Osteochondral Lesions of the Talar Dome

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Abstract

Osteochondral lesions of the talar dome are relatively common causes of ankle pain and disability. Trauma is the most common cause, but ischemic necrosis, endocrine disorders, and genetic factors may have etiologic significance. Medial lesions are usually located posteriorly on the dome of the talus, whereas lateral lesions are most frequently located anteriorly. Although the staging system described by Berndt and Harty remains popular, it may not accurately reflect the integrity of the articular cartilage. Small lesions of the talar dome may be present despite a normal appearance on plain radiography. Bone scintigraphy may show increased radionuclide uptake in the talar dome. Magnetic resonance imaging is also sensitive for identifying intraosseous abnormalities in the talus and has the added benefit of revealing other types of soft-tissue lesions not visible on routine radiographic studies. Computed tomography remains the imaging technique of choice when delineation of a bone fragment is desired. Nonoperative management of osteochondral lesions, including restricted weight-bearing and/or immobilization, is recommended unless a loose fragment is clearly present. Surgical options include drilling (usually reserved for intact lesions), debridement of the lesion with curettage or abrasion of the bone bed, internal fixation of the fragment, and bone grafting. Recent technical advances allow these procedures to be performed arthroscopically, with potential reduction of surgical trauma, length of hospital stay, and complication rates.

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The term "osteochondritis dissecans" was coined by König[1] to describe a disorder of the knee joint characterized by detachment of a portion of the articular cartilage and its underlying subchondral bone to form a loose body within the joint. Later, Kappis[2] applied the term to describe a similar process affecting the ankle joint. Although neither König nor Kappis had specific evidence, they suggested that the pathophysiologic basis of these lesions was ischemic necrosis of the subchondral bone followed by separation of the fragment and its attached articular cartilage. Although the etiology remains open to question, the inflammation implied by the derivation of the term has not been shown to be a significant factor in the disorder. For this reason, I prefer the more general term "osteochondral lesion."

The etiology of these lesions and their optimal treatment remain unresolved despite multiple clinical investigations. This article reviews current knowledge about the diagnosis and management of this condition.

Etiology and Epidemiology

Although early investigators suggested a primarily vascular cause for the development of osteochondral lesions of the talus, most contemporary reports suggest a traumatic etiology. In 1959, Berndt and Harty[3] presented their seminal study on this topic, which analyzed the findings in 54 reports that appeared in the period from 1856 through 1956, in which were described a total of 191 transchondral fractures of the talar dome. Most of the articles reviewed were case reports of 1 to 4 patients. Berndt and Harty added 24 of their own patients with transchondral fractures and also presented data on 15 cadaveric ankle specimens subjected to a variety of imposed forces.

Although the number of cadaveric specimens was small, Berndt and Harty obtained data to support a theory that the lesion commonly known as osteochondritis dissecans is actually a transchondral fracture of the talar dome. A single lateral talar dome osteochondral lesion was created in two specimens when inversion and dorsiflexion forces were applied in combination. Medial dome lesions were created by a com-

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bination of inversion, plantar-flexion, and rotation forces in another two specimens. The theory was further strengthened by their eliciting a history of significant trauma to the ankle in 21 of their 24 patients.

Berndt and Harty postulated that lateral lesions are produced when the anterolateral aspect of the talar dome impacts the face of the fibula while the ankle is positioned in dorsiflexion and an inversion stress is applied to the joint. The osteochondral lesion can vary from a minor area of compression to a completely detached osteochondral fragment (Fig. 1). Similarly, when the plantar-flexed ankle is subjected to a combination of inversion force and external rotation of the ankle on the tibia, the posteromedial talar dome impacts the tibial articular surface, creating the classic posteromedial lesion. Their study has been cited by many subsequent investigators as a definitive demonstration that osteochondral lesions of the talar dome are traumatic in origin. Microscopic examination of specimens obtained from their patients showed viable articular cartilage overlying subchondral trabecular bone devoid of viable osteocytes, which in turn overlay a deeper layer of fibrous tissue separating the lesion from the viable subchondral bone bed.

More recent investigations have generally supported a traumatic etiology for these osteochondral lesions. Canale and Belding[4] reported on 31 talar dome lesions in 29 patients and found that all of the lateral lesions were associated with trauma, but that only 64% of patients with medial lesions had experienced a significant traumatic event. Combining these data with the work of Yvars,[5] Rödén et al,[6] and Marks,[7] the authors concluded that lateral lesions are usually traumatic in origin, whereas medial lesions may be either traumatic or nontraumatic. This view was supported by Alexander and Lichtman.[8] In their study of 25 patients, all lateral lesions were associated with a "sprain" or "trauma," while 18% of the patients with medial lesions reported no prior history of trauma.

In a comprehensive review of the literature published before 1985, Flick and Gould[9] found reports of osteochondral lesions of the talar dome in over 500 patients. They observed that 98% of lateral talar dome lesions and 70% of medial talar dome lesions were associated with a history of trauma. In their own group of 22 patients, all of those with lateral lesions had experienced significant ankle trauma, compared with only 80% of those with medial lesions.

