procedure satisfies the need for bone graft filling of defects as well as providing a matrix for the PRP. PRP provides concentrated growth factors for potential cartilage and bone regrowth.

Surgical Technique

The surgeon can choose any one of a number of allografts, which will come in a granular or powdered form. This material is then mixed with PRP. The PRP is obtained by drawing approximately 60 cc of blood from the patient, centrifuging it, and adding thrombin and calcium to obtain the appropriate texture. A ratio must be established for each allograft and PRP composite so that the sludge that is created will be able to pass through a 14-gauge bone marrow needle. There is a set period of time of approximately 15 to 20 minutes for the composite mixture to set up and create the correct consistency. Working time will be dependent on the bone graft material. In general, the ratio that we have used has been 5 cc of allograft to 4 cc of PRP.

After the lesion has been prepared on the talar dome, a percutaneous or transmalleolar delivery system is used with a 2-mm bone marrow needle through a 2-mm drill hole to deliver the graft (Fig 6). Fluid is removed from the ankle joint, and the arthroscopic procedure is then done as a "dry scope." The defect is then injected and filled under direct visualization. The transplanted AAP is then tamponaded, and the ankle is taken though a full range of motion with traction removed, closed in the usual fashion, and the ankle immobilized in a bulky soft dressing (Fig 7).

The patient is allowed touch weight bearing in 3 to 5 days as well as early range of motion. Partial weight bearing is prescribed for 4 weeks after which the

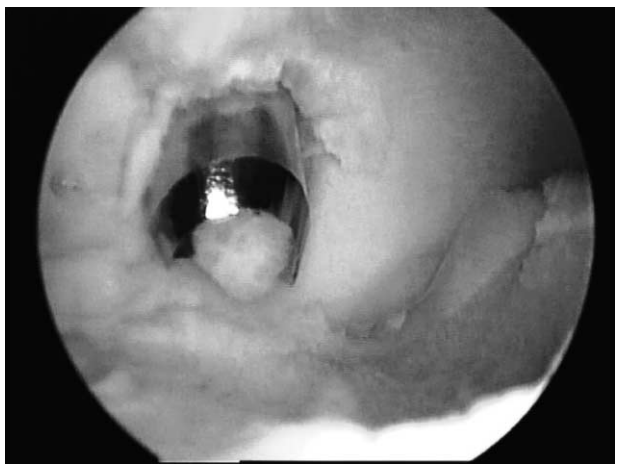

FIGURE 6. Arthroscopic allograft/autograft being delivered through a 2-mm drill hole in the medial malleolus.

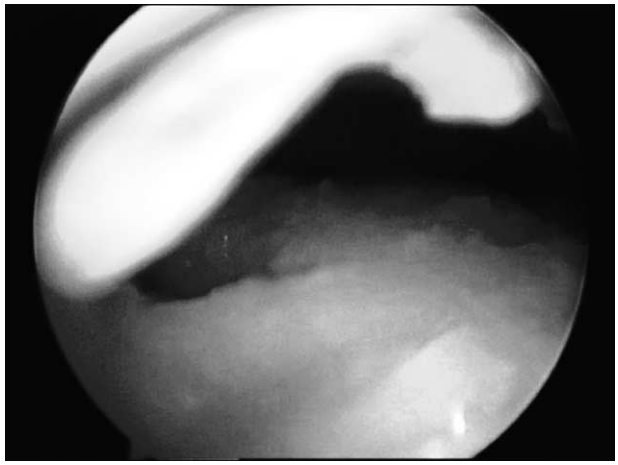

FIGURE 7. Transplanted arthroscopic allograft/autograft is tamponaded during a "dry scope" taking the ankle through a full range of motion.

patient is allowed full weight bearing as tolerated. The preliminary results of this procedure have been encouraging. This is technically a relatively easy procedure to perform if all the appropriate tools are available. It provides the surgeon with a single-staged surgical procedure. It does not require bulk allograft procurement and can supplement the debridement of lesions encountered at the time of surgery that are larger than one would choose to ignore. It also avoids the necessity of autograft harvesting of an articular cartilage graft from the knee. It is unknown at this time what the potential for articular cartilage or hyaline-like cartilage regeneration will be like in this composite. The addition of PRP to the allograft or autograft, hopefully, will have the ability to develop pluripotential cells that could give us a more complete organ structure than merely allograft alone.

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