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Chronic Achilles Tendon Rupture Treated with Endoscopic Flexor Hallucis Longus Transfer: Case Report and Surgical Technique Review

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Abstract **Case Report**

Chronic rupture of the Achilles tendon presents a therapeutic challenge. The endoscopic transfer of the flexor hallucis longus (FHL) tendon offers a minimally invasive alternative that provides both effective biomechanical reinforcement and enhanced healing potential. Through a clinical case and a review of the surgical technique, we highlight the relevance of this approach, especially in the presence of a large tendon gap. This treatment appears to be safe, reliable, and reproducible in experienced hands.

Keywords: Achilles tendon, chronic rupture, flexor hallucis longus tendon, tendon transfer, endoscopy, minimally invasive surgery.

INTRODUCTION

The endoscopic transfer of the flexor hallucis longus (FHL) tendon to replace the Achilles tendon is becoming increasingly common. Its primary advantage lies in the reduction of morbidity associated with the surgical approach.

This technique was initially described by Wapner *et al*. in 1993 as an open procedure involving the transfer of the FHL tendon to the calcaneus as a substitute for the ruptured Achilles tendon [1] , The most commonly used endoscopic technique consists of harvesting the FHL tendon from zone 1–2 and fixing it into a calcaneal tunnel using an interference screw [2], The calcaneal fixation tunnel can be oriented either vertically or horizontally [3].

In this article, we present a modified surgical technique through the clinical case of a 78-year-old patient with a chronic Achilles tendon rupture of 6 months' duration. The repair involved a vertical insertion of the FHL into the calcaneus.

CASE REPORT

The patient is a 78-year-old man with a medical history of peripheral arterial disease (PAD) on the right side. He sustained a laceration on the posterior aspect of the right ankle following a domestic accident. The wound was initially sutured, but the patient presented six months later due to persistent gait disturbances, difficulty during push-off, and decreased muscle strength, particularly when walking on tiptoes.

On clinical examination, the patient exhibited a mild limp. He was able to walk on his heels but unable to bear weight on the toes of his right foot. A palpable gap was noted in the mid-portion of the Achilles tendon, and the Thompson test was positive. These findings were consistent with a neglected Achilles tendon rupture. Magnetic resonance imaging (MRI) confirmed the diagnosis, revealing a 7 cm gap between the proximal and distal stumps of the tendon.

After thorough evaluation, a decision was made to proceed with a flexor hallucis longus (FHL) tendon transfer. The endoscopic approach was favored due to its minimally invasive nature and superior healing profile, particularly in a poorly vascularized area and in a patient with existing peripheral arterial disease.

Figure 1: MRI of the ankle showing a 7 cm gap between the 2 ends with intermediate fibrosis

Surgical Technique

Patient Positioning

The procedure can be performed under general or spinal anesthesia. The patient is placed in the prone position, with the foot extending beyond the edge of the operating table. A soft bolster is placed under the ipsilateral leg, and another under the contralateral pelvis to minimize external rotation. A pneumatic tourniquet is applied at the proximal thigh.

Surgical Approach

Two endoscopic portals are made at the level of the tip of the lateral malleolus:

- a posterolateral portal for visualization
- a posteromedial portal for instrumentation [4].

The posterolateral portal is established first, with a 4.0 mm 30° arthroscope inserted along the lateral border of the ruptured Achilles tendon. The posteromedial portal is then placed just medial to the tendon. After careful debridement using a 4.0 mm shaver, important anatomical landmarks can be clearly visualized, including the ankle joint, subtalar joint, and the FHL tendon.

Tendon Release

The FHL tendon is meticulously debrided and mobilized by releasing any adhesions and its proximal fascial sheath. If tendon identification is difficult, passive plantarflexion and dorsiflexion of the great toe can help localize the FHL tendon and muscle belly. Caution is essential to avoid working medially due to the proximity of neurovascular structures (tibial nerve and posterior tibial artery)[5,6].

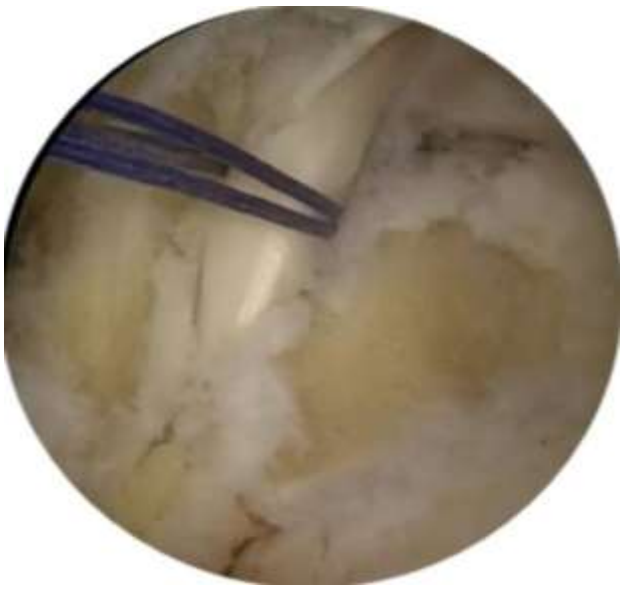

Figure 2: Arthroscopic location of the FHL tendon

Once identified, the FHL tendon is sectioned in zone 1 or 2, taking care to preserve the knot of Henry. This ensures residual flexion of the hallux via the flexor digitorum longus[7], A locking loop suture is placed around the tendon via the posteromedial portal. A minimum tendon length of 15–20 mm is required[8] The tendon can be cut either using a tendon stripper or percutaneously under transillumination guidance. The tendon is then retrieved through the posteromedial portal, prepared with a Krackow suture, and measured.

