Interposition Ankle Arthroplasty Using Acellular Dermal Matrix: A Case Report

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Purpose and Literature Review:
Arthritis is a debilitating condition, representing a leading cause of disability in the US with 50,000 new cases diagnosed each year [1-3]. The most common etiology of ankle arthritis is post-traumatic OA (70%), although rheumatologic (12%), primary (9%) and neuropathic (5%) arthritis are relatively common [4].

The gold standard surgical treatment for end stage ankle arthritis is ankle arthrodesis although alternative methods of treatment have been described [5]. Total ankle arthroplasty has emerged as a common alternative to fusion. Initial failure rates and complications in early generation total ankle replacements highlighted the more favorable outcomes of ankle joint fusion; however recent modifications have improved outcomes, supporting use in select patients [6]. In a recent meta-analysis of comparative studies, Kim and colleagues found that fusion and total ankle arthroplasty had similar results, with instances of improved function in selected arthroplasty patients [7]. However, given the complications and post-operative sequelae with both arthrodesis and total ankle arthroplasty, new techniques and improvements in current technology are constantly being explored.

Interposition ankle arthroplasty is a relatively new concept in treatment of end-stage ankle arthritis. To our knowledge, interposition arthroplasty of the ankle has only been described in the literature twice. Both Adams et al and Kline et al showed improvements in pain and function after short term follow up after implanting allograft and xenograft respectively [8,9].

The purpose of this study is to present our surgical protocol for interposition ankle arthroplasty using an acellular dermal matrix as well as results from four patients with end stage ankle arthritis.

Case Report:
Four patients ranging in ages 32-42, with stage III-IV ankle arthrosis underwent interposition ankle arthroplasty [10]. Etiology consisted of three patients with post-traumatic osteoarthritides of the ankle and a single patient with primary osteoarthritis. One patient was noted to have history of open trauma and a negative bone biopsy was obtained prior to definitive treatment. None of the patients had significant medical comorbidities nor did any use tobacco products. All four subjects were noted to have severe pain with ambulation and significant functional deficits, including decreased range of motion and inability to manage stairs and/or uneven surfaces. The position of the foot in respect to the ankle was noted to be well aligned and plantigrade in all patients. Pre-operative imaging for one of the patients is shown below in Figure 1.

Surgical Procedure:
The patient was placed in a prone position on the operating table and the leg was scrubbed, prepped and draped in a sterile aseptic manner. A longitudinal incision was made lateral to the Achilles tendon and dissection was carried down to the posterior ankle capsule. A posterior ankle arthrotomy was performed and visualization of the talus and posterior malleolus was achieved. A femoral distractor was utilized to displace the joint and the articular surface of the talus was denuded (Fig 2A). Subchondral drilling was performed and a 3mm thick acellular dermal matrix was secured to the posterior medial and lateral corners of the talus, using suture anchors and a braided polyblend suture (Fig 2B). The graft was then passed under the anterior aspect of the ankle mortise and the posterior surgical site was closed in a standard, layer by layer fashion. The femoral distractor was removed and the patient was placed supine on the operating table. The extremity was re-prepped and draped and an anterior ankle arthrotomy was performed using a midline incision (Fig 2C). Anterior osteotomies of the tibia and talus were resected and the remaining articular cartilage on the talus was removed. Subchondral drilling was again performed along the anterior aspect of the talar dome. The dermal matrix was then secured to the anterior medial and lateral corners of the talus, again using suture anchors and a braided polyblend suture (Fig 2D).

Fluorescopic images were then obtained to evaluate adequate osteophyte resection and restoration of tibio-talar joint space (Fig 3). The surgical wound was then irrigated and closed in a layer by layer fashion.

Post-operatively the patient is kept non-weight bearing for two weeks and transitioned to protected weight bearing in a fracture boot at time of suture removal. The patient is then transitioned to full weight bearing in regular shoes over the following two weeks. All patients underwent physical therapy which was initiated 3-4 weeks post-operatively.

FIGURE 1 - Pre-op lateral X-ray and CT images

Results:
Follow-up ranged from 12 to 18 months with a mean follow-up of 14 months. ADOFAS scores were obtained both pre-operatively and 12 months post-operatively (Table 1). All four patients healed incisions uneventfully and transitioned to unrestricted weight bearing without complications. Mean AOFAS scores improved from 35 pre-operatively to 88.5 post-operatively at 12 month follow-up. The pain subscore improved from 0 (severe, almost always present) pre-operatively to 30 (mild, occasional) post-operatively, in all patients. One patient who was on light duty restrictions due to inability to pass a work physical as a firefighter, returned to work without restrictions after passing his physical approximately 2 months after surgery. Two patients were not employed or seeking employment prior to treatment, and the final patient was working as a paralegal prior to surgery and continued to do so after. Subjectively, all subjects were satisfied with their surgical outcome.

Discussion:
In our case report we have presented results from four patients. Although our follow up is short term, and long term results remain unknown, our patients have returned to a high degree of function. Perhaps the most appealing aspect of this procedure is that future procedures such as arthrodesis or arthroplasty are not precluded should the patient’s arthritis progress. Still, the prospect of a repeat interposition arthroplasty is one that should be considered although we have not attempted this to date. Long term follow up will undoubtedly elucidate the durability of this procedure as well as the feasibility of a revision operation. To our knowledge, the results of a similar procedure have only been reported twice in the literature, both with comparable favorable results [8,9]. We conclude that interposition arthroplasty of the ankle joint appears to improve function, range of motion and decrease of pain and may be the procedure of choice for young patients with end stage ankle arthritis. Longer term follow up, histological testing and arthroscopic evaluation would be advantageous in future studies.

References:
7. Jordan Ernst, DPM. Private practice, Chicago, IL. Personal communication with author regarding use of xenografts in ankle procedures.
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