New Surgical Autograft Algorithm for Achilles Tendinopathy

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Statement of Purpose

The purpose of this study is to present a surgical algorithm for the repair of chronic tendinopathy of the Achilles tendon based on MRI and intraoperative findings. The algorithm is designed to utilize autograft for several possible repair methods to reconstruct the Achilles tendon after significant debridement of pathologic tissue. We present a series of cases utilizing the gastrocnemius aponeurosis as a free tendon graft for a large Achilles tendon deficit. This method is a reliable and cost-effective option for the repair of a variety of symptomatic Achilles tendon pathologies.

Literature Review

Advanced Achilles tendinopathies may lead to significant impairments in function and gait. (1) With significant degeneration of tendon substance, surgical reconstruction is required to restore integrity to the gastrocnemius-soleus complex. (2,3) A variety of reconstructive options have been identified depending on the size of the defect, chronicity, vascularity, location, and patient-comorbidities. (4)
Other authors have described surgical techniques including the use of bone anchor systems, allografts, biologics, various tendon transfers, and minimally invasive systems. (5,6,7) In this study, we describe an inexpensive, effective, and reliable algorithm based on varying patient anatomy, that utilizes autograft to reconstruct large Achilles tendon deficits after resection of advanced symptomatic tendinopathies . (9).

Case Series/Procedure

We present a series of 5 patients with advanced symptomatic Achilles tendinopathies requiring extensive tendon resection with an average follow-up of over 12 months. We utilize a novel surgical algorithm for autograft repair of a 5-8 cm deficit using the gastrocnemius-soleus complex and flexor hallucis longus (FHL) or peroneus brevis when necessary based on patient anatomy.
The patient is placed in prone position with a pneumatic thigh tourniquet. Initial incision placement is an inverted T skin incision with the base at the plantar posterior junction of the calcaneus. The longitudinal incision extends proximally to the flare of the gastrocnemius-soleus aponeurosis. Exposure of the Achilles is performed with the standard technique, with care to preserve the paratenon. All damaged tendon is fully resected and the deficit is measured to determine required graft length. (A, B) The posterior aspect of the calcaneus is prepared for tenodesis by exposing cancellous bone.
The incision is extended proximally 3-4cm longer than the measured tendon deficit. (C) Dissection is carried down to gastrocnemius aponeurosis, where the graft is measured and drawn out. (D, E) Length is determined by excised tendon length plus 2-3 cm, allowing for proximal overlap during repair. Width is determined by measuring the distance between the medial and lateral intact flares of the Achilles insertion. The graft is obtained from the central aponeurosis if possible. More length and width may be obtained if necessary by utilizing the lateral aspect of the aponeurosis due to the more proximal lateral gastrocnemius muscle belly. If the gastrocnemius and soleal portions of the aponeurosis are easily identified, they can be separated to facilitate an isolated gastrocnemius flap. (F, G) The excised graft will be trapezoidal in shape with the wide base proximal. (H) Otherwise, both aponeuroses can be resected together.

Intraoperative Pictures & Achilles Tendon Augmentation Flowchart
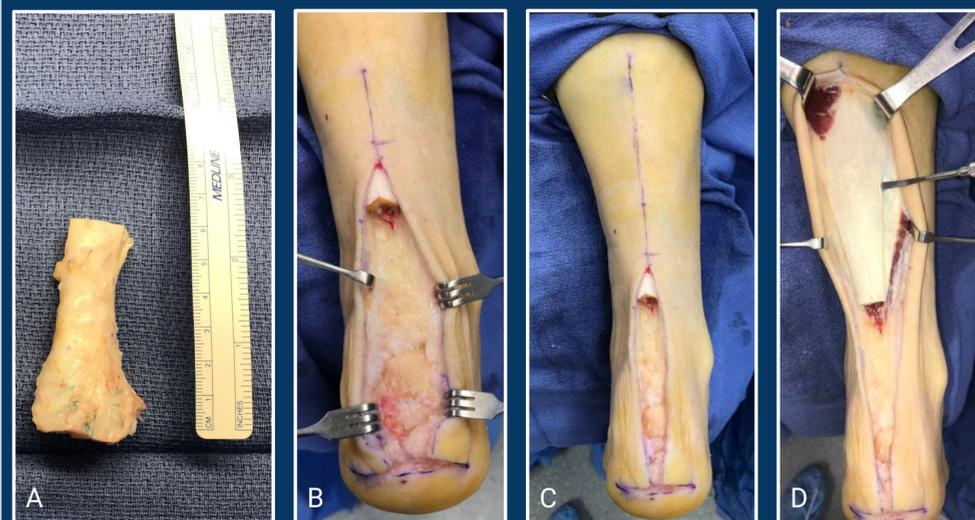
A. Resection diseased tendon

