One-Stage Reconstruction for Re-rupture of Achilles Tendon with Soft Tissue Infection: Using an Anterolateral Thigh Flap Incorporating a Vascularized Muscle Flap and a Strip of Iliotibial Tract

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Abstract

Keywords

- Achilles tendon
- anterolateral thigh flap
- one-stage reconstruction
- re-rupture

Reconstruction is challenging in a patient with loss of a segment of Achilles tendon and infection in the overlying soft tissue. Here the authors describe one-stage tendon reconstruction, using an anterolateral thigh free flap incorporating a vascularized muscle flap and a strip of iliotibial tract in a patient with re-rupture of an Achilles tendon and soft tissue infection. Postoperative immobilization of the affected ankle using an external fixator enabled us to observe the flap directly and reduce pressure on the flap. The patient had a successful outcome, with no difficulty in walking, running, or climbing stairs and no limitation of range of motion at the ankle joint postoperatively. This is a promising technique for reconstruction of the Achilles tendon and treatment of infection as a one-step procedure.

Introduction

The Achilles tendon is essential for everyday functioning of the ankle joint. Loss of function of this tendon impairs dorsiflexion and plantar flexion of the ankle, leading to difficulty in performing the basic activities of daily living. Surgical treatment of an Achilles tendon rupture has the advantages of allowing early recovery of ankle joint function and reducing the risk of re-rupture¹; however, it has several potential complications including wound infection and necrosis² because of the poorly vascularized skin and thin soft tissue in the calcaneal region. Such complications often cause extensive loss of the soft tissue containing the segmental Achilles tendon defect, and reconstruction of this type of defect is challenging.

Here the authors describe successful one-stage reconstruction in a patient with re-rupture of an Achilles tendon at the site of insertion on the calcaneus and with infection of the overlying

soft tissue, using an anterolateral thigh free flap comprising a vascularized muscle flap and a strip of the iliotibial tract.

Case Report

A 63-year-old woman experienced persistent heel pain for 5 months that was diagnosed as insertional Achilles tendinosis and treated conservatively. Her pain increased after a fall down a flight of stairs. Plain radiography and computed tomography revealed a slight Haglund's deformity and a bone fragment in the Achilles tendon. Ultrasonography revealed a rupture of the Achilles tendon at the site of insertion on the calcaneus. The ruptured tendon was repaired surgically using a suture bridge technique. The patient's postoperative course was complicated, and 2 months later, she presented with re-rupture of the Achilles tendon after falling and an infected surgical wound. Steadily worsening dehiscence was

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found, along with purulent discharge and skin necrosis at the wound edges. The distal end of the Achilles tendon was exposed, showing liquefactive necrosis.

Staphylococcus lugdunensis and *Corynebacterium* spp. were identified in the necrotic tissue. Magnetic resonance imaging revealed a re-rupture of the Achilles tendon at the site of calcaneal insertion and osteomyelitis of the calcaneus (►Fig. 1). The authors diagnosed Achilles tendon re-rupture with infection and planned simultaneous reconstruction of the Achilles tendon and treatment of the infection.

Radical debridement was performed with removal of screws and the artificial ligament. The resulting skin defect was measured approximately 8 cm × 2 cm with loss of a 4-cm segment of the Achilles tendon (►Fig. 2).

Two cutaneous perforators were detected preoperatively on Doppler audiometry. The authors designed an anterolateral thigh skin flap (12 × 3 cm) containing two marked cutaneous perforators (►Fig. 3A). The dissection was deepened underneath the deep fascia and continued to the descending branch of the lateral femoral circumflex artery. A strip of iliotibial tract was harvested for reconstruction of the Achilles tendon. Two walnut-sized portions of vastus lateralis supplied by the descending branch of the lateral femoral circumflex artery were harvested as the muscle flap to fill the defects left by debridement (►Fig. 3B). The donor site was closed without skin graft.

Vascular anastomoses were constructed by microsurgery as follows. The cutaneous perforators from the descending branch of the lateral femoral circumflex artery and concomitant vein were used as a vascular pedicle. A 12-cm section of the descending branch of the lateral femoral circumflex artery was harvested in a T-shape and anastomosed in an end-to-end fashion with the posterior tibial artery as a flow-through-type repair. A section of the lateral femoral circumflex vein was anastomosed to the posterior tibial vein in an end-to-end fashion. The harvested strip of iliotibial tract was held in half to match

the size and shape of the Achilles tendon and sutured to the distal end of the tendon and soft tissue around the calcaneus.

The affected ankle was fixed at 20-degree plantar flexion using an external fixator (Hoffman, Stryker, Kalamazoo, Minnesota, United States) for 6 weeks to immobilize the ankle after surgery and for easier observation of the transplanted flap (►Fig. 4).

Six weeks after the reconstruction, the external fixator was removed, the flap was thinned, and the ankle was immobilized in the neutral position by cast fixation for 2 weeks. Eight weeks after surgery, the patient started actively moving the affected ankle and partial weight-bearing gait therapy. Two years after surgery, the range of active dorsiflexion in the ankle joint is 20 degrees and that of plantar flexion is 60 degrees (►Fig. 5A, B). Ultrasonography revealed a smooth reconstructed tendon that glided easily during ankle motion (►Fig. 5A, B). The patient had no pain and no difficulty in performing her daily activities, including running and climbing stairs without the use of assistive device. She was able to stand on the toe tips and perform a single-heel rise test. At the last time of the follow-up, the American Orthopaedic Foot and Ankle Society (AOFAS) score was 100.

The patient consented to submission of this manuscript for publication.