Similarly, Pritsch et al[10] found that in a group of 24 patients, 75% of both medial and lateral lesions were associated with trauma. The studies of Parisien,[11] Baker et al,[12] Pettine and Morrey,[13] Van Buecken et al,[14] and Anderson et al[15] revealed a history of trauma in over 85% of patients. All of these studies support the hypothesis that trauma is the primary cause in most, but not all, patients.

Lateral lesions are almost always associated with an acute traumatic episode and most likely represent true osteochondral or transchondral fractures, as suggested by Berndt and Harty. Patients are more likely to have a medial osteochondral lesion when a clear-cut history of trauma is absent. Because this observation has been made in several

Fig. 1 Mechanism by which transchondral fracture of the lateral talar dome results in osteochondritis dissecans, according to Berndt and Harty.[3] **A,** Normal ankle. **B,** As the foot is inverted on the leg, the lateral border of the dome is compressed against the face of the fibula, while the collateral ligament remains intact. **C,** Further inversion ruptures the lateral ligament and begins avulsion of the chip. **D,** Chip is detached but remains in place. **E,** Chip is displaced.

studies, it suggests that at least some lesions may have a nontraumatic cause, such as a primary ischemic event. Another finding that supports nontraumatic causation in some patients is the finding of families with multiple affected members, as well as the occasional reports of patients with involvement of other joints in addition to the ankle joint. Furthermore, 10% to 25% of patients have lesions in both ankles. Whether atraumatic lesions are the result of ischemic necrosis, hormonal factors, hereditary contributions, or some other "constitutional" abnormality is unknown.

Lateral osteochondral lesions are typically located over the anterolateral portion of the talar dome. Medial lesions are most commonly located over the posteromedial portion. Morphologically, lateral lesions tend to be shallower and more wafer shaped than medial lesions, which appear as deeper, cup-shaped defects. Osteochondral lesions less commonly occur centrally on the talar dome or in other locations. One recent study found that lateral lesions also occurred posteriorly on the dome of the talus.[15]

Staging

Berndt and Harty[3] suggested a staging system that has been cited in virtually every subsequent publication on the topic. The description of this widely used system appears only in a footnote to a table in which their patient data are presented. Berndt and Harty themselves termed the system "arbitrary," nor is it clearly stated whether the system is based on radiographic criteria, inspection of the lesion at surgery, or a combination of both. However, since 1959, the Berndt and Harty criteria have been applied in most studies as a radiographic staging system. As shown in Figure 2, the stages are as follows: stage I, a small compression fracture; stage II, incomplete avulsion of a fragment; stage III, complete avulsion without displacement; and stage IV, avulsed fragment displaced within the joint.

Because the Berndt and Harty classification system is primarily a radiographic staging system, we must ask how the scheme correlates with the intraoperative findings. Their system implies that progressively greater trauma creates lesions with a greater probability of separation from the underlying bone bed. Therefore, it would be expected that increasing degrees of fragment separation would be identified intraoperatively with increasing grade of the lesion.

Pritsch et al[10] specifically addressed this issue in a study of plain-radiographic and arthroscopic findings in 24 patients. The arthroscopic appearance of the lesions was graded as follows: grade I, intact, firm, shiny cartilage; grade II, intact but soft cartilage; and grade III, frayed cartilage. The authors found that an increase in the radiographic stage of the lesion did not necessarily predict increasing fragmentation or loosening of the lesion. Of eight radiographic stage IV lesions, four were considered grade I (intact) lesions when viewed arthroscopically. Furthermore, of eight radiographic stage II lesions, which would be expected to have lesser degrees of articular cartilage damage, seven actually had an arthroscopic grade III appearance. Pritsch et al concluded that treatment choices should be based on the actual condition of the articular cartilage, rather

