Exploring a Unique, Minimally Invasive Approach to End Stage Ankle Arthritis

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Statement of Purpose

This case study describes a new technique in the treatment of severe ankle arthritis. Traditionally, degenerative joint disease (DJD) of the ankle is treated through traumatic surgical modalities such as total ankle replacement (TAR) or fusions. In this case, a less traumatic technique was performed with outstanding results. Anterior ankle spurring was resected, talar dome lesions were filled with calcium phosphate, and living amniotic cells were injected into the ankle joint and extensor retinaculum.

Methodology

Review of the literature reveals traditional treatment of ankle DJD with TAR and fusions, yet fails to include a less traumatic but effective option. To our knowledge, there are no cases reported in the literature using this method.

This is a single case study of a 38 year old female with a history of rheumatoid arthritis and post traumatic ankle arthritis. She complained of severe right ankle pain and severe equinus. X-rays and an MRI were obtained revealing ankle DJD and spurring as well as two erosions to her distal talus. In surgery, all spurring was resected and the talus erosions were filled with bone paste. The ankle joint and extensor tendons were then infiltrated with flowable amnion.

Case Presentation

The patient suffered a trimalleolar ankle fracture 10 years prior to seeing us. At the time of her appointment, she had severe post-traumatic arthritic changes in conjunction with rheumatologic changes to her ankle joint.

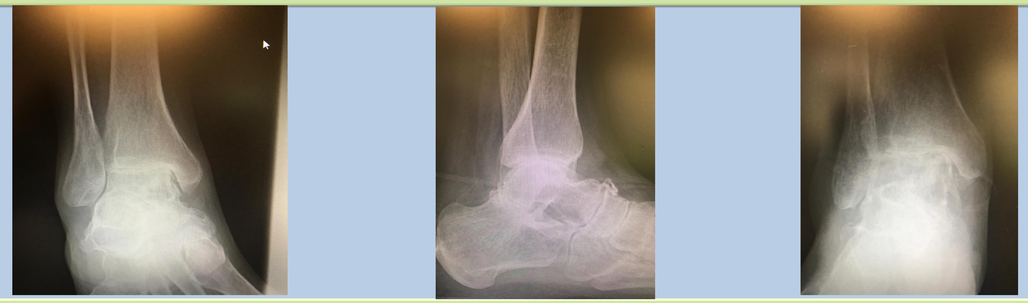
Prior to seeing us, the patient was treating her severe ankle pain with routine corticosteroid injections via her rheumatologist. Once the pain and lack of motion at her ankle became unbearable, she visited an orthopedist who immediately recommended an ankle fusion. The patient preferred to avoid a fusion at all costs and came to us for a second opinion.

On presentation, the patient had extremely antalgic gait and had to use an 2.5 inch heel lift in her shoe to simply ambulate. She was unable to dorsiflex her foot at her ankle and any attempt at range of motion elicited pain.

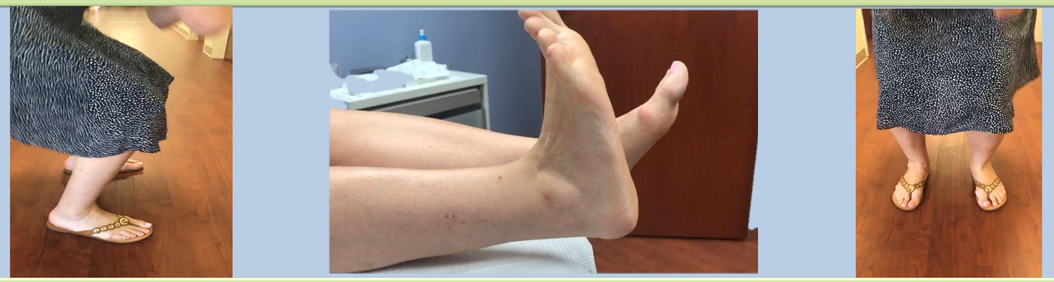
X-rays were obtained showing end stage ankle arthritis with bone on bone contact as well as anterior boney lipping at the tibia and a dorsal exostosis at the distal talus. The CT scan revealed

Our initial plan was for a TAR but the patient, again, wanted to avoid such a traumatic surgical modality and asked if there was anything else we could try. As a last ditch effort, we decided to attempt the procedure detailed on this poster.

Diagnostic Imaging



Clinical Postoperative



Procedure

A curvilinear incision was made at the anterior aspect of the right ankle. The incision was carried deep utilizing both sharp and blunt dissection taking special care to retract and protect the superficial vessels and nerves. The tibialis anterior tendon was identified and freed from its surrounding scar tissues and the extensor retinaculum was completely released. The ankle capsule was incised and reflected. The spur across the anterior ankle was resected with a sagittal saw and rough areas were rasped and smoothed. A severe loss of cartilage and a large osteochondral defect measuring 1.5 cm in diameter was noted on the talar dome. The defect was located on the dorsal medial aspect of the dome. Subchondral drilling was performed on the talar dome. From a lateral, separate port, a probe was drilled into the talar body and calcium phosphate paste mixed with flowable frozen amnion was utilized to fill the area. Some flowable amnion was utilized at the sites of subchondral drilling as well. Prior to closure an amniotic membrane matrix was laid over he anterior lip of the tibia and curved into the ankle joint partially over the distal talar body. Another amniotic membrane matrix was laid over the extensor tendon complex. The ankle capsule was then closed and the extensor retinaculum was repaired and both were infiltrated with 2 mL of frozen, living amniotic cells.

