Hypothermically Stored Amniotic Membrane for Repair of Osteochondral Lesions Of the Ankle

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Purpose

This case study documents three patients with osteochondral lesions of the talar dome treated arthroscopically with debridement of the lesion and placement of hypothermically stored amniotic membrane (HSAM) into the defect.

Literature Review

An osteochondral (OCD) lesion of the talar dome is a potentially debilitating condition. Several etiologies have been discussed including: vascular compromise, genetic predisposition, repetitive microtrauma, metabolic disorders, endocrine disorders, idiopathic and degenerative joint disease.[1-4] The most widely accepted etiology is a traumatic origin.[5]

Prior to surgical intervention, conservative treatment options should be attempted, such as activity modification, physical therapy, injection therapy or immobilization. Recent studies have shown that only 45–59% of patients treated conservatively have achieved relief of symptoms.[6,7]

The goal of surgical intervention is to either repair or replace the injured osteochondral region in order to regain function and pain free motion. A number of treatment modalities have been attempted to accomplish this goal, including: curettage with bone marrow stimulation, platelet-rich plasma, bone marrow aspirate, autologous or allogeneic osteochondral transplantation, cartilage allografts, osteochondral autologous transplantation and autologous chondrocyte implantation.[6-8]

Human amniotic membrane has been shown to facilitate healing in soft tissue, bone, and cartilage.[9-12] Recently, animal studies have shown the potential for amniotic membrane supplied cells, including pluripotent mesenchymal stem cells (MSCs), to differentiate into active chondrocytes with the potential for cartilage regeneration.[9,10] The amniotic membrane used in this case study undergoes a hypothermic preservation process allowing for the amniotic cells to be stored in their fresh state and not subjected to potentially damaging freezing and thawing processes.

Case Study

Figure 1. Preoperative anterior-posterior ankle radiograph.

Three patients with osteochondral lesions of the talus were treated with arthroscopic debridement and implantation of a HSAM. All had a history of an ankle injury resulting in chronic ankle pain and instability.

Average age of the patients was 46 years old (25 to 61), including two females and one male. All patients had initial radiographs (Figure 1) and a MRI (Figure 2) of the ankle joint. Two of the patients had osteochondral lesions of the medial and lateral talar dome. The third patient had an isolated lesion of the medial talar dome. All lesions measured < 1.8 cm^2.

All three patients attempted and failed a minimum of three months of conservative treatments consisting of bracing, NSAID's, injections and physical therapy and wished to proceed with surgical intervention.

Surgical Technique:

Each patient was placed in a supine position. The surgical procedure was performed under general and regional anesthesia. In addition, a thigh tourniquet was utilized at 300 mmHg.

The ankle arthroscopy was performed with standard anteromedial and anterolateral ankle portals. A non-invasive ankle distractor was utilized for adequate access to the ankle joint and osteochondral lesion. The ankle joint was inspected and all synovitis, loose bodies and scar tissue were removed as indicated.

The osteochondral lesion of the talar dome was identified and evaluated. The cartilage of the osteochondral lesion was debrided to the subchondral bone level (Figure 3a). In these patients, no marrow stimulation was performed in order to minimize bleeding. The ankle joint and osteochondral lesion was thoroughly dried by stopping the flow of fluid and applying suction to the joint. A layer of fibrin glue was applied to the base of the osteochondral lesion. The amniotic membrane allograft was then implanted into the lesion (Figure 3b). An additional layer of fibrin glue was applied to the top of the allograft and allowed to completely dry (Figure 3c).

The arthroscopic instrumentation was removed and a Brostrom lateral ankle stabilization was performed in each patient. The surgical incisions were closed and the patients were placed in a posterior splint.

Postoperatively, patients remained non-weight bearing for 6 weeks followed by weight bearing in a controlled ankle motion boot for 2 more weeks. Physical therapy and ankle range of motion exercises were initiated at 6 weeks. Patients returned to normal shoe gear with a lace up ankle brace at 2 months, low impact activity at 3 months and full activity at 6 months postoperative. All patients were followed for at least 18 months post-operatively.