B. Large Achilles tendon deficit

C. Proximal incision outline

D. Dissected gastroc-soleal aponeurosis

E. Graft placement drawn out

F. Borders of the gastroc-soleal autograft identified

G. Gastrocnemius aspect of the autograft is reflected off the soleus aponeurosis

H. Gastrocnemius autograft

I. Distal graft secured to Achilles tendon insertion

J. Graft secured to gastroc-soleal aponeurosis with physiologic tension
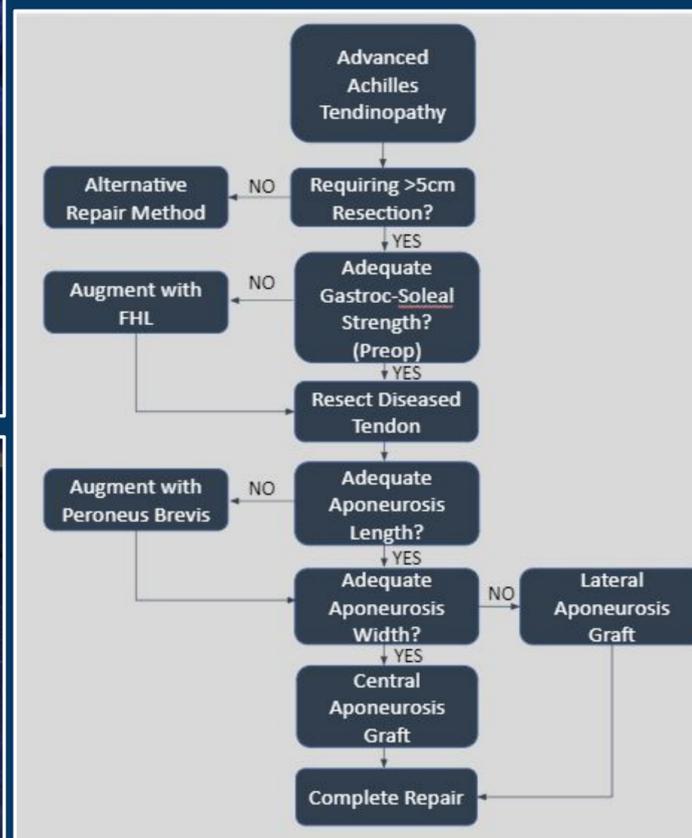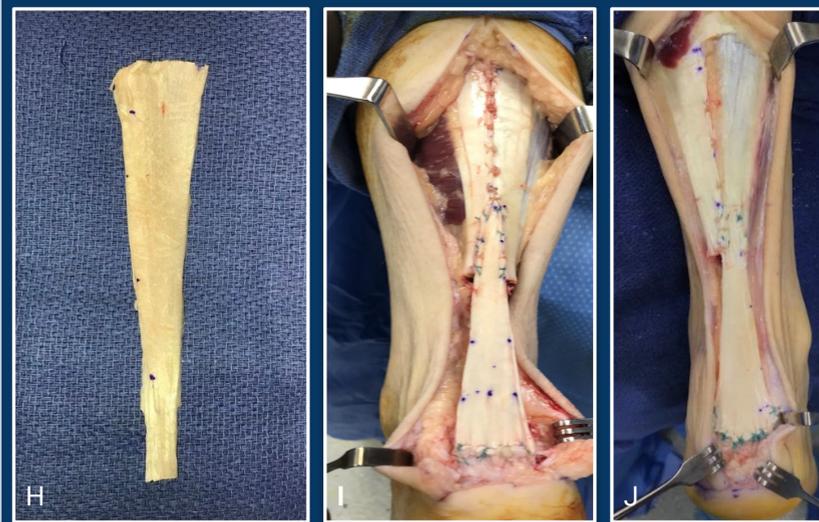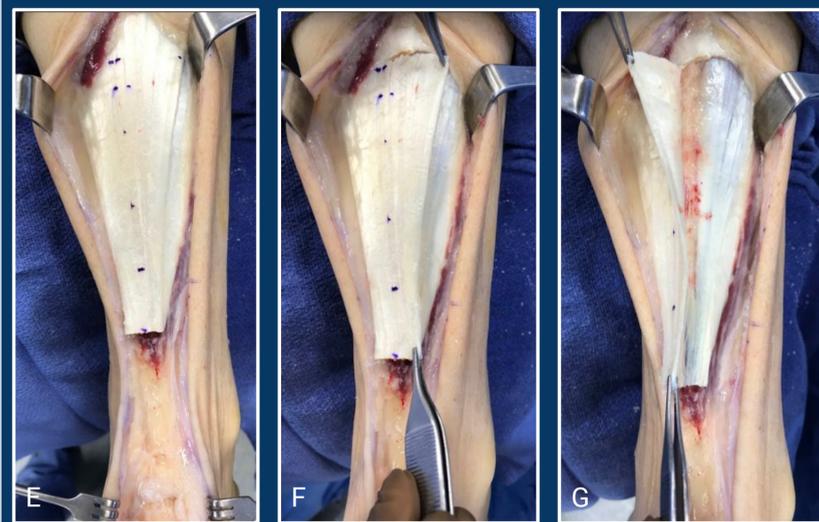
Case Study/Procedure Continued

