International Journal of Surgery Case Reports 103 (2023) 107886

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.elsevier.com/locate/ijscr

Case report

# Extensor digitorum longus (EDL) to extensor hallucis longus (EHL) tendon transfer for delayed EHL tendon rupture following anterior ankle arthroscopy – Case report

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ARTICLE INFO

*Keywords:*
Ankle arthroscopy
Extensor hallucis longus (EHL)
Extensor digitorum longus (EDL)
EHL tendon rupture
EDL to EHL tendon transfer
Case report

ABSTRACT

*Background:* Arthroscopy of the ankle is an important surgical technique that has become increasingly popular over the years due to its usefulness in the treatment of many ankle conditions. Nevertheless, it's not deprived of complications. Extensor hallucis longus (EHL) tendon ruptures following anterior ankle arthroscopy have only been reported 3 times in the literature.

*Case report:* We report the case of a 52-year-old female submitted to ankle arthroscopy with removal of a bony fragment located at the tip of the lateral malleolus and ATFL ligament repair (arthroscopic Bröstrom-Gould). At the sixth postoperative week, she experienced a sudden "pop" located at the anterior aspect of the ankle with inability to actively extend the hallux and difficulty in walking barefoot with disruption of normal gait. MRI showed a complete rupture of the extensor hallucis longus tendon with approximately 6 cm separation between the tendon ends. Surgical treatment was performed: tendinous transfer of the extensor digitorum longus (EDL) to the EHL using a Pulvertaft technique. At the 12th postoperative week, the patient could actively extend the hallux and the second toe with a range of motion similar to the contralateral foot.

*Conclusion:* This case reports a delayed EHL tendon rupture following ankle arthroscopy treated surgically with a good functional result. To our knowledge, this is the first published case of delayed EHL tendon rupture following anterior ankle arthroscopy treated surgically with a tendinous transfer of the EDL to the EHL. The possible causes leading to this complication and the different surgical techniques that could have been used to treat this pathology were discussed.

## 1. Introduction

Ankle arthroscopy is an important surgical technique that has been progressively increasing popularity over the years [1] because of its utility to treat numerous ankle disorders, such as impingement syndromes, osteochondral lesions, ligamentous injuries, and retrieval of loose bodies in a minimally invasive way [2,3]. Nevertheless, complications such as neurovascular injuries, infections, wound complications, articular cartilage, ligament or tendon injuries may occur [1]. To the best of the authors' knowledge, extensor hallucis longus (EHL) tendon ruptures following anterior ankle arthroscopy have only been reported 3 times in the literature [1,3–5].

The aim of this publication is to report this rare complication of anterior ankle arthroscopy, which presented in a delayed setting and was treated surgically with a good clinical result, discuss the possible causes that lead to this complication and evaluate the different surgical techniques that could have been chosen to treat this tendon rupture.

This paper has been reported in line with the SCARE 2020 criteria [6].

## 2. Case report

We report the case of a sedentary 52-year-old woman with a history of hypothyroidism, hypertension, dyslipidemia and anxiety with symptomatic pseudarthrosis of the tip of the left lateral malleolus (avulsion of the anterior tibiofibular ligament (ATFL) with an 11 mm bony fragment) after a work accident one year earlier. She underwent ankle arthroscopy with removal of the bony fragment and ATFL

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https://doi.org/10.1016/j.ijscr.2023.107886
Received 8 November 2022; Received in revised form 27 December 2022; Accepted 9 January 2023
Available online 12 January 2023

ligament repair (arthroscopic Bröstrom-Gould). The surgery and the immediate post-operative period were uneventful. The posterior short-leg splint was removed 4 weeks later, and the patient began rehabilitation.

In the sixth postoperative week, the patient reported that she started walking one morning after waking up and felt a sudden "pop" located at the anterior aspect of the operated ankle, followed by pain (VAS 2/10) and inability to actively extend the left hallux. She complained of difficulty walking barefoot with a disruption of normal gait. She also experienced difficulty in wearing socks and shoes.

### 2.1. Clinical findings

Clinically, the patient presented with anterior ankle tenderness and oedema, without ecchymosis or haematoma, with a small deformity of the interphalangeal joint of the hallux in flexion (Fig. 1) and inability to actively dorsiflex the hallux (muscle strength 0/5). The active range of motion (ROM) of the ankle joint was 10/0/35, with visible continuity and active movement of the tibialis anterior (TA) tendon. The lesser toes showed no restriction of active range of motion, with muscle strength 5/5. Sensibility of the ankle and of the dorsal and plantar aspect of the foot, including the first web space, was normal.

### 2.2. Diagnostic assessment

MRI showed complete rupture of the extensor hallucis longus tendon (Fig. 2) with approximately 6 cm gap between the tendon ends. The proximal end was at the level of the superior extensor retinaculum and the distal end was at the level of the dorsal aspect of the navicular bone.