Calcaneal Tunnel

The next step involves preparing the calcaneal tunnel. The tunnel diameter is typically 1 mm larger than the harvested tendon diameter. Under fluoroscopic control, a guidewire is introduced retrogradely through the plantar aspect of the calcaneus. Alternatively, an antegrade drilling approach may be used. The key point is to ensure that the tunnel trajectory is as posterior and medial as possible[9].

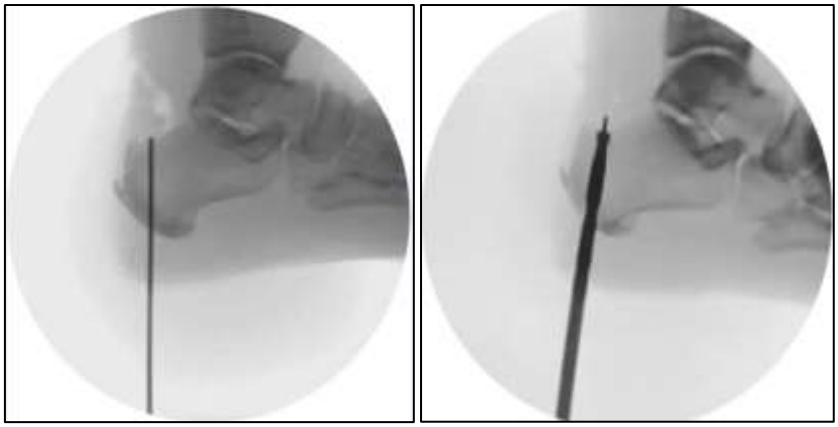

Figure 3 retrograde calcaneal tunnel guided by k-wire

Tendon Fixation

The prepared FHL tendon is passed through the calcaneal tunnel using a suture-passing guidewire. With the foot held in plantarflexion, the tendon is tensioned and secured using an interference screw inserted through the plantar side. Arthroscopic control is then performed, followed by debridement and freshening of the remaining Achilles tendon stumps to promote optimal healing.

DISCUSSION

Endoscopic transfer of the flexor hallucis longus (FHL) tendon is a promising arthroscopic technique for the management of both chronic and acute Achilles tendon ruptures. It combines the biological and biomechanical advantages of reinforcing the Achilles tendon while avoiding the morbidity associated with extensive surgical exposure.

The FHL tendon is considered an ideal graft for Achilles reconstruction for several reasons:

- It contracts in synchrony with the triceps surae.
- Its force vector is parallel to that of the Achilles tendon.
- Its posterior insertion on the calcaneus increases the lever arm, generating greater plantarflexion torque.
- When transferred, it acts as an internal splint, improving approximation of the tendon stumps [10].

In addition to its biomechanical role, this technique enhances the biological potential for healing. The posterior advancement of the FHL brings the distal Achilles stump closer to the richly vascularized FHL muscle belly [5,6,10]. This effect can be facilitated by releasing the FHL's proximal fascial sheath.

The minimally invasive approach also preserves the paratenon and avoids long cutaneous incisions, thereby reducing the risk of infection and wound complications[11].

Technical Innovations in Our Approach

Two specific technical aspects of our procedure differ from standard techniques:

1. The calcaneal tunnel is drilled (from the plantar surface to the superior-posterior calcaneus), rather than through the posteromedial portal. retrograde
2. The interference screw is also inserted from the plantar side.
   This configuration facilitates surgical execution but requires careful attention to the plantar emergence of the screw, which may otherwise irritate the plantar fat pad.

Another unique aspect of our technique is the arthroscopic debridement of the Achilles stumps. We believe that creating a bleeding surface and removing degenerated tissue optimizes the healing environment.

Donor Site Morbidity

The main expected complication is a reduction in hallux flexion strength, potentially affecting push-off and gait. However, this loss appears minimal if the FHL tendon is harvested proximal to the knot of Henry (MKH)[5,6,10,11].

Advantages

- Safe and reliable, even in high-risk patients
- Enhances healing through increased vascularization
- Avoids large incisions and minimizes soft tissue disruption
- Brings the FHL muscle belly in close proximity to the Achilles stump, facilitating biological integration

Disadvantages

- Technically demanding procedure
- Longer operative time compared to conventional techniques
- Requires specialized equipment (arthroscope, fluoroscopy) and familiarity with hindfoot endoscopy

CONCLUSION

Endoscopic transfer of the flexor hallucis longus (FHL) tendon represents a safe, reliable, and biologically advantageous therapeutic option for the treatment of chronic Achilles tendon ruptures. This technique offers effective biomechanical reinforcement through the synergistic action of the FHL with the triceps surae and enhances healing potential by bringing the vascularized muscle belly of the FHL into proximity with the rupture site.

Its minimally invasive nature reduces the risk of wound complications while preserving key anatomical structures such as the paratenon. However, due to the technical complexity and equipment requirements, this approach should be reserved for experienced surgeons and ideally preceded by cadaveric training.

In skilled hands, this technique constitutes a significant advancement in the management of chronic Achilles tendon ruptures.

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