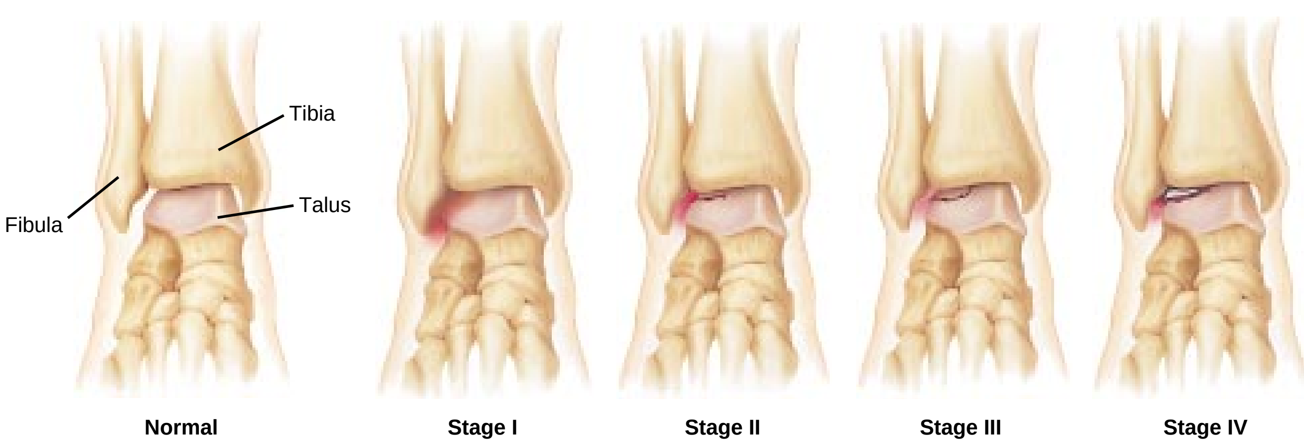


Fig. 2 Berndt and Harty system for staging osteochondral lesions of the talar dome.[3] Stage I is characterized by a small area of subchondral compression. In stage II, there is a partially detached fragment. In stage III, a completely detached fragment remains in the crater. In stage IV, a fragment is loose in the joint.

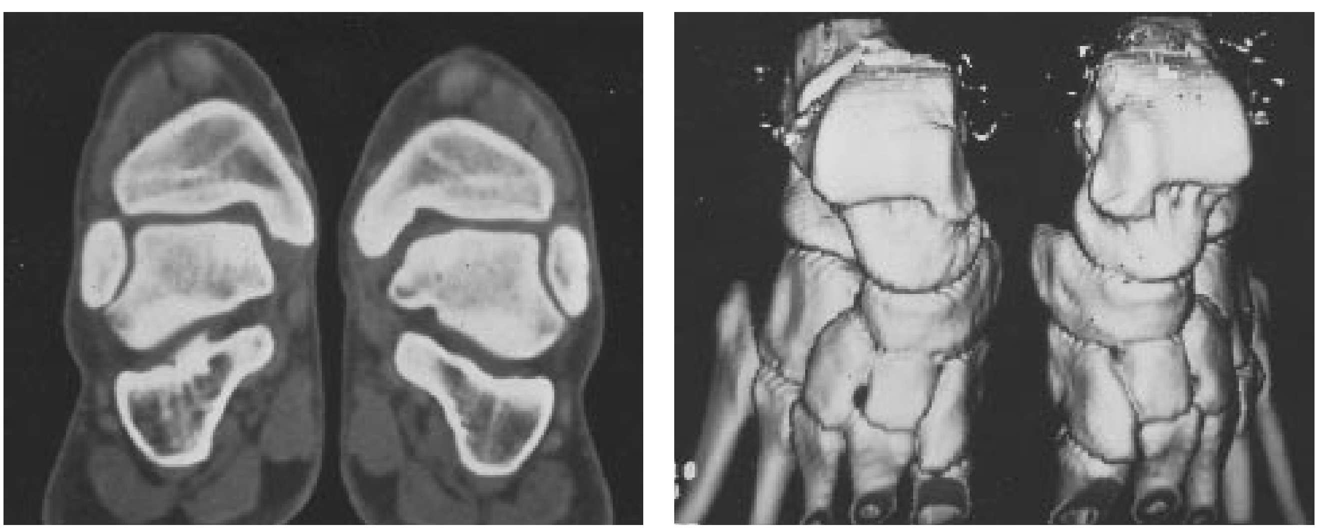
than the plain-radiographic appearance, and stressed the role of arthroscopy in providing this critical information.

More sophisticated radiologic imaging techniques have also been used in an attempt to predict the relative intactness of the articular cartilage. Computed tomography (CT), with or without the addition of intra-articular contrast material, provides improved bone delineation in both axial and coronal planes (Fig. 3). Magnetic resonance (MR) imaging has the advantages of high sensitivity for detecting subtle bone changes that may suggest edema or hemorrhage accompanying a recent osteochondral fracture, the absence of exposure to ionizing radiation, and the ability to image the ankle in multiple planes (Fig. 4).

The merits of the various imaging techniques, particularly MR imaging and CT, in evaluating and treating osteochondral lesions of the talus remain incompletely defined. Anderson et al[15] attempted to clarify the relative usefulness of bone scanning, CT, and MR imaging in 24 patients with a history of ankle injury. One group of 14 patients presented with persistent ankle symptoms and normal plain radiographs. These patients underwent bone scanning, followed by CT and MR imaging. All 14 patients in this group had abnormal bone scans and were found to have talar dome osteochondral abnormalities on MR imaging; however, the CT scans of 4 were interpreted as normal, despite the presence of stage I changes (subchondral trabecular compression) on MR imaging. The second group of 10 patients presented with abnormal plain radiographs and underwent only CT and MR imaging. The investigators concluded that the two studies gave equivalent results in 9 of the 10 cases. On the basis of these results, Anderson et al concluded that bone scanning should be performed on patients in whom an osteochondral lesion is suspected despite negative plain radiographs. They also concluded that MR imaging can depict subtle, stage I lesions that may represent trabecular compression, and that CT provides the best definition of bone fragments and is the study of choice for evaluating osteochondral lesions observed on plain radiographs.