### 2.3. Therapeutic intervention

This clinical case was discussed in a multidisciplinary meeting of Orthopaedic and Plastic surgeons. Surgical treatment was recommended to restore the alignment of the hallux and the ability to actively extend the hallux, with the purpose to restore normal gait. Due to the late presentation of the tendon rupture and the retraction between the tendon ends, the authors decided to perform a tendinous transfer of the extensor digitorum longus (EDL) to the EHL using a Pulvertaft technique [7,8] (Fig. 3).

### 2.4. Follow-up and outcomes

The patient was immobilised with a posterior short leg splint for four weeks. Rehabilitation was then resumed, and the patient was allowed to initiate progressive weight bearing with a Walker boot without restriction of ankle ROM. The Walker boot and crutches were removed at the 6th postoperative week. At the 12Th postoperative week, the patient could actively extend the hallux and the second toe with a similar ROM of the contralateral foot (Fig. 4), with hallux extension strength of 3/5.

At six months, the patient complained of occasional mild pain over the hallux (VAS 1-2/10) without need of taking analgesic medication, presented a symmetric ROM of ankle and toes (Fig. 5), with hallux extension strength of 4/5 and had resumed her professional activities. The patient didn't perform any type of sport activity before the surgeries. She presented an Ankle-Hindfoot AOFAS scale [9] of 80 and a Hallux

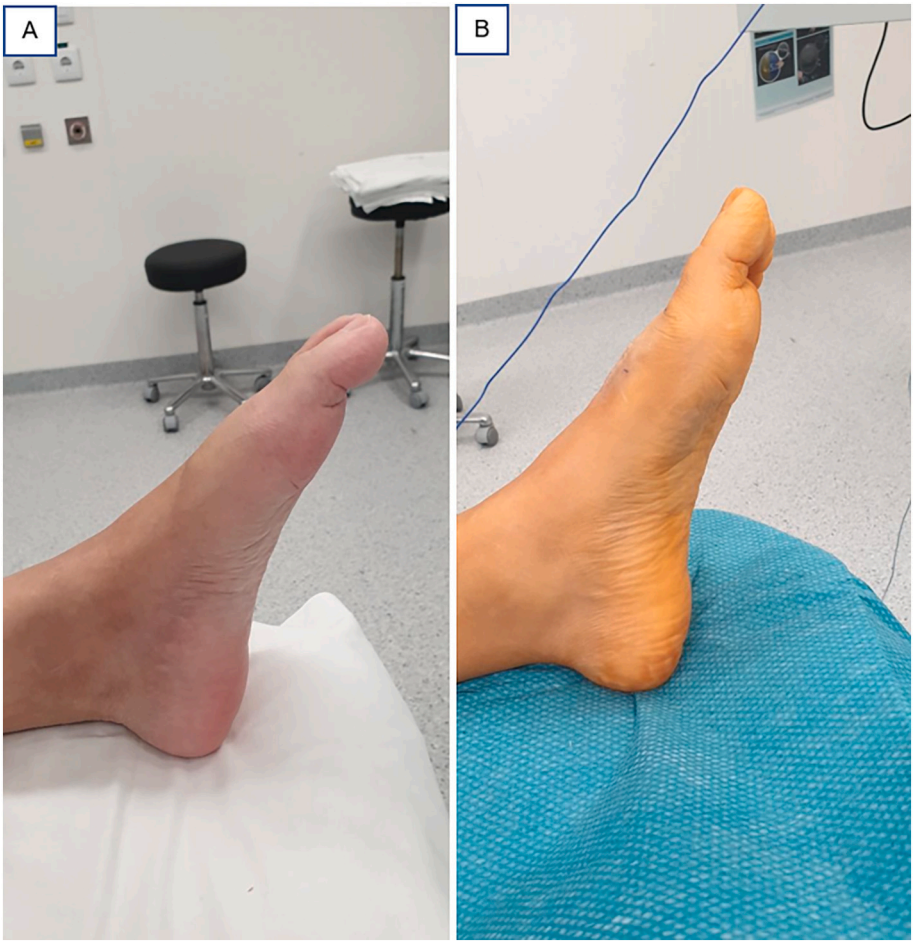


**Fig. 1.** A) Pre-operative deformity of the IF joint of the hallux in flexion.
B) Correct alignment of the hallux in the immediate postoperative setting.