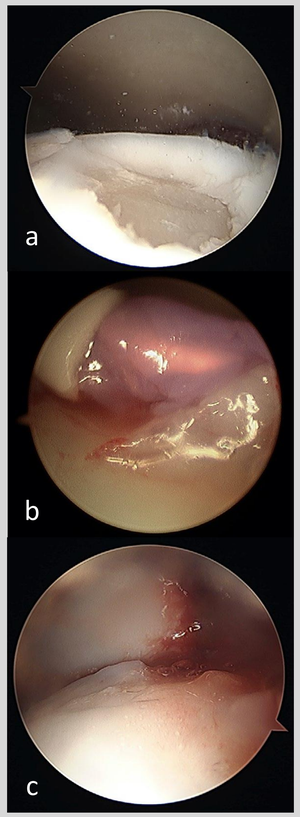

Figure 3
3a. Talar osteochondral lesion following debridement
3b.Implantation of the amniotic membrane allograft
3c. Final application of fibrin glue covering the allograft

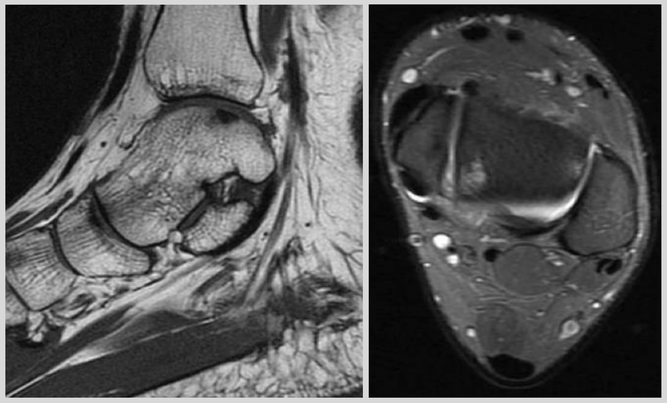

Figure 2. Preoperative MRI demonstrating the talar dome lesions.

Results

Two patients had no ankle pain and normal range of motion at 18 months follow-up and one patient had occasional soreness after several hours of activity without any limitations or restrictions at 18 months. All patients were able to return to all desired activities without restrictions.

Conclusion

This case study demonstrates the preliminary use of amniotic membrane may be an effective treatment option for the repair of osteochondral talar lesions. HSAM could be added to the armamentarium of surgical options to repair OCD lesions.

References

1. Hintermann B, Regazzoni P, Lampert C, Stutz G. Arthroscopic findings in acute fractures of the ankle. J Bone Joint Surg [Br]. 2000;82B:345-351.
2. Baumhauer JF, Alosa DM, Renstrom AF, Trevino S. A prospective study of ankle injury risk factors. Am J Sports Med. 1995;23:564-570.
3. Elias I, Zoga AC, and Morrison WB. Osteochondral lesions of the talus: localization and morphologic data from 424 patients using a novel anatomic grid scheme. Foot Ankle Int. 2007;28(2):154-161.
4. Lomax A, Miller RJ, Fogg QA. Quantitative assessment of the subchondral vascularity of the talar dome: a cadaveric study. Foot Ankle Surg. 2014;20(1):57-60.
5. Berndt AL, Harty M. Transchondral fractures (osteochondritis dissecans) of the talus. J Bone Joint Surg Am. 1959;41-A:988-1020.
6. Tol JL, Struijs PA, Bossuyt PM. Treatment strategies in osteochondral defects of the talar dome: a systematic review. Foot Ankle Int. 2001;21:119-126.
7. Verhagen RA, Struijs PA, Bossuyt PM. Systematic review of treatment strategies for osteochondral defects of the talar dome. Foot Ankle Clin 2003;8(2:)233-242.
8. Hannon, CP, Smith NA, Murawski CD. Osteochondral lesions of the talus. J Bone Joint Surg Am. 2014;96B:164-171.
9. Tabet S, Clark A, Chapman E. The Use of Hypothermically Stored Amniotic Membrane for Cartilage Repair: A Sheep Study. Stem Cell Discovery, 2015;5:62-71.
10. Garcia D, Longo U, Vaquero J. Amniotic Membrane Transplant for Articular Cartilage Repair: An Experimental Study in Sheep. Current Stem Cell Research & Therapy 2015;10:77-83.
11. Anderson J, Swayzee Z. The Use of Human Amniotic Allograft on Osteochondritis Dissecans of the Talar Dome: A Comparison with and without Allografts in Arthroscopically Treated Ankles. Surgical Science. 2015;6:412-417.
12. Anderson J, Swayzee Z, Hansen M. Human Amniotic Allograft in Use on Talar Dome Lesions: A Prospective Report of 37 Patients. Stem Cell Discovery. 2014;4:55-60.

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