Osteochondral Defect of the Calcaneocuboid Joint: A Case Study

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Statement of Purpose

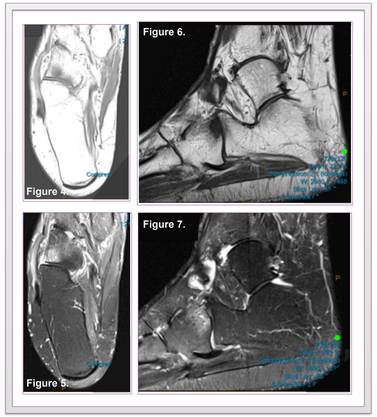
Osteochondral lesions (OCLs) are injuries to the articular cartilage surface of bone within a joint. To the best of the authors' knowledge, OCLs of the cuboid have not been described. This rare case of a bipolar osteochondral lesion of the cuboid and calcaneus presented as lateral heel pain following traumatic injury.

Case Study

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 three months during which time she remained non-weight bearing (NWB) with assistance of a wheelchair. Her tibial fracture healed uneventfully. She was then permitted protected weight-bearing 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 calcaneocuboid (CC) joint.

Figures 1-3. Pre-operative dorso-plantar, medial oblique and lateral radiographic foot views

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 non-operative management with low-impact activity restriction, NSAIDs and an ultrasound-guided cortisone injection. Unfortunately, conservative modalities were unsuccessful in alleviating the patient's symptoms.

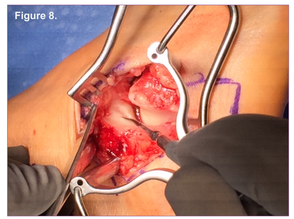


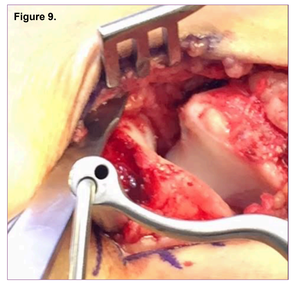
Figures 4-5. MRI foot sagittal views with decreased signal intensity on T1 and increased signal intensity on T2
Figures 6-7. MRI foot axial views with decreased signal intensity on T1 and increased signal intensity on T2
*Indicating bone marrow edema and cartilage disruption

Advanced MR imaging revealed an isolated, bipolar osteochondral defect of the calcaneocuboid joint approximately one centimeter 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 tendons were also identified (Figs. 4-7). The patient underwent surgical management with application of juvenile particulate cartilage allograft.

Operative Technique

Patient was positioned in lateral decubitus on the operating table. 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 utilized to distract the calcaneocuboid joint allowing for access to the osteochondral defect within the midportion 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 was applied to the bipolar defect, followed by injection of fibrin glue. Care was taken to ensure the fibrin glue and cartilage construct was congruent relative to surrounding native cartilage.





Figures 8-9. Intraoperative photos of CCJ.

Figures 10-12. Post-operative DP, MO and lateral radiographic views at final follow-up.

After the appropriate dry time had elapsed, the periosteal and capsular structures were re-approximated. A dry, sterile dressing and posterior splint were applied to the operative foot and leg.

At one-week post-operative follow-up, a short-leg cast was applied to the right lower extremity. The patient was NWB on the right lower extremity for a total of six weeks, followed by two weeks in a walking boot with physical therapy. No infection, wound dehiscence, deep venous thrombosis, or neuritis symptoms were appreciated. The patient transitioned into supportive athletic shoe gear at eight weeks post-operatively. At eight-month follow-up appointment, the patient was ambulating in supportive shoe gear without pain. Plain film radiographs showed appropriate uniform joint space with no significant degenerative changes (Figs. 8-10).

Discussion

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 following a traumatic incident (2). OCLs are well reported in the literature 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 OCLs depends upon 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 NWB (8). Small OCLs, less than 1.5cm^2 in diameter, may respond well to excision of the osteochondral fragment, curettage, and subchondral drilling procedures (9-12). However, larger lesions, greater than 1.5cm^2, 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 advanced defects (2,13-15).

Trauma is often recognized as the most important etiological factor in osteochondral injuries inclusive of knee, shoulder, and ankle. Radiographs performed after inversion type foot injuries are related to the calcaneocuboid joint in 2.3% of cases (16). In 2005, Jennings reported 6.7% of patients presenting with plantarflexion and inversion injuries of the ankle had associated calcaneocuboid joint injury (17). Presumably, a indirect compressive force to the lateral column occurs when the foot is in a fixed plantarflexion-abduction position. This incites significant stress 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 OCL's 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 anatomical construct of the calcaneocuboid joint and its kinematics. It has been reported that the CC joint anteriorly and posteriorly distracts during the gait cycle (19). The finding of a bipolar lesion to the cuboid and calcaneus is significant. It is unknown if the anatomy 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-weight bearing, immobilization, and restricted activity. NSAIDs and cortisone injections may also be used for pain relief and to control inflammation. If lesions are identified prior to fragmentation and joint destruction, conservative therapy may be successful in alleviation of symptoms and limiting progression of degenerative changes.

Discussion

When symptoms and condition of the OCL progress, surgical intervention should be considered. The traditional surgical approach for articular cartilage injury has been debridement with microfracture (6, 11,12,14). However, procedures such as excision and curettage, bone marrow stimulation, autogenous cancellous bone graft, autologous chondrocyte implantation (ACI), 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. Despite minimal morbidity, microfracture produces fibrocartilage, not hyaline cartilage, which is known to have limited durability (21). Allograft or autograft osteochondral implantation can produce type II collagen, offering an improved repair tissue but with tradeoffs including 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 re-establish a congruent cartilage joint surface (24). The use of particulated juvenile cartilage allograft 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).

Conclusion

OCL localization to the calcaneocuboid joint has not been previously described. The scarcity of literature on the mechanism of injury to 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 anatomical variances within the CC joint cause OCL's within the CC joint, inclusion of OCL should be considered in the differential diagnosis for adults with lateral column and calcaneocuboid joint pain.

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