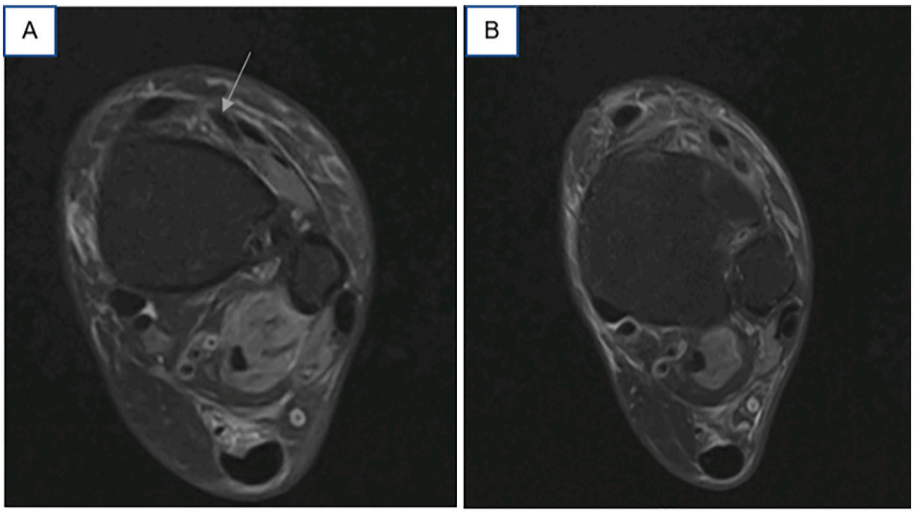


**Fig. 2.** Axial T2 weighted MRI images of the ankle.
A) Proximal image: EHL present (arrow).
B) Distal image: EHL absent.

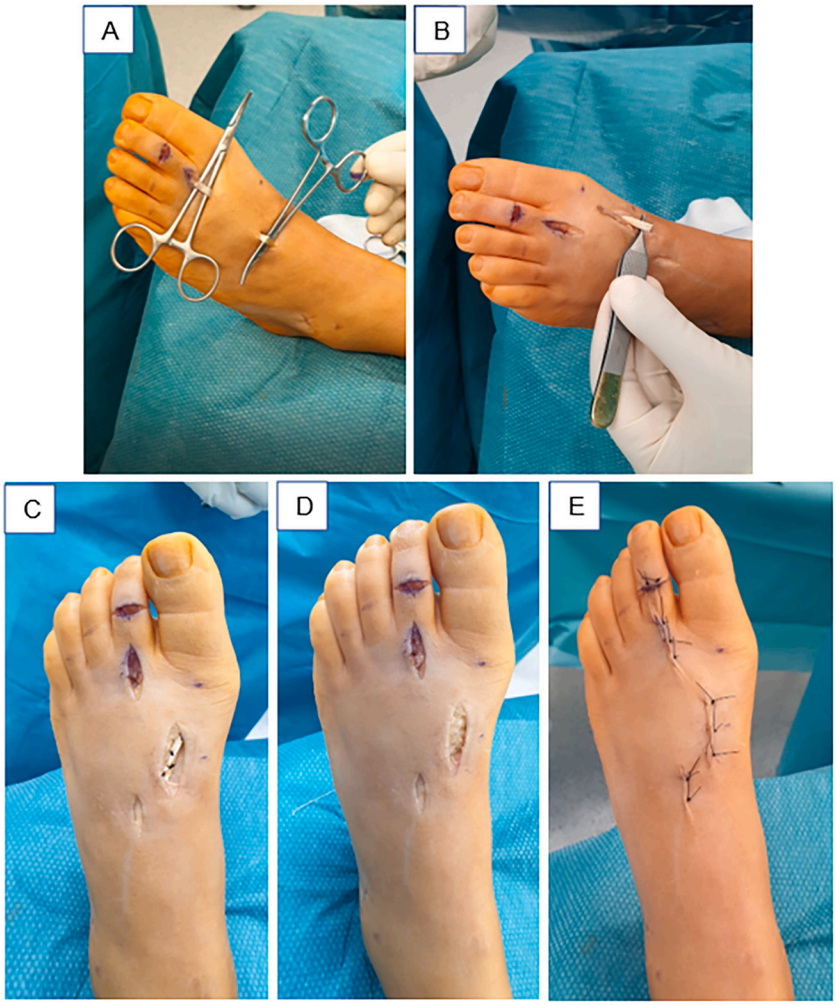


**Fig. 3.** Tendinous transfer of the EDL to the EHL - Operative technique.
A) Identification of the EDL; B) identification and preparation of the distal end of the EHL; C and D): tendon transfer before (C) and after (D) subcutaneous tissue coverage; E) Surgical wounds closure.

**Fig. 4.** Hallux active range of motion at 12 weeks follow-up.

**Fig. 5.** Hallux active range of motion at 6 months follow-up.

Metatarsophalangeal-Interphalangeal AOFAS scale [9] of 82.

## 3. Discussion

EHL tendon rupture is an infrequent complication following anterior ankle arthroscopy [1]. To the best of the authors' knowledge, EHL tendon ruptures following anterior ankle arthroscopy have only been reported 3 times in the literature [1,3–5].

