Large Defect Repair in Achilles Tendon Ruptures Utilizing Achilles Tendon with Calcaneal Bone Block Allograft Without Osseous Fixation

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Statement of Purpose:

Repair of large defects (>5 centimeters) in Achilles tendon ruptures with the use of Achilles tendon allograft with calcaneal bone block is infrequently described in the literature. This case report details the surgical repair of large defects following chronic Achilles tendon rupture in two elderly, obese, diabetic females utilizing an Achilles tendon with calcaneal bone block allograft that was press fit into the posterior calcaneus without osseous fixation to preserve the biomechanical properties of the bone allograft.

Literature Review:

Large defects of > 5 centimeters are often seen following debridement of the Achilles tendon in acute and chronic ruptures especially in patients with multiple comorbidities including obesity and diabetes. A real dilemma for both patient and physician arises when obese patients with multiple comorbidities present to physicians with large Achilles defects who want to return to normal ambulatory function.[1] Many times this means they possess chronic degeneration and/or rupture, leaving the tendon tissues void of function. Surgical options for repair of the degenerated tissue often leave a large void after debridement. While many current repair techniques in the literature have shown promising results, all have potential for suboptimal functional outcomes for the patient. Advancement techniques lead to thinning of tendon and use of potentially diseased remaining tissue.[1] Tendon transfers are effective, but result in a loss of function of the original anatomical purpose of the muscle. To combat these disadvantages an Achilles tendon allograft is used for repair of the large defect (> 5 centimeters) especially when turndown flaps and V-Y transfer do not elicit enough length to re-approximate the soft tissue void.[2]

In addition, addressing Achilles tendon segmental loss at the level of the insertion of the tendon is a particularly challenging problem for adequate fixation. Several techniques have been described in the literature to repair insertional ruptures including passing tendinous autograft through the calcaneus, and then suturing the graft back upon itself to recreate the plantarflexory tension of the Achilles.[3] Others have even anchored of the distal portion of the reconstructed Achilles tendon into plantar fascia.[5] However, soft tissue length continues to be an issue for repair. Various tendon autografts from patellar tendon and quadriceps tendon, to allografts with attached bone have been used to reconstruct the Achilles tendon at its calcaneal attachment.[5-7] The attached allograft bone is desirable because it allows for secure stable fixation of the graft distally into the calcaneus with recreation of the tendinous insertion as well as to span large soft tissue voids.

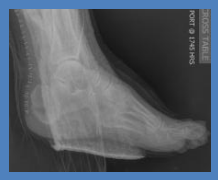


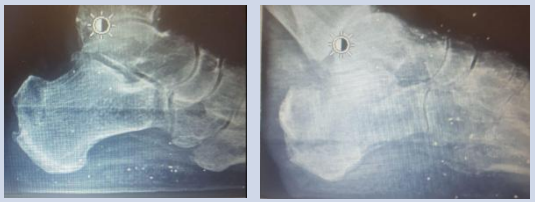
Figure 1: Immediate post-operative radiograph of Patient A

Figure 2: Immediate post-operative radiograph of Patient B

Case Report:

We present a case study of 2 elderly, morbidly obese females with low-energy trauma who underwent surgical reconstruction of the ruptured Achilles tendon approximately 14 days after initial insult. An MRI illustrating >5 centimeter mid-substance deficits and extension into the distal insertion were found in both patients. The patients underwent surgical reconstruction of the Achilles tendon using tendon allograft attached to a calcaneal bone block allograft by creating a bone window in the posterior aspect of the native calcaneus, and without the use of any osseous fixation. The procedure produced a stable repair with restoration of the physiologic tension of the gastroc-soleus muscle-tendon unit. The procedure consisted of a posterior mid-line curvilinear incision from the distal tip of the grastrocnemius muscle belly to the glaborous junction of the heel. After sharp debridement of the Achilles tendon rupture, we noted a deficit of 9 and 10 centimeters with extension into the insertion of the tendon. Both FHL tendons were exposed and noted to have signs of degeneration. There was not enough aponeurosis available to perform a turndown flap. Next, a 2.0 x 1.0 bone block was resected from the posterior aspect of the calcaneus. The exact dimensions of the bone block were measured on the back table. The Achilles tendon with calcaneal bone block allograft was then prepared on the back table. The bone block was cut 0.2 millimeters greater in each dimension to allow for a press fit into the calcaneus. Once the bone block was press fit into the calcaneus, the tendon was placed under tension with the foot in plantarflexion, and the tendon was then stitched to the remaining gastro-soleal aponeurosis using the Krakow technique. The soft tissues were closed in anatomic fashion and the operative extremity was splinted in plantarflexion.

Post-Operative Course: Both patients were non-weight bearing for approximately 6 weeks after surgery with progression to full dorsiflexion at the ankle via serial casting. The patients were transferred to a CAM walker after 6 weeks and were allowed to stand on the operative limb during physical therapy. At 10 weeks, the patients were allowed to ambulate in a CAM walker and were transitioned to a sneaker 12 weeks post-operative. Radiographic incorporation of the calcaneal bone block allograft was noted at 8 weeks post-operative. Both patients returned to pre-operative function without any surgical site complications. Manual muscle strength and ankle range of motion was determined to be equal to the contra-lateral limb. One patient developed an antalgic gait due to increased contralateral knee pain due to over compensation.



Figures 3 and 4: Post-operative radiographs showing osseous incursion of allograft after 8 weeks of Patient A&B

Analysis and Discussion:

This case study details our surgical treatment for the repair of chronic Achilles tendon ruptures >5 centimeters with insertional extension with an Achilles tendon with calcaneal bone block allograft without osseous fixation. The goal of our procedure is to bridge the tendon defect with an appropriate interface to re-establish the normal physiologic tension of the gastrocsoleus muscle-tendon unit while limiting healthy tissue morbidity, minimizing the risk of re-rupture, and improving functional outcomes for the patient.

The use of Achilles tendon allograft with calcaneal bone block to repair large defects (> 5 centimeters) after chronic Achilles tendon ruptures presents a few significant advantages when tendon transfers and takedown flaps are unavailable.[8-10] The advantages include: donor site morbidity is non-existent with the use of allograft, tendon is available without chronic degeneration, and the healing occurs at areas not subject to decreased vascularity where an end to end repair might occur.[2] Haraguchi et al. presented a case series in which the author repair large Achilles defects with calcaneal bone block that was definitively stabilized with 4.0 millimeter cancellous screws. Catanzari et al. stabilized the graft with osseous fixation inside a trough created in the insertional aspect of the calcaneus with favorable results.[1-2] We opted not to use osseous fixation in order to press fit the osseous allograft, to increase osseous incursion without the risk of over compression of the allograft. Allografts go through standard processing in order to allow the graft to be suitable to implant into a patient. Most allografts undergo freeze-drying and irradiation, which diminish the biomechanical properties of the allograft. Torsional and bending strengths of osseous allografts are reduced after freeze-drying. More importantly, irradiation decreases the compressive and breaking strength of osseous and soft tissue allografts.[11] In accordance with the biomechanical properties of osseous and soft tissue allografts, we decided to press fit the graft instead of using internal fixation in order to maximize the compressive strength of the allograft within the calcaneus. Thus far, our patients have returned to pre-injury function by which they are able to ambulate without an assistive device and have had complete radiologic incorporation of the Achilles tendon with calcaneal allograft.

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