In a more recent study, De Smet et al[16] examined 14 patients with MR imaging and compared the predicted degree of intactness of the chondral surface with the arthroscopic findings. The authors found MR imaging to be an accurate predictor of fragment stability. As more experience is gained with MR imaging and correlations are made between the MR appearance and the surgical findings, this technique may prove useful in predicting the relative intactness of osteochondral lesions.

The diagnostic approach at my institution is as follows: Patients who present with an acute ankle injury accompanied by hemarthrosis or significant tenderness over the osseous structures of the joint are examined first with plain radiography. If an osteochondral lesion is noted, a



A B

Fig. 3 **A,** Computed tomogram of bilateral medial talar dome osteochondral lesions after arthroscopic debridement. **B,** Three-dimensional CT reconstruction of same ankle joints.

Fig. 4 Magnetic resonance image of osteochondral lesion of the medial talar dome.

CT scan is then obtained to delineate the size, location, and degree of displacement of the bone fragment. If there is persistent ankle pain and no lesion is visible on plain radiographs, we recommend MR imaging because of its ability to image both bone and soft-tissue lesions that might be responsible for the patient's symptoms, such as soft-tissue lesions of tendons, ligament injuries, and soft-tissue impingement lesions.

Clinical and Radiologic Evaluation

Patients usually present to the physician for evaluation of an acute ankle inversion injury or persistent ankle pain or instability after unsuccessful nonoperative treatment. A patient with an osteochondral lesion of the talar dome usually complains of pain in the ankle, frequently localized to the side of the lesion and accompanied by intermittent episodes of swelling. Complaints of catching or grinding in the joint are also common, although true joint locking is less common. Instability of the ankle, with giving way and frequent inversion injuries, is another common complaint, but the incidence of objective joint laxity, as documented by stress radiographs, is less common.

The findings from physical examination of the patient with an osteochondral lesion of the talar dome are often nonspecific. Posteromedial lesions may demonstrate tenderness to palpation, particularly when the ankle is dorsiflexed and the area just posterior to the medial malleolus is palpated. Similarly, anterolateral lesions are often tender when the joint is palpated laterally with the ankle in a plantar-flexed position. Joint crepitus may be noted on active or passive range-of-motion exercises. The possibility of coexisting joint laxity should be assessed with either inversion or anterior application of joint stress, with comparison being made with the opposite ankle.

The plain-radiographic examination should include anteroposterior, lateral, and mortise views. If there is suspicion of a posteromedial lesion, a mortise view in plantar flexion may better delineate the abnormality. An anterolateral lesion may be better visualized in ankle dorsiflexion, which brings the lesion parallel to the x-ray beam. Plain radiographs of the asymptomatic opposite ankle should be obtained to investigate the possibility of a contralateral lesion, which is noted in 10% to 25% of patients. Although an asymptomatic contralateral lesion may not require active treatment, the treating physician and the patient should both be aware of its presence, so that it can be reassessed clinically or radiographically.

Because osteochondral lesions of the talar dome may coexist with lateral ligament laxity, stress radiographs should be obtained if ligament laxity was identified on clinical examination. Local or general anesthesia may be required if the patient's guarding makes it difficult to obtain accurate stress radiographs.

If an osteochondral lesion is seen on plain radiographs, the size, location, and intactness of the lesion should be assessed. A small, acute lesion that is clearly delineated on plain radiographs may be treated nonoperatively with a period of immobilization and weight-bearing relief with crutches. We recommend CT as the most efficient and reproducible means of evaluating the osseous anatomy of these lesions. Primary scans, not computer reconstructions, should be obtained in both coronal and axial planes.

If a patient presents with an acute injury but no bone lesion is identified on the initial radiographs, nonoperative treatment for a presumed soft-tissue injury is indicated. This treatment may include a limited period of immobilization and non-weight-bearing, weight restriction without immobilization, or limited immobilization with use of a removable orthosis, depending on the nature of the injury. If the patient responds favorably to increasing activity and rehabilitation, no further intervention is necessary. If the patient remains symptomatic despite attempts to rehabilitate the ankle, plain radiographs should be obtained again 2 to 4 weeks after injury. If the radiographic appearance remains normal but symptoms persist, we recommend obtaining a bone scan 8 to 12 weeks after injury. A positive bone scan that shows increased uptake over the talar dome mandates further investigation with CT or MR imaging.

Treatment

The indications for nonoperative and operative treatment of osteochondral lesions of the talus are controversial because of conflicting reports regarding efficacy. The controversy stems in part from the inadequacy of the imaging studies on which orthopaedists have based their decisions. As stated previously, accurate delineation of the size and location of lesions has not been provided in most published studies. Arthroscopic examination remains the most reliable means of determining the relative intactness of the articular surface of the lesion, although MR imaging holds considerable promise. The orthopaedic surgeon must also consider the age of the patient and the size, location, intactness, and chronicity of the lesion.

The concept that osteochondral lesions are best treated surgically dates back at least to the publication of the 1959 study by Berndt and Harty.[3] In their review of the literature and their own series of patients, poor results were obtained in a high proportion of patients treated nonoperatively. In contrast, good results were obtained in 84% of patients treated surgically.