In 2006, Navadji et al [4] described a case of isolated rupture of the EHL tendon, probably related to instrument use during an ankle arthroscopy performed three weeks earlier in another institution, and performed a primary end-to-end repair with a good clinical result.

Both Tuncer [3] in 2010 and Kaufman [5] in 2017 described cases of delayed ruptures of EHL and extensor digitorum communis (EDC) following anterior ankle arthroscopy. In the first case, the rupture was diagnosed in the 10th postoperative week and was attributed to breaching the anterior capsule with a radiofrequency probe during ankle arthroscopy. The EDC rupture was repaired primarily and a semitendinosus tendon graft was used to reconstruct the EHL [3].

In the second case, Kaufman [5] described that their patient started to become symptomatic one month after the surgery, during transition to full weight bearing, and the rupture was diagnosed 3,5 months postoperatively. They considered the combined EHL and EDC rupture to be spontaneous and attributed the cause to chronic tendinosis, recurrent ankle sprains, flatfoot, chronic disease such as obesity in addition to an equinus strain following immobilization from surgery.

In our case, the authors reviewed the video of the arthroscopy and ruled out anterior capsule perforation and direct rupture of the EHL during surgery. The anteromedial portal was made in the standard position, medial to the TA tendon, and the insertion of the trocar, arthroscope and instruments into the joint had occurred uneventfully. Nevertheless, radiofrequency was used. Radiofrequency energy can lead to collagen denaturation, cell necrosis and potentially damaging mechanical effects in the soft tissues [3], which may have contributed to the EHL rupture.

In a multidisciplinary meeting with a senior musculoskeletal radiologist, the authors reviewed images from two MRIs of the ankle taken by the patient 7 months and 6 weeks before surgery respectively. They concluded that there was no previous evidence of tendinosis or tenosynovitis affecting the EHL tendon.

The authors consider that in this case, it is not possible to determine the exact cause of the tendon rupture. It may be spontaneous, but iatrogenic causes cannot be completely ruled out. The fact that the patient suffered from painful pseudarthrosis of the tip of the lateral malleolus with an altered gait pattern for one year before surgery, as well as the patient's chronic diseases (hypothyroidism and dyslipidemia treated with levothyroxine and a statin), the surgical aggression (distention of the capsule due to fluid, harmful effects of radiofrequency energy) and the one-month immobilization after surgery might have contributed to this isolated EHL tendon rupture.

Injuries to the EHL are infrequently reported in the literature [10,11], thus, guidelines for treatment and decision making remain scarce [12].

In 2019, Jaffe [10] reported a case of untreated rupture of the extensor hallucis longus due to a laceration on the dorsal aspect of the foot in an active 66-year-old woman. The patient regained active extension of her hallux between 6 months and one year and did not develop any deformity. Therefore, the author stated that there is a paucity of literature regarding the natural history and the functional consequences of neglected EHL ruptures.

The management of EHL tendon ruptures include: conservative treatment [13], primary repairs [4,14,15], reconstruction with tendon grafts [3,16] or tendon transfers [7,17].

In this case, due to the late onset of the tendon rupture and the retraction of approximately 6 cm between the tendon ends, the authors preferred a less invasive technique without having to perform extensive dissection to find the tendon ends and also without using a tendon autograft (donor site morbidity) or a tendon allograft (higher cost, susceptibility to rejection and potential risk of infection [17]). For these reasons, the authors performed a tendinous transfer of the EDL to the EHL using a Pulvertaft technique [7,8]. Initially described by Leung [7] in 2002 as a new method to treat dysfunction of the extensor hallucis longus, this technique has also been used in cases of neurologic impairment of the deep peroneal nerve affecting exclusively the EHL [8] and it has been recently modified for reconstruction of the EHL using a double looped EDL tendon in cases of dorsal foot lacerations [18].

To the best of the author's knowledge, this is the first published case of delayed EHL tendon rupture following anterior ankle arthroscopy treated surgically with a tendinous transfer of the EDL to the EHL. The possible causes leading to this complication and the different surgical techniques that could have been used to treat this pathology were discussed. As this complication is rarely reported in the literature, there are no guidelines for its management. More case reports and higher quality studies are desirable to establish accurate decision-making protocols for this pathology.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

## Ethical approval

This study is exempt from ethical approval in our institution.

## Source of funding

N/A.

## Author contribution

Jean-Michel Fallah: Conceptualization, data collection, writing - original draft.
Luís Simões de Almeida: review and editing.
João Protásio: writing – review and editing.

## Guarantor

Jean-Michel Fallah, MD.
Luís Simões de Almeida, MD.

## Research registration number

Not applicable.

## Declaration of competing interest

There is no conflict of interest.

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