Surgical Resection of a Pediatric Osteochondroma Treated with Juvenile Chondrocytes and BMA

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Statement of Purpose

The purpose of this case study is to present the long-term outcome of a pediatric athlete who was diagnosed with a talar osteochondral lesion and failed conservative therapy who went on to have resection of a left talar osteochondroma with implantation of juvenile chondrocytes and application of BMA.

Literature Review

Osteochondral lesion of the talus (OLT), is a term referring to an injury, deformity, or abnormality to the articular cartilage of the dome of the talus. Other terms including Osteochondritis dissecans (OCD) are commonly used interchangeably when referring to OLT[1]. Symptoms of OCD's include deep pain to the ankle with weightbearing, impaired function, stiffness, catching, locking, and swelling.

Conservative treatment of OCD's includes NSAIDs, bracing, and casting. Zengerink et al published a 45% success rate in patients who were conservatively treated for an OCD[2].

Surgical treatments of OCD's can be separated into two main categories: reparative and replacement. Historically, treatment selection between the two groups is determined by size of the OCD. If the lesion is <1.5cm, reparative treatments are often selected, whereas replacement options are frequently selected for lesions >1.5cm[3].

Bone marrow stimulation, is a reparative surgical treatment that aims to promote the replacement of the OCD with fibrous cartilage tissue. Polat et al reported 43% of patients with no pain after a 10-year follow-up while 23% had pain after 2 hours of walking[4].

Autologous chondrocyte implantation (ACI), is another reparative procedure that involves harvesting a patient's own healthy cartilage and culturing the chondrocytes for 2-3 weeks, and then implanting them into the talar lesion. Giannini et al reported an AOFAS score increase from 38 to 93[5] after ten years of follow up.

Autologous osteochondral transplantation (OAT procedure), is a replacement procedure where a cylindrical osteochondral graft is harvested from the knee and placed into the OLT. Fraser reported an AOFAS score of 89 in patients at 24 months follow-up[6].

Cartilage allografting is a procedure where the lesion is resected and is then packed with juvenile cartilage allograft. Coutzee demonstrated an AOFAS score of 85 at 16 months after the cartilage allograft procedure[7].

Case Study

Patient is a 16-year-old Caucasian female with no significant PMH with who presents with left ankle pain that has been present for approximately one year. Patient is a year-round athlete participating in sports such as track and volleyball. Patient relates pain to the left anteromedial ankle, which worsens with activity. She experiences catching and swelling of the ankle. Initial radiographs raised suspicion for an osteochondroma to the medial talar dome (Figure. 1). The follow up MRI revealed a concave deformity of the anterior medial talar dome with loose bodies and cystic changes within the lesion (Figure 2). The lesion measured 26 mm from anterior to posterior on the sagittal view, and 10 mm from medial to lateral on a coronal view. Patient failed conservative therapy including NSAIDS, bracing, and being placed non-weightbearing. The patient was scheduled for a talar dome lesion repair with juvenile cartilage and bone marrow aspirate from the proximal tibia. An anterior approach medial to the Tibialis Anterior tendon was used. Upon incision into the ankle capsule, multiple sizable joint mice extruded from the joint. The osteochondroma was removed with a sagittal saw. The OCD lesion was debrided to health bleeding bone. The lesion was then drilled with a threaded 0.062 k-wire. The lesion was then drilled in a retrograde fashion with both a k-wire and 3.5 drill bit from an incision over the neck of the talus. The drill holes were then back filled with rhPDGF-BB, demineralized bone matrix, and bone marrow aspirate concentrate. Next, fibrin glue was placed over the OCD, and the juvenile chondrocytes were placed on top of that. Another layer of fibrin glue was applied over the juvenile chondrocytes (Figure 3). The ankle was placed through range of motion and was found to dorsiflex and plantarflex without any catching or clicking. The patient was placed in a below knee cast and ordered to be NWB for 6 weeks. She started physical therapy 6 weeks postoperatively. At 3 months, she transitioned to a tennis shoe with an ankle brace. At 4 months the patient was cleared for return to sports. Postoperative radiographs show normal architecture of the ankle mortise with no collapse or subsidence of the talar dome. To date the patient has returned to full activity with an ankle brace and has no complaints of pain or range of motion to the operative extremity.

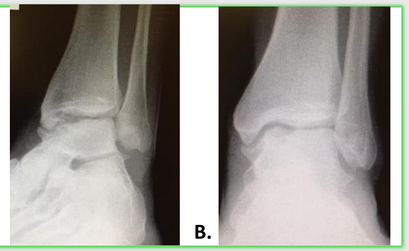

Figure 1: Preoperative Radiographs, A: Mortise View, B: AP View

A. B.

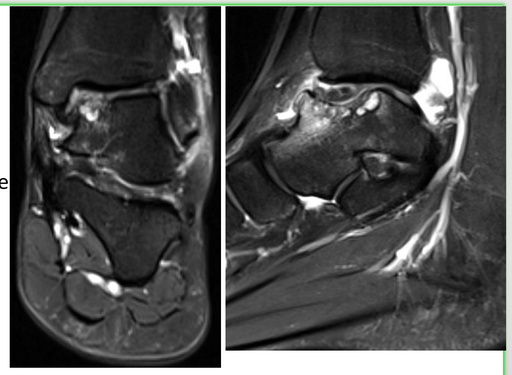

Figure 2: Preoperative T2 MRI. A: Coronal View B: Sagittal View

A. B.

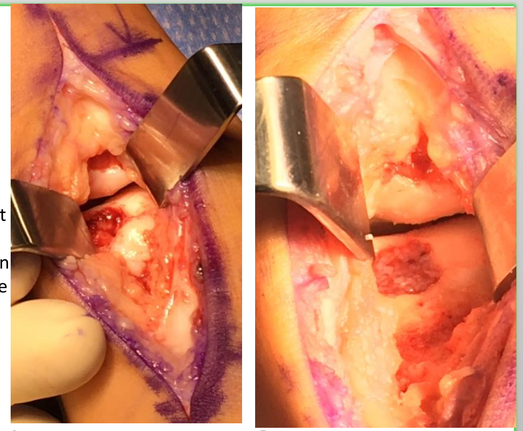

Figure 3: Intra-op Pictures, A: OCD lesion post debridement

B: OCD lesion after juvenile cartilage placement

A. B.

Analysis and Discussion

The treatment of osteochondral lesions of the talus is a complex issue with multiple treatment options. Often, the size of the lesion will dictate the treatment. Classically, lesions that are <1.5 cm in diameter are treated with reparative methods while lesions that are >1.5 cm are treated with replacement methods.

In the present case study, due to the size of the lesion, as well as the age of the patient, it was determined that a procedure that replaced the OCD would be most beneficial.

The theory behind the use of juvenile chondrocytes is that the chondrocytes have a higher metabolic activity and would lead to an increased chance to reproduce into viable hyaline cartilage[7]. If the aforementioned is true, then the chondrocytes are essentially reproducing the normal environment of the cartilage of the talar dome. This is compared to other treatment methods which encourage growth of a fibrous cartilage which will function differently from hyaline cartilage leading to future risk of breakdown or subsidence.

While further studies including randomized double-blinded studies with a larger sample size, including patients with a wider range of co-morbidities would be beneficial, this approach is a valid treatment for patients suffering from osteochondral lesions of the talar dome.

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