International Journal of Research in Orthopaedics
Sidhu GAS et al. Int J Res Orthop. 2025 Jul;11(4):889-894
http://www.ijoro.org

Case Report

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20251812

Extensor hallucis longus tendon rupture and reconstruction using allograft tendon: a case report and literature review

Gur Aziz Singh Sidhu*, Isabel Bodgner, Jagmeet Singh Bhamra

Department of Orthopaedics, UHL, London, UK

Received: 15 April 2025
Revised: 02 June 2025
Accepted: 11 June 2025

***Correspondence:**
Dr. Gur Aziz Singh Sidhu,
E-mail: azizsidhu1026@gmail.com

ABSTRACT

This case report examined tendon reconstruction using allograft as a treatment approach for chronic extensor hallucis longus (EHL) tendon ruptures, an area with limited existing research. Two cases were discussed to evaluate this method's effectiveness. The first case involved a 27-years-old male (Patient A) with an EHL tendon tear with retraction up to 2.2 cm and an additional 1.6 cm gap in the extensor hallucis brevis (EHB) tendon confirmed on imaging. The second case was a 28-years-old female (Patient B) with a spontaneous rupture of the left EHL tendon tear with retraction to the tarsometatarsal joint and proximal attenuation extending to the ankle joint. Both patients received reconstruction with an allograft, performed using Kessler's technique, reinforced with epitenon sutures. Postoperatively, they remained non-weight bearing for four weeks with early range of motion. At the 3-months follow-up, both patients demonstrated active hallux extension and full range of motion, reporting no discomfort during daily activities. Improvements were noted on the American Orthopedic Foot and Ankle Society (AOFAS) Hallux Metatarsophalangeal-Interphalangeal scale and Foot and Ankle ability Measure (FAAM) scores, including the Activities of Daily Living and Sports subscales.

Keywords: Allograft, Extensor hallucis longus, Kessler repair, Tendon injury

INTRODUCTION

The extensor hallucis longus (EHL) muscle, situated in the anterior compartment of the lower leg between the tibialis anterior and the extensor digitorum longus, plays a crucial role in toe extension. This muscle originates along the medial aspect of the fibular shaft and attaches distally at the base of the great toe's distal phalanx. Its main function is to extend the big toe.[1]

Injury to the EHL often results in compromised active extension, where opposing flexor muscles may create a flexion deformity that prevents the toe from lifting off the ground during walking. This impairment can disrupt gait and is particularly challenging for physically active individuals, such as those in this report.[2] EHL tendon injuries have varied origins, including lacerations, overuse, tendonitis and nerve injury.[3] Additional risk factors may include steroid injections, systemic diseases like diabetes and rheumatoid arthritis.

Treatment approaches for EHL ruptures depend on the rupture's location. Distal ruptures at the extensor expansion are often managed conservatively, whereas proximal ruptures typically require surgical intervention.[4] The objective of surgical repair is to restore function, prevent deformity and promote a normal gait.

Acute tendon ruptures are generally treated with direct end-to-end repair, while chronic ruptures which may involve fibrosis, scarring and tendon retraction necessitate more complex repairs, such as with autografts, allografts or synthetic tendon replacements.[5] Studies indicate that allografts can reduce operating time and eliminate donor site complications compared to autografts.[6] However, literature on chronic EHL injuries is sparse, leaving the optimal treatment methods under-explored.

CASE REPORT

Case 1 (Patient A)

The patient was a 27-years-old male gardener with no significant medical history. He was a marathon runner. Fifteen days before presenting to the emergency department, he accidentally dropped a large ceramic pot on his left foot, causing a laceration to his EHL tendon.

On physical examination, a 2 cm healing wound was observed on the dorsum of the foot, near the metatarsal head. The patient was unable to actively extend his great toe at the interphalangeal joint, although passive movement was intact. Both active and passive movement at the metacarpophalangeal joint was unaffected.

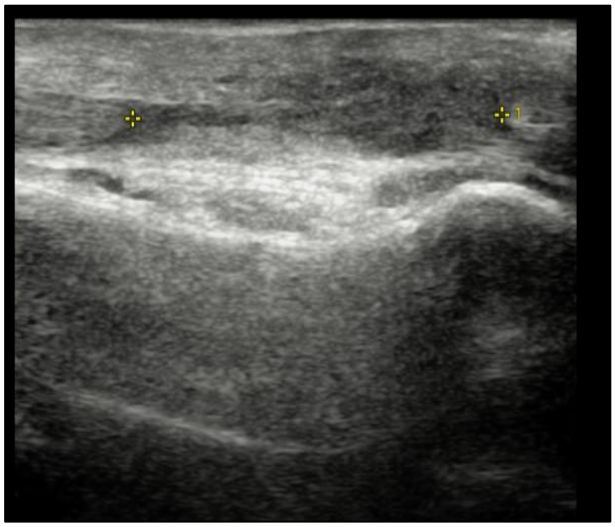

Figure 1: Ultrasound of extensor hallucis longus tear is seen more proximal, at the level of the midfoot, with torn and frayed ends retracted up to 2.2 cm.

Figure 2: Incision for EHL reconstruction.

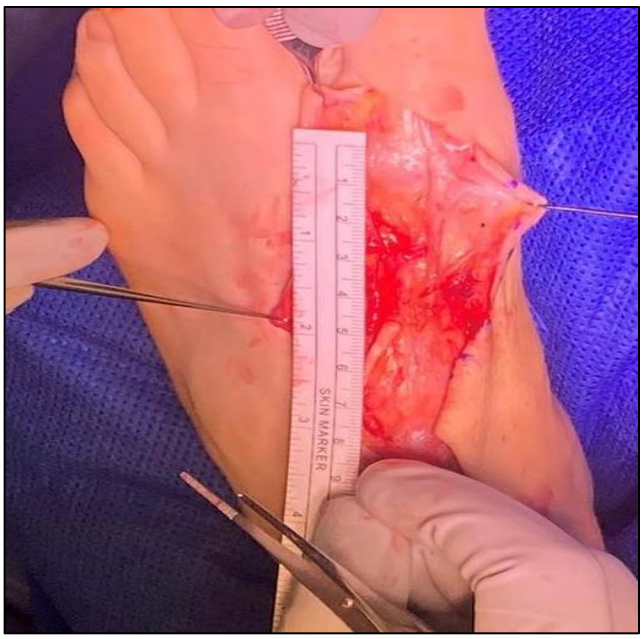

Figure 3: Gap after excision of scarred tissue.

Figure 4: Final reconstruction using tibialis anterior allograft.

Ultrasound imaging confirmed a chronic rupture of the EHL tendon, with a severe tear located proximally at the midfoot, where the tendon ends were frayed and retracted by 2.2 cm. Additionally, the EHB was torn at the level of the distal metatarsal, with a 1.6 cm gap between the tendon ends. The Ultrasound images can be seen in Figure 1. Options for reconstruction were discussed with the patient opting for tendon reconstruction. Primary repair due to retraction and time taken to present meant that this was not at option. Reconstruction using autograft or allograft were discussed. Due to his high level of sports activities his preference was use of an allograft. Surgery was performed

38 days after the injury. The operation was performed under general anaesthesia, with the patient in a supine position with a tourniquet. A zigzag incision was made over the dorsum of the foot to expose the EHL tendon and the neurovascular structures, Figure 2. Approximately 5 cm of