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Case Reports and Series

Osteochondral Defect of the Calcaneocuboid Joint: A Case Study

Eric So, DPM, AACFAS¹, Emily Zulauf, DPM², Jeffrey S. Weber, DPM, AACFAS³, Christopher F. Hyer, DPM, MS, FACFAS⁴¹ Fellow, The CORE Institute, Phoenix, AZ² Resident, Grant Medical Center, Columbus, OH³ Fellowship-Trained Foot and Ankle Surgeon, Milwaukee Foot and Ankle Specialists, Milwaukee, WI⁴ Fellowship-Trained Foot and Ankle Surgeon, Orthopedic Foot and Ankle Center, Westerville, OH

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ABSTRACT

Osteochondral lesions (OCLs) are injuries affecting the articular cartilage surface of a joint. OCLs are well reported in the literature to affect the knee, talus, tibia, navicular, and first metatarsal. This rare case of a bipolar osteochondral lesion of the cuboid and calcaneus presented as lateral heel pain after a traumatic injury. After an unsuccessful course of conservative therapy, the lesion was treated with curettage and application juvenile particulate cartilage allograft. Eight months postoperatively, the patient was ambulating in supportive shoe gear without pain. The mechanism of injury leading to calcaneocuboid joint osteochondral lesions is not clearly understood. It is also questionable whether anatomic variances are contributory. Regardless of causality, OCLs should be included in the differential diagnoses for patients presenting with calcaneocuboid joint or lateral hindfoot pain.

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Osteochondral lesion (OCL) describes an injury to the articular cartilage surface of bone within a joint. It may result in a defect that subsequently affects the subchondral bone and, in severe cases, may lead to formation of an osteochondral fragment. With disease progression, the fragment may detach, leading to degenerative osteoarthritis (1). Patients with osteochondral injuries commonly present with symptoms of pain, joint stiffness, and disability after a traumatic incident (2). OCLs are generally well reported and are most commonly identified in the knee; however, other notable sites include the talus, tibia, navicular, and first metatarsal (3–7). To the best of the authors' knowledge, OCLs of the cuboid have not been described.

The course of treatment for osteochondral lesions depends on severity and chronicity of patients' symptoms, but typically includes both conservative and surgical management. Initial treatment of OCLs may focus on immobilization, with restricted activity and non-weightbearing (8). Small OCLs < 1.5 cm² in diameter may respond well to excision of the osteochondral fragment, the curettage, and the subchondral drilling procedures (9–12). However, larger lesions (> 1.5 cm²) may not respond favorably to these techniques, resulting in continued deterioration of the articular surface. More-invasive options such as arthroscopic debridement and microfracture, osteochondral grafting, and mosaicplasty have been described to successfully treat these advanced defects

(2,13–15). We report a rare case of a bipolar osteochondral lesion of the calcaneocuboid (CC) joint treated with curettage and application of juvenile particulate cartilage allograft.

Case Report

A 54-year-old female sustained a fall from a ladder resulting in a right tibial fracture. Her right lower extremity was casted for approximately 3 months, during which time she remained non-weightbearing with assistance of a wheelchair. Her tibial fracture healed uneventfully. She was then permitted protected weightbearing activity in a walking boot, followed by a course of physical therapy. However, during physical therapy sessions, the patient related a new complaint of lateral heel pain to the ipsilateral foot. Physical examination revealed severe pain with manipulation and palpation of the lateral CC joint. The patient related significant pain to a localized area on the lateral foot with walking activity.

Standard plain film radiographs revealed no signs of obvious fractures or dislocation (Figs. 1–3). First-line therapy included nonoperative management with low-impact activity restriction, nonsteroidal antiinflammatory medications, and an ultrasound-guided cortisone injection. Unfortunately, conservative modalities were unsuccessful in alleviating the patient's symptoms.

Advanced magnetic resonance imaging revealed an isolated, bipolar osteochondral defect of the CC joint approximately 1 cm in length on the dorsal half of the right cuboid. Significant bone marrow edema was noted within the cuboid. Mild tendinosis of peroneus longus and brevis

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Address correspondence to: Eric So, DPM, AACFAS, The CORE Institute, 18444 N 25th Avenue, Suite 310, Phoenix, AZ 85023.

E-mail address: Ericso70@gmail.com (E. So).



Fig. 1. Preoperative anteroposterior foot radiograph.

tendons was also identified (Figs. 4–7). The patient underwent surgical management with application of juvenile particulate cartilage allograft.