In a report of the data on 29 patients with 31 osteochondral lesions, Canale and Belding[4] found that the results of nonoperative and surgical treatment were equivalent in medial stage III lesions. However, the results in lateral stage III lesions were better with surgical treatment. They suggested that all stage IV lesions are best treated surgically but had results in only a small number of patients to support this conclusion. Despite the small number of patients, this study is frequently cited to support operative treatment of stage III and stage IV osteochondral lesions.

Flick and Gould[9] reported that six of eight patients treated nonoperatively had poor results; one patient had a grade I lesion, and the remainder had lesions graded "II/III" or higher. Symptomatic patients with radiographs suggesting partially or completely detached lesions did poorly with nonoperative treatment. These authors agree with Alexander and Lichtman[8] that the delay in operative treatment resulting from a trial of nonoperative therapy does not adversely affect the results of later surgical treatment.

Pettine and Morrey[13] agree that one should initially attempt to treat lesions of the talar dome with a period of immobilization and suggest that even nondisplaced medial stage III lesions have a significant chance of healing. They concluded that delay in diagnosis had an adverse effect on outcome, but that delaying surgery for less than 1 year did not.

Nonoperative Treatment

As stated previously, there is general agreement that delaying surgery for up to 12 months to allow a trial of nonoperative treatment does not compromise the results of subsequent surgical treatment.[13,14,17] Most asymptomatic contralateral lesions need not be treated actively either, but their appearance on plain radiographs or CT scans dictates appropriate clinical and radiologic follow-up.

Nonoperative treatment may take various forms, including some combination of weight limitation and/or cast or brace immobilization. Instillation of synthetic corticosteroid preparations into the ankle joint has not been shown to have any beneficial effect on healing and is not recommended. The required duration of nonoperative treatment and the relative roles of weight restriction and immobilization are difficult to assess from the literature because these factors have been very poorly controlled in the published studies to date.

Surgical Options

Options for surgical treatment of osteochondral talar dome lesions include drilling of intact lesions, internal fixation of intact or separated lesions, bone grafting, and fragment excision followed by curettage, abrasion, or drilling of the base of the lesion. These procedures may be performed either by open arthrotomy of the ankle joint or by arthroscopy.

Open Arthrotomy

More anteriorly located lateral lesions are approached with an anterolateral arthrotomy incision, while exercising care not to injure branches of the superficial peroneal nerve. Medial lesions present a more difficult problem of exposure, because they are typically located more posteriorly on the talar dome. Some lesions are accessible with use of an anteromedial approach to the ankle joint combined with plantar flexion to allow visualization as far posterior as possible. Another method, described by Flick and Gould,[9] is to groove the anteromedial surface of the distal tibia with a gouge after exposing the joint through the tendon sheath of the tibialis anterior. The groove removes articular cartilage and bone to a depth of approximately 6 to 8 mm.

If a medial lesion cannot be exposed with one of these methods, a medial malleolar osteotomy should be performed. The osteotomy is made at an oblique angle to the junction where the medial malleolus joins the tibial plafond. Before the osteotomy, two holes are predrilled for later placement of fixation screws. Care should be taken to perform the osteotomy at the proper angle, so that the cut is made neither too far laterally, causing it to impinge on the tibial plafond, nor too far distally on the medial malleolus, potentially compromising exposure and rendering internal fixation more difficult. Although this technique provides excellent exposure, it risks injury to the articular cartilage of the tibia, the posterior tibial tendon, the flexor digitorum longus tendon, and the neurovascular bundle. This procedure also entails internal fixation and possibly later removal of the screws used to internally fix the osteotomy, the risk of delayed union or nonunion, and the need to protect the joint during the period of osteotomy healing.

Osteochondral Lesions Associated With Ligamentous Instability

Treatment of coexisting osteochondral lesions of the talar dome and lateral ligament instability is controversial. When an acute osteochondral fracture that involves a fragment greater than 0.5 to 1.0 cm occurs in association with a severe inversion ligament injury, we recommend surgical treatment of the osteochondral lesion and nonoperative treatment of the ligament injury. In most cases, late lateral ligament reconstruction is not necessary.

When a chronic osteochondral lesion coexists with chronic ligament laxity, the surgical decision is more difficult. A staged procedure may be selected because the rehabilitation goals of the two procedures are different. In general, early motion is the goal of surgery for osteochondral lesions. In contrast, procedures to reconstruct the lateral ligaments require a significant period of postoperative immobilization. We generally perform the surgery for the osteochondral lesion first and perform the ligament surgery only if indicated as the second-stage procedure.

Arthroscopic Approach

An arthroscopic approach can improve visualization of the entire joint surface and avoids some of the morbidity that attends arthrotomy. As the surgeon becomes more practiced in ankle arthroscopic techniques, even lesions on the far posteromedial talar dome can be both examined and treated. Whereas arthrotomy usually requires hospital admission, arthroscopy usually can be done on an outpatient basis. Furthermore, rehabilitation and functional return are facilitated. Despite these advantages, even the most experienced arthroscopist can be challenged by some lesions, particularly those located far posteromedially. If the surgeon can perform the procedure with less morbidity by using open techniques, that should be his or her prerogative.