Fig. 1 Preoperative magnetic resonance images (T2 STIR weighting) showing high-intensity changes between the soft tissue and calcaneus around the screws.

Fig. 2 Intraoperative findings. Loss of a 4-cm length of the Achilles tendon and a soft tissue defect measuring 8 × 2 cm are evident following debridement.

Fig. 3 (A) A flap measuring 12 × 3 cm is harvested. (B) The harvested anterior thigh flap includes a strip of vascularized iliotibial tract and a muscle flap with a vascular pedicle.

Fig. 4 Postoperative ankle fixation using an external fixator allows direct observation of the grafted tissue.

Discussion

Surgical site infection is one of the worst complications of surgical repair of an Achilles tendon rupture. Infection of the surgical wound often leads to soft tissue necrosis because of the poorly vascularized surrounding skin and the thin and less mobile soft tissues in the calcaneal region, resulting in composite soft tissue loss that is difficult to treat. Treatment for re-rupture of an Achilles tendon complicated by infection, as in the case described here, consists of infection control combined with soft tissues coverage at first, followed next by functional repair of the ruptured tendon. Control of infection requires radical debridement of dead tissue, stabilization of

bone, local administration of appropriate antibiotics, and coverage of the skin to prevent further microbial invasion.³

Conventional two-stage reconstruction using a combination of a local flap with a nonvascularized fascial graft has several drawbacks, including delayed healing and a high risk of infection because of the avascular nature of the grafted tendon. A vascularized free tissue transplant allows reconstruction of the tendon and coverage of the soft tissue defect with well-vascularized tissues in a single surgical step. For the reconstruction to be successful, the skin coverage should be strong enough to resist repetitive friction and shearing forces, allow the tendon to glide smoothly, and withstand the dynamic workload of daily activities.

Several procedures have been reported to restore combined soft tissue and tendon loss, including radial forearm, lateral arm, and posteromedial thigh flaps.⁴⁻⁷ The anterolateral thigh flap originally described by Song et al⁸ and used in this case has the advantages of being able to cover a large territory, providing a highly durable skin flap, affording good resistance to infection, having adequate strength, and promoting rapid healing of a reconstructed tendon when a strip of vascularized iliotibial tract is used. Moreover, with the addition of a vascularized muscle flap by using a muscle supplied by the descending branch of the lateral femoral circumflex artery as a vascular pedicle, the dead spaces remaining after radical debridement can be filled with living tissue, which enables antibiotics to target the focus of infection efficiently.

Adequate management of the free flap was required for a successful postoperative course. The affected ankle needed to be immobilized until the reconstructed Achilles tendon recovered enough strength to withstand ankle motion

Fig. 5 Postoperative active motion at the ankle on ultrasonography in (A) dorsiflexion and (B) plantar flexion 2 years after surgery. Lateral views show a good range of motion of the affected ankle. Ultrasonography shows smooth gliding of the tendon during ankle motion.

exercises. The authors used an external fixator rather than a cast for temporary fixation of the affected ankle, which made it easier to observe the condition of the flap and avoid unnecessary pressure on the flap. Their experience with this patient indicates that an external fixator is a simple and useful tool for temporary immobilization in postoperative management.

In this patient, one-stage reconstruction using a free anterolateral thigh flap comprising a vascularized muscle flap and a strip of iliotibial tract successfully treated re-rupture of the Achilles tendon with soft tissue infection. A good functional ankle with cosmetic soft tissue coverage was maintained at the 2-year follow-up. The authors suggest that a vascularized strip of iliotibial tract can restore an Achilles tendon with adequate strength and offer resistance to infection, an additional vascularized muscle flap is effective for the treatment of infection, and external fixation allows the condition of the flap to be monitored more easily.

Note

Informed consent for publication of this case report was obtained from the patient.

Funding

None.

Conflict of Interest

None.

References

- 1 Costa ML, MacMillan K, Halliday D, et al. Randomised controlled trials of immediate weight-bearing mobilisation for rupture of the tendo Achilles. *J Bone Joint Surg Br* 2006;88(1):69–77
- 2 Cetti R, Christensen SE, Ejsted R, Jensen NM, Jorgensen U. Operative versus nonoperative treatment of Achilles tendon rupture. A prospective randomized study and review of the literature. *Am J Sports Med* 1993;21(6):791–799
- 3 Patzakis MJ, Zalavras CG. Chronic posttraumatic osteomyelitis and infected nonunion of the tibia: current management concepts. *J Am Acad Orthop Surg* 2005;13(6):417–427
- 4 Leppilahti J, Kaarela O, Teerikangas H, Raatikainen T, Orava S, Waris T. Free tissue coverage of wound complications following Achilles tendon rupture surgery. *Clin Orthop Relat Res* 1996;(328):171–176
- 5 Kim CH, Tark MS, Choi CY, Kang SG, Kim YB. A single-stage reconstruction of a complex Achilles wound with modified free composite lateral arm flap. *J Reconstr Microsurg* 2008;24(2):127–130
- 6 Innocenti M, Tani M, Carulli C, Ghezzi S, Raspanti A, Menichini G. Radial forearm flap plus flexor carpi radialis tendon in Achilles tendon reconstruction: surgical technique, functional results, and gait analysis. *Microsurgery* 2015;35(8):608–614
- 7 Scaglioni MF, Hsieh CH, Giovanoli P, Chen YC. The postero-medial thigh (PMT) flap for lower extremity reconstruction. *Microsurgery* 7;37(8):865–872
- 8 Song YG, Chen GZ, Song YL. The free thigh flap: a new free flap concept based on the septocutaneous artery. *Br J Plast Surg* 1984;37(2):149–159