Operative Technique

The patient underwent general anesthesia with regional blockade. She was positioned in lateral decubitus on the operating table. Hemostasis was achieved and maintained with a pneumatic thigh tourniquet set to 300 mm Hg. The right foot was prepped and draped in typical



Fig. 2. Preoperative lateral foot radiograph.

aseptic fashion. Image intensification was used to identify the CC joint, allowing for proper incision placement over the lateral aspect of the right foot. The CC joint was accessed through a 6-cm longitudinal linear incision. Dissection was deepened down to the level of the CC joint. Care was taken to identify and retract all vital neurovascular structures. All bleeders were cauterized as needed. A capsular incision was made to expose the CC joint. A pin-based retractor was used to distract the CC joint, allowing for access to the osteochondral defect within the mid-portion of the CC joint. Delamination of hyaline cartilage was identified on both the cuboid and calcaneus (Figs. 8,9). The detached cartilage was debrided. The subchondral bone within the defects was drilled to stimulate bone marrow. Juvenile particulated allograft cartilage (DeNovo NT; Zimmer, Warsaw, IN) was applied to the bipolar defect, followed by injection of fibrin glue (Tisseel; Baxter, Deerfield, IL). Care was taken to ensure the fibrin glue and cartilage construct were congruent relative to surrounding native cartilage. After the appropriate dry time had elapsed, the periosteal and capsular structures were reapproximated with 2-0 Vicryl (Ethicon Inc., Cornelia, GA) and skin was reapproximated with 3-0 Nylon. A dry, sterile dressing and posterior splint were applied to the operative foot and leg.

At the 1-week postoperative follow-up, a short-leg cast was applied to the right lower extremity. The patient was non-weightbearing on the right lower extremity for a total of 6 weeks, followed by 2 weeks in a walking boot with physical therapy. No infection, wound dehiscence, deep venous thrombosis, or neuritis symptoms were experienced. The patient transitioned into supportive athletic shoe gear at 8 weeks postoperatively. At the final follow-up appointment 8 months postoperatively, the patient was ambulating in supportive shoe gear without pain. Plain film radiographs showed appropriate uniform joint space, with no significant degenerative changes (Figs. 10–12).

Discussion

There is a paucity of literature describing OCLs of the CC joint. OCLs themselves lack an abundance of evidence-based literature concerning their etiology and pathogenesis. Consequently, the specific mechanism of injury leading to CC joint OCLs has not been described (Figs. 11,12).

Trauma is often recognized as the most important etiologic factor in osteochondral injuries inclusive of knee, shoulder, and ankle. Radiographs obtained after inversion-type foot injuries are related to the CC joint in 2.3% of cases (16). In 2005, Jennings and Davies (17) reported that 6.7% of patients presenting with plantarflexion and inversion injuries of the ankle had associated CC joint injury. Presumably, an indirect compressive force to the lateral column occurs when the foot is in a fixed plantarflexion-abduction position. This incites significant stress



Fig. 3. Preoperative medial-oblique foot radiograph.

on the cuboid and its articular surface with the fourth and fifth metatarsal distally and the calcaneus proximally (18).

Given the reports of traumatically induced OCLs after ankle sprains, it is conceivable that a history of trauma, such as falling from a height, may be contributory to the development of OCLs. An additional factor to consider is the anatomic construction of the CC joint and its kinematics. It has been reported that the CC joint distracts anteriorly and posteriorly during the gait cycle (19). The finding of a bipolar lesion to the cuboid and calcaneus is significant. It is unknown whether the anatomy



Fig. 4. Magnetic resonance scan of the foot with decreased signal intensity on a T1 sagittal view.

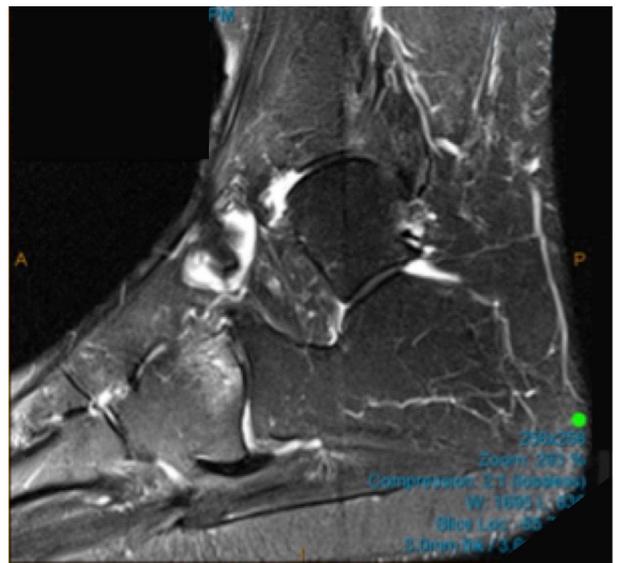


Fig. 5. Magnetic resonance scan of the foot with increased signal intensity indicating bone marrow edema and cartilage disruption on a T2 sagittal view.

of the CC joint or the mechanism of injury predisposes the CC joint to bipolar lesions.