Because of the congruent joint surfaces and tight ligament restraints, it is especially challenging to insert and maneuver arthroscopic instruments in the ankle without injuring the articular cartilage. Two major innovations have increased the ability to use the arthroscopic approach. The first involves the major improvements that have been made in the quality of fiberoptic arthroscopes, so that excellent resolution is now possible with small-diameter, wide-angle arthroscopes. I routinely use a 2.7-mm arthroscope because the larger 4- to 5-mm arthroscopes are difficult to maneuver within the joint and the smaller 1.9-mm arthroscopes are easily bent and broken. Arthroscopes with both 30-degree and 70-degree viewing angulation should be available to maximize the surgeon's ability to visualize the entire joint.

The second innovation is the development of efficient mechanisms to distract the joint, making more space available for the arthroscopic instrumentation. Guhl pioneered the use of invasive distraction with an external joint distractor attached to 3/16-inch threaded pins placed into the tibia and calcaneus. This technique provides excellent exposure even in very tight ankles. However, it carries a risk of complications, including pin-tract infection, fracture through pin sites, and injury to ligamentous or superficial neurovascular structures. Although such complications are rare, the potential risks stimulated the development of noninvasive mechanisms for joint distraction (Fig. 5).[18,19] Our current preferred method utilizes a strap placed around the heel and the midfoot. The strap is attached to a sterile bar and clamp, and distraction is applied without the need for placement of pins into the bones. We have found that this technique, combined with the use of small-diameter arthroscopes, has virtually eliminated the need for pin distraction. To date, we have had no complications related to the use of this technique.

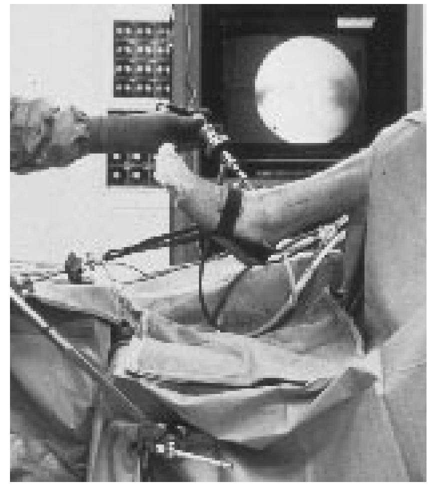


Fig. 5 Ankle arthroscopy performed with use of a noninvasive distractor. Strap is attached by means of a distractor to a sterile bar fixed to the side rail of the operating table.

Drilling of Intact Lesions

Drilling a lesion with multiple small holes is frequently recommended for intact lesions, although there is little scientific evidence that it promotes healing of osteochondral lesions of the talar dome. The rationale is that drill tracts provide a route for vascularization and healing of the avascular fragment.

Anterolateral lesions are usually easily accessible for drilling via an anterolateral exposure to the ankle joint. Posteromedial lesions may be inaccessible for drilling without malleolar osteotomy. If an arthroscopic approach is chosen, we use a 0.062-inch smooth Kirschner wire placed through a needle-scope cannula to prevent bending and breaking of the wire. Anterolateral lesions are easily approached from the anterolateral portal or through an accessory portal placed adjacent to the tibial plafond. Although medial lesions usually cannot be reached from the anteromedial portal, a recently described technique involving the use of a curved meniscus-repair needle guide allows this to be performed.[20]

An alternative is to place multiple drill holes with use of a transmalleolar technique under arthroscopic control. The pin is directed across the medial malleolus, and multiple holes are placed by plantar-flexing and dorsiflexing the ankle or by using multiple tracts. Pin placement can be performed accurately with use of a commercially available drill guide. Transmalleolar drilling entails some damage to the normal articular cartilage of the tibial plafond, but small Kirschner wires theoretically make this damage minimal. Although mentioned as a possible complication, fracture after arthroscopically guided transmalleolar drilling has not been reported in the literature.

Another technique for placing multiple drill holes in a posteromedial lesion avoids the potential for injury to the articular cartilage inherent in the transmalleolar technique. A pin is placed percutaneously into the sinus tarsi, entering the talus in its nonarticular portion anterior to the anterior talofibular ligament insertion area. The pin is then drilled from distal to proximal under direct arthroscopic visualization. A drill guide is also available for this technique (Fig. 6).

Regardless of which technique is used, the ankle is immobilized postoperatively for approximately 6 weeks. Active and passive range-of-motion exercises are then begun. Weight-bearing is advanced as tolerated, and exercises to regain strength and proprioception are also begun.

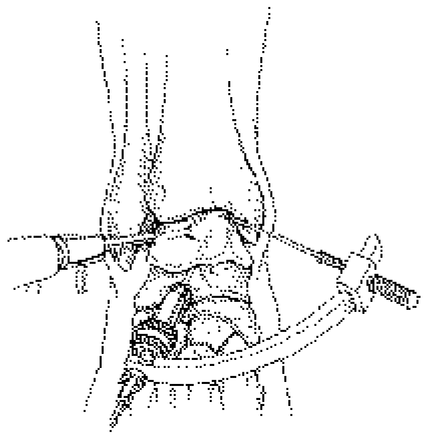


Fig. 6 Use of a drill guide with a tissue-protective cannula in retrograde transtalar drilling of a posteromedial talar dome lesion.

