Outcomes for the Treatment of Osteochondral Lesions of the Talus and Associated Bone Marrow Edema with Fluoroscopically Guided Subchondral Calcium Phosphate Injections: 28 Consecutive Case series

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Statement of Purpose

Cartilage is avascular and aneural, which should begin the question, is the cartilage defect the true etiology of the patient’s pain? A biological solution to repair these osteochondral lesions (OCL) appears to be the Holy Grail. Unfortunately, the biological solution has been misguided in trying to repair the actual cartilage itself, and not the true underlying issue of the resulting painful subchondral cyst and associated bone marrow edema.

Literature Review

Literature supports the fact that these lesions predominantly affect young and middle-aged adults. There appears, in the majority of the cases, to be some preceding episode of trauma, foot or ankle. The precise etiology, pathogenesis, and natural history of osteochondral lesions of the talus have not been well understood.

As a general rule, we accept that the majority of these lesions occur either at the postero-medial or central medial area or at the anterolateral aspect of the talus. The staging classification system of osteochondral lesions has contributed to the poor results witnessed by attempts at microfracture, drilling, abrasion, and osteochondral grafting, so prevalent in the treatment of these patients.

Often, arthroscopic evaluation of the painful ankle, with positive CT or MRI evidence of subchondral injury, will reveal relatively normal cartilage of the entire talar dome. CT scans of the ankle have traditionally been accepted as the gold standard for diagnosing osteochondral lesions of the talus. However, as we turn our attention to the true nature of the painful problem, the subchondral cyst, MRI has gained popularity in its ability to demonstrate the true extent of the subchondral injury. The goals of surgery in patients suffering from an osteochondral lesion should include a pain-free ankle with full range of motion and a stable ankle joint. The ultimate goal would include eliminating the progression of degenerative joint disease of the ankle. Obtaining a pain-free ankle should include removing loose fragments stabilizing peripheral cartilage, and ultimately, repairing the subchondral cyst. The removal of unstable subchondral bone and the need to reconstitute articular cartilage remain a large unanswered question.

Methodology

Retrospective outcomes from 28 patients who underwent filling of the subchondral bone with calcium phosphate from February 2017 to September 2019 are presented. All included intraoperative reports were reviewed by one fellowship-trained surgeon with records of advanced imaging including MRI and CT scans (Fig. 1).

Inclusion criteria required that all patients underwent a fluoroscopically guided retrograde backfilling of bone (Fig. 1).

Also commonly known as subchondroplasty, the procedure is performed by injecting a flowable, synthetic nanocrystalline calcium phosphate (CaP). CaP undergoes an endothemic reaction and crystallizes to mimic the properties of healthy cancellous bone. The technique allows CaP to be injected within the subchondral cancellous trabeculae without affecting the existing bone scaffold. Live fluoroscopic and arthroscopic verification were used intraoperatively to ensure bone cement was not extruded into the joint. 21 advanced imaging scans and reports were available for these postoperatively, the patients were weightbearing as tolerated in a low tide walker boot.

Analysis & Discussion

Comparison of the patient outcomes from each case revealed that if the etiology of the OCL stemmed from a prior ankle fracture, the patient outcomes were not as favorable as those patients that resulted from an anklyotic event.

Building on our knowledge of pathophysiology, etiology, and extrapolation of data from the literature, the authors suggest a less invasive etiological-driven treatment option of OCL/subchondral cyst lesions of the talus. Not unlike typical floor construction, walking surfaces are only as strong as the beams, or infrastructure supporting them. We believe to place new floor material (ie. on top of broken down, non-supportive beams will only lead to further subsidence of the floor (cartilage) due to inadequate sub-flooring, the subchondral bone). An MRI analysis of 42 patients by Shammoso and colleagues has demonstrated gradual subchondral bone degradation and positively correlated to clinical outcomes over a mean span of 13.7 to 22 months.

Would it not make sense to treat talus lesions similar to repairing walking surfaces and that of the supportive beams? In fact, the cartilage may not need to be repaired at all and still allow for proper foot traffic, once the beams or subchondral bone are reinforced. Having already determined that cartilage is avascular and aneural, does it really matter if the cartilage appearance is not optimal, so long as the subchondral bone is reinforced? Furthermore, preventing the disease and ultimately preventing degenerative joint disease and subsidence of the joint?

While literature has reported a handful of cases of iatrogenic avascular necrosis in the talus, none of the reports have discussed the intraoperative volume of CaP injection. The authors believe that the low volume and rate of injection of the nanocrystalline nanogel significantly contribute to the pressure changes of the subchondral bone repair process. We suggest intraoperatively injecting the volume of the measured cyst or OCL size which typically yields less than or equal to 0.8mL. Less is more, a paradox it may seem.

The authors present a minimally invasive, fluoroscopically-assisted procedure that targets and fills subchondral bone defects through the delivery of calcium phosphate that removes pain and restores function regardless of the extent of damage present with the osteochondral lesions. This technique makes no effort to restore or repair the cartilage defect itself.

References