Conservative treatment modalities of CC joint injuries most often include a period of non-weightbearing, immobilization, and restricted activity. Nonsteroidal antiinflammatory medications and cortisone injections may also be used for pain relief and to control inflammation. If lesions are identified before fragmentation and joint destruction, conservative therapy may be successful in alleviation of symptoms and limiting progression of degenerative changes.

When symptoms and condition of the OCL have progressed beyond the point where conservative therapy is successful, surgical intervention should be considered. The traditional surgical approach for articular cartilage injury has been debridement with microfracture



Fig. 6. Magnetic resonance scan of the foot with decreased signal intensity on a T1 axial view.

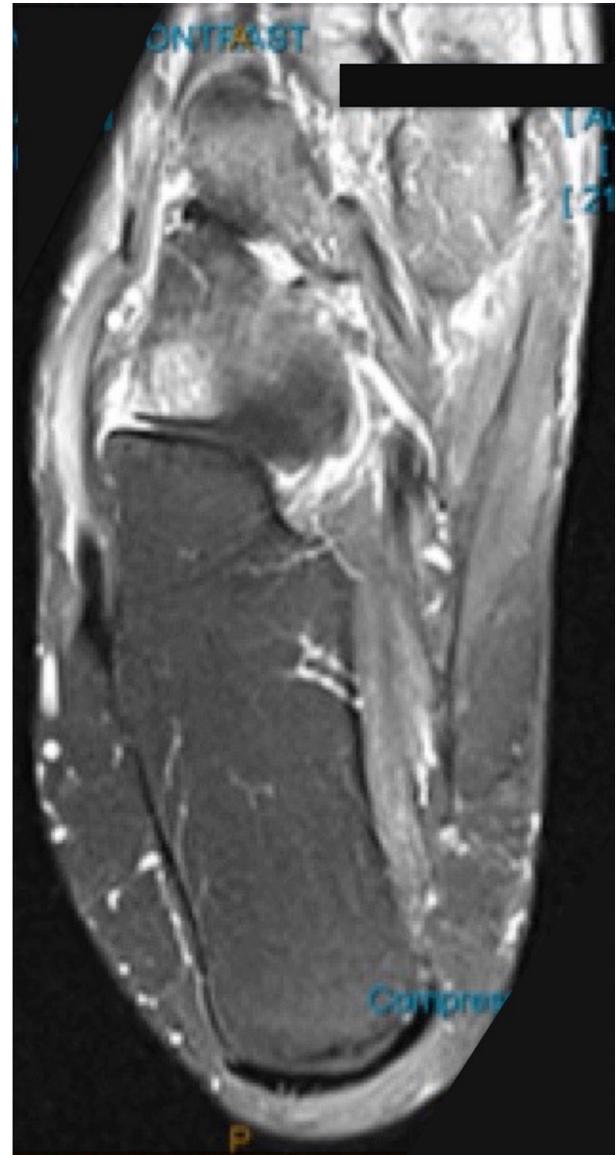


Fig. 7. Magnetic resonance scan of the foot with increased signal intensity indicating bone marrow edema and cartilage disruption on a T2 axial view.

(6,11,12,14). However, procedures such as excision and curettage, bone marrow stimulation, autogenous cancellous bone graft, autologous chondrocyte implantation, and osteochondral allograft transplantation have gained popularity (4,5,12,20). A growing body of literature describes use of juvenile particulate allograft as a viable treatment modality (20).

Microfracture stimulates the bone marrow by creating channels in the subchondral plate through which pluripotent stem cells can travel, differentiate, and ultimately form a cartilage-like repair tissue. Microfracture produces fibrocartilage, which is known to be more durable than hyaline cartilage (21). Allograft or autograft osteochondral implantation can produce type II collagen, offering an improved repair tissue but with tradeoffs that include graft subsidence, lack of peripheral integration, and peripheral chondrocyte death (21). Modern studies demonstrate that single-stage use of particulated cartilage can lead to formation of new hyaline-like repair tissues (20,22–24). The particulated cartilage is able to multiply to form a new cartilage tissue matrix, integrate with surrounding host tissue, and reestablish a congruent cartilage joint surface (24). The use of

particulated juvenile cartilage allograft (DeNovo NT) to treat OCLs, first used in the knee for a patella cartilage defect, is now well documented for use in the lower extremity (20,25,26).