Debridement

Detached osteochondral lesions and loose bodies secondary to osteochondral lesions of the talar dome usually require fragment removal and debridement of the bone bed. In general, the edges of the lesion are debrided to healthy, well-attached articular cartilage, and the base of the lesion is abraded to viable, bleeding subchondral bone. As noted previously, anterolateral lesions can usually be reached with use of an anterolateral open approach to the ankle joint. Like drilling procedures, surgery for a posteromedial lesion may require malleolar osteotomy if the lesion cannot be reached by plantar-flexing the ankle and using an anteromedial approach.

If osteochondral lesions of the talar dome are to be treated arthroscopically, we use small-diameter arthroscopes combined with noninvasive joint distraction. Lateral lesions can usually be approached for debridement with use of the three standard arthroscopic portals; with the inflow in the posterolateral portal and the arthroscope in the anteromedial portal, instruments are introduced through the anterolateral portal to debride the lesion.

Medial lesions are more difficult to approach. However, instruments can usually be passed from anterior to posterior more easily from the medial side of the joint, because of the presence of an anatomic notch at the anteromedial tibial plafond known as the “notch of Harty,” after the anatomist credited with its description. The inflow is placed posterolaterally, the arthroscope is placed in the anterolateral portal, and the instruments for debriding the lesion are placed in the anteromedial portal. Occasionally, posteromedial dome lesions are located so far posterior as to be difficult to visualize from the anterior portals. Under these circumstances, the arthroscope can be placed posterolaterally while the instruments are passed through the anteromedial portal and the inflow is placed anterolaterally.

Regardless of whether an open or an arthroscopic technique is used, a variety of instruments should be available to debride an osteochondral lesion, as each ankle presents peculiar anatomic constraints to surgery. We find that small ring curettes are particularly useful for debriding the articular cartilage back to healthy tissue, with edges perpendicular to the underlying subchondral bone. Alternatively, small cervical curettes, which are available in a variety of angulations, can also be useful. Lesions that present an elevated articular surface attached to a loose piece of underlying bone may require dissection from the bone bed with use of a blunt-tipped probe or a small Freer elevator. Once a fragment has been isolated from its bed, an attempt should be made to remove it as a single piece with loose-body forceps.

After debridement of the articular cartilage and any loose bone, the base of the lesion should be further debrided with curettes or abraded with a small round burr. Debridement should not be carried beyond exposure of viable subchondral bone. It is not necessary to drill deep into cancellous bone. Alternatively, multiple drill holes can be placed by the techniques already described. The viability of the subchondral bone can be demonstrated by decreasing the inflow pressure and observing punctate bleeding from the bone. When inflow pressure and flow are adequate, the use of a tourniquet is usually not required.

Postoperatively, range-of-motion exercises are begun early, but weight-bearing is avoided for the first 6 weeks after the procedure. After that period, weight-bearing is advanced as tolerated, and a graduated program of exercises to regain motion, strength, and proprioception is initiated.

Internal Fixation of Osteochondral Lesions

Although reviews of osteochondral lesions contain occasional reports of internal fixation, no large series are available on which to base definite recommendations. The best candidate for internal fixation is a young patient with an acute traumatic lesion. The larger the piece of attached subchondral bone and the healthier the articular cartilage, the greater the likelihood that internal fixation will be successful. Specific recommendations regarding the size of lesions that can be treated with internal fixation cannot be made, but we would consider lesions measuring 0.75 cm in diameter or larger.

Both open and arthroscopic techniques have been used for internal fixation of osteochondral lesions of the talar dome. One of the potential difficulties inherent in internal fixation of osteochondral lesions of the talus is that removal of the hardware used for fixation may be necessary after healing. Screw fixation of a posteromedial lesion requires either malleolar osteotomy or a large transmalleolar hole, and screw removal requires a procedure of similar magnitude. For these reasons, most surgeons have been deterred from attempting internal fixation of lesions in this anatomic site. Anterolateral lesions are much more accessible, and fixation performed with open or arthroscopic techniques is less difficult. Even if a screw is used, removal is relatively simple, requiring only arthrotomy or arthroscopy, rather than osteotomy.

Fixation with Kirschner wires is less secure than screw fixation with small cancellous screws or Herbert screws, and compression across the fragment cannot be achieved. However, Kirschner wires have the advantage that they can be placed by a retrograde transtalar technique. The pins are placed percutaneously into the nonarticular portion of the talus through the sinus tarsi and advanced into the lesion. The joint surface is monitored arthroscopically. When the pins pass through the lesion and reach the articular surface, they can be withdrawn to just below the level of the articular surface. The pins can be cut off below skin level and removed later without difficulty.