Literature Review

Osteoarthritis (OA) is a condition categorized as a degenerative joint disease. OA is the most prevalent form of arthritis in the U.S. due to aging population and obesity (3). An osteoarthritic joint has a cellular cartilaginous scaffold, which undergoes stresses at the cellular level leading to extracellular matrix (ECM) degradation thus ultimately destroys the articular cartilage. OA is initially recognized as an inflammation in the early stages of the disease process (3). On a molecular level, osteoarthritic joints have a decrease in proteoglycans (PG) in the cartilage matrix. PGs are pertinent in effectively providing a scaffold in the ECM to assist in developing cartilage. A lack of PGs ultimately cause lesions to form and causes an inflammatory cascade effect releasing several proinflammatory cytokines which are upregulated and lead to structural changes of the joint and cartilage degradation (3).

Amniotic membrane is a multilayer tissue that is connected to the chorion layer, which together form the placenta. Amnion/chorion tissue is widely studied in orthopedic literature for arthritic knees or shoulders but rarely shown to be used in the foot and ankle joint for osteoarthritis. Amniotic tissue is an ECM which acts as a scaffold for building new cells which comprise of collagen types I,III,IV,V,VI, hyaluronic acid (which is also important for cartilage formation), and a multitude of growth factors (2). Amnion tissue has been shown to wield an anti-inflammatory effect, which inhibits the aforementioned inflammatory cascade. Amniotic tissue also helps in chondrogenesis and in several in vitro studies reported about human osteoarthritic tissue scaffolds, the amniotic cells did not differentiate into other cellular processes, rather, they integrated and repaired damaged articular cartilage (2). In a study by Willett et al, showed that intraarticular injection of an amniotic membrane allograft can block cartilage damage in a rat medial meniscal transection (MMT) model of OA (4). In measuring of the synovium of the injected rat model after 21 days, a "single intra-articular infection of dehydrated human amnion chorion membrane (dHACM) had a significant chondroprotective effect, slowing proteoglycan loss and preventing lesion formation (4)."

Results

Post-operatively, she was non-weightbearing in a cast for 3 weeks transitioning to a CAM boot and additive 25% weightbearing for the next 5 weeks. ROM physical therapy began at week 6 post-op. At 1 year post-op, she has no evidence of equinus, no ankle pain, no gait abnormalities, and is able to fully squat and be active.

Discussions and Conclusions

Traditionally, degenerative joint disease (DJD) of the ankle is treated through traumatic surgical modalities such as total ankle replacement (TAR) or fusions. In this case study, a less traumatic surgical technique was performed with outstanding results.

The patient in this study suffered from rheumatoid arthritis compounded with severe post-traumatic right ankle arthritis. After exhausting steroid injections to her ankle, the pain became so severe she feared she would be unable to ambulate. After being offered an ankle fusion by another orthopedic specialist, she came to us for a second opinion. Because of her adamance to avoid advanced bone resection and trauma to her ankle, we decided to attempt a technique involving minimal bone resection and generous use of frozen, living amniotic cells in areas of breakdown and disease.

Generally, medical use of amnion at areas of injury yield a considerable reduction in inflammation, earlier and greater ROM, and has even been found to reduce infection in some cases. We have used amnion with much success in the past on injured tendons, ligaments, small joints, and fractures but never really attempted to use it as the primary mode of treatment for ankle arthritis as advanced as in this case. There is abundant literature of amnion injections for advanced arthritis of the knee, hip, and shoulder however little to no research on the foot and ankle. We extrapolated this research and coupled it with our own anecdotal outcomes in the ankle and foot and decided to attempt the less invasive and less traumatic procedure listed.

We know that amnion's peptide growth factors stimulate and signal migration of fibroblasts to areas of high inflammation in order to reduce scarring, pain, and inflammation in said areas as well as increase ROM. There is literature that shows that cryopreserved amnion, as used in this case, triggers an even greater proliferation and migration of fibroblasts to areas of inflammation versus dry amnion and is therefore more effective.

In this case, resection of abrasive and redundant boney overgrowth at the anterior ankle allowed the overlying tendon complex and soft tissue to lay and glide with less resistance and friction reducing inflammation at the site. This, coupled with subchondral drilling and filling of an eroded talar dome and generous use of cryopreserved flowable amnion to sites of high inflammation have completely reversed this patient's prognosis.

We hypothesize that removal of traumatic osteophytes and the increase in fibroblast migration and proliferation at the site, via amnion, has dramatically reduced inflammatory changes at the joint and facilitated, reduction in pain, and an earlier and a greater ROM. At 18 months post-op the patient is still without pain and still has full ROM at the ankle joint. At this point it is safe to conclude that this less traumatic procedure has, at the very least, delayed the patient's need for a TAR or ankle fusion. The patient's results speak for themselves.

References

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