If more graft is required, augmentation with the peroneus brevis can be performed. If preoperative clinical weakness is noted, the FHL is used. If a central graft is obtained, the aponeurosis is repaired with absorbable suture. If laterally isolated gastrocnemius graft is obtained, the gastrocnemius and soleal portions of the aponeurosis are sutured at longitudinal and transverse excision sites. The distal graft is then attached to the remaining Achilles insertion, including the intact medial and lateral flares, with non-absorbable and absorbable suture. (I) Physiologic tension is applied to the graft along with the gastrocnemius and soleus using the contralateral limb as a reference and maintained throughout repair. The graft is then secured to the proximal aponeurosis with non-absorbable suture. (J) The paratenon and deep fascia are closed as a continuous layer over the entirety of the tendon and aponeurosis. Subcutaneous fascia and skin are closed based on surgeon preference.
A below-knee plantarflexed cast is then applied at 20 degrees (8). The patient remains non-weight bearing in a plantarflexed cast for 6 weeks. This is followed by a 2-4 week progressive conversion to a neutral position in an immobilization boot. The patient is then transitioned to weight-bearing in normal shoe gear.

Analysis & Discussion

Patients present with a wide variety of anatomical and clinical variance, and it is often necessary to adapt surgical plans intraoperatively (9). According to Peacock and Van Winkle (10), flat tendon union heals better than round tendon union leading us to believe that the gastrocnemius aponeurosis autograft does not require tubularization. This procedure takes advantage of the benefits of autogenous tissue and avoids the use of expensive suture anchors, allografts, or biologics. The procedure provides good exposure for adjunct posterior surgery and the ability to fill a variety of large tendon deficits. By following the algorithm, the procedure is technically achievable and reproducible.
In conclusion, this case series of 5 patients with advanced symptomatic Achilles tendinopathies with deficits greater than 5 cm allowed us to develop a novel surgical algorithm, which can be adapted to varying patient anatomy.

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