Methods of internal fixation involving the use of bioabsorbable pins have been studied recently. Although compression cannot be achieved, removal of the fixation device is not required (Fig. 7). Bone resorption around bioabsorbable fixation devices has been reported in other joints, but there is inadequate experience to establish whether this is a problem with osteochondral lesions of the talus. Anterolateral lesions can usually be approached without the use of a transmalleolar approach. Some posteromedial lesions can be reached without a transmalleolar approach if the lesion can be brought forward enough by plantar-flexing the ankle. If not, a transmalleolar approach or an open osteotomy approach must be used. It

A B C

Fig. 7 Intraoperative arthroscopic photographs illustrate insertion of a bioabsorbable pin into a medial talar dome lesion. **A,** Intact medial talar dome lesion. **B,** Smooth pin is drilled percutaneously into the lesion before placement of a bioabsorbable pin. **C,** The surface of the pin is visible as a dark spot on the dome of the talus.

is advantageous to approach the lesion with the fixation device as perpendicular to the articular surface as possible, to avoid skiving the surface and encountering difficulties in passing the device across the lesion.

Postoperatively, the ankle joint is immobilized for approximately 6 weeks. A routine postoperative rehabilitation program can then be begun.

Bone Grafting

Although the use of bone grafts for internal fixation and stimulation of healing of osteochondral lesions of the femoral condyles of the knee joint is a well-documented technique, applications for osteochondral lesions of the talus have not been so well defined. Most lesions in children will heal with less invasive techniques, such as drilling combined with immobilization and weight restriction. The most appropriate candidate is an adult patient who has a detached lesion that has not healed with nonoperative treatment or with less invasive operative techniques, such as drilling, but who still has a congruent articular surface on arthroscopic inspection. Open techniques have been described, but there are no large patient series on which to base judgments of efficacy.

Arthroscopic techniques for bone grafting have been reported. One technique described by Guhl involves placement of corticocancellous graft material via a transmalleolar approach. Unfortunately, this technique necessitates the creation of two holes, one in the tibial articular surface for drill placement and one in the talar articular surface for graft placement. This technique is not recommended.

Another technique involves placement of the bone graft beneath the osteochondral lesion with use of the retrograde transtalar approach described previously for drilling. However, most adult patients present for treatment with detached lesions that require fragment excision, and simple bone grafting is rarely appropriate.

Postoperative Rehabilitation

Initiation of weight-bearing after surgery depends on the type of procedure performed and the size of the osteochondral lesion. If the lesion has been debrided, range-of-motion exercises may be instituted before weight-bearing. If drilling, internal fixation, or bone grafting has been used, a more prolonged period of non-weight-bearing may be elected until healing is demonstrated on clinical or radiographic examination.

The first goal of rehabilitation is attainment of full joint motion by a combination of passive and active exercises. Strength is regained by institution of resistive exercises that involve use of weight, elastic bands, or isokinetic exercise machines. Proprioceptive exercises, such as those performed with the biomechanical ankle platform system, or BAPS board, are also important. For patients who hope to return to sports activities, a plyometric exercise program for strength and agility is important. It is often useful for the rehabilitation program to be directed and monitored by a registered physical therapist, but most patients can perform the bulk of the rehabilitation program on their own in a supervised home-exercise program.

Summary

Physicians must maintain a high index of suspicion that an osteochondral lesion of the talar dome exists in a patient who does not improve with nonoperative management of a “routine” ankle sprain or who presents for evaluation of chronic ankle pain despite the absence of an abnormality on plain radiographs. Bone scanning should be the next diagnostic study. If an osteochondral lesion of the talar dome is present, further evaluation with CT is appropriate to evaluate the location, size, and displacement of the bone fragment. If a bone scan is negative, but symptoms persist, the next study should be MR imaging, which may be the most sensitive test for occult lesions of the talar dome.

A patient without an obvious loose body should be initially treated nonoperatively, with some combination of weight limitation and/or immobilization for several weeks to several months. If nonoperative treatment results in resolution of symptoms, the patient should be followed up with clinical examination and plain radiographs.

If nonoperative management is not successful, operative options should be explored. Arthroscopy has proved to be of great value, offering the most direct and least invasive means of evaluating the relative intactness of a talar dome lesion.

Traditional surgical treatment has used arthrotomy for direct exposure of the lesion. These surgical procedures can now be performed arthroscopically. Arthroscopic approaches afford improved joint visualization without the need for extensive open approaches, including malleolar osteotomy for posteromedial lesions. These procedures require special expertise in arthroscopic techniques and are technically demanding.

In most cases, surgical treatment of osteochondral lesions involves loose-body removal and debridement of the bone bed with use of curettage, abrasion with a burr, or drilling with a Kirschner wire. Internal fixation of a loose fragment may be performed if it fits precisely into the bone bed and has a subchondral fragment sufficient to support internal fixation with pins, screws, or absorbable pins. An intact lesion may be drilled with a Kirschner wire to create multiple passages into the subchondral bone and possibly to stimulate healing. Bone grafting is rarely indicated, but might be considered in a skeletally mature patient with a loose fragment and an intact articular cartilage surface. Skeletally immature patients have a greater chance of lesion healing with drilling, internal fixation, or bone grafting.

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