Using arthrodesis as a salvage procedure may be warranted in instances of significant articular damage with associated symptomatic pain and loss of function, in addition to cases with significant degenerative changes. Although isolated arthrodesis of the CC joint is uncommon, it typically follows failure of other treatment modalities in cases of severe arthritis and joint deformity. Potential complications associated with joint fusion include nonunion, malunion, fixation failure, lateral impingement of soft tissues or sural nerve, and painful hardware justify additional surgical intervention. Given the size of the lesion, joint-sparing procedures should be first-line surgical treatment. Prognosis after articular cartilage trauma depends on the age of the patient, localization and severity of symptoms, the size of the lesion, and state of disease progression (12,27).

In conclusion, OCL localization to the CC joint has not been previously described. The scarcity of literature on the mechanism of injury to

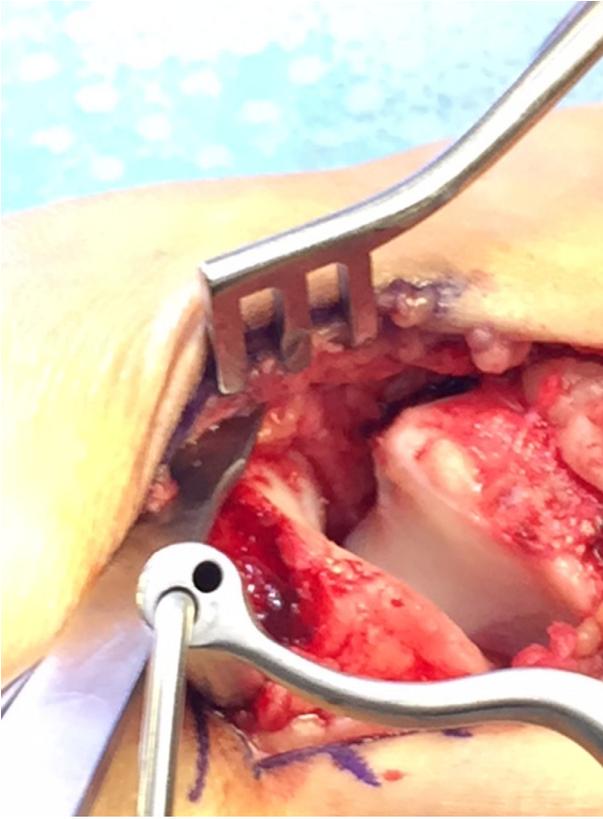


Fig. 8. Intraoperative image displaying the osteochondral lesion on the cuboid.

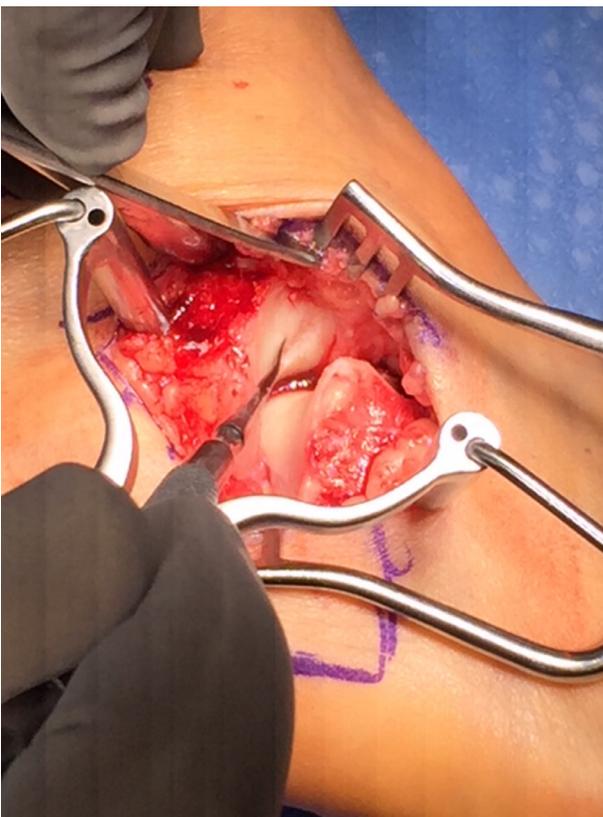


Fig. 9. Intraoperative image displaying the osteochondral lesion on the calcaneus.



Fig. 10. Postoperative anteroposterior radiograph at the final follow-up.

the CC joint does not eliminate the need for its consideration within the differential list for acute and/or recalcitrant midfoot or rearfoot pain. Whether traumatic injury or anatomic variances within the CC joint cause OCLs within the CC joint, inclusion of OCL should be considered in the differential diagnosis for adults with lateral column and CC joint pain.



Fig. 11. Postoperative lateral radiograph at the final follow-up.



Fig. 12. Postoperative medial-oblique radiograph at the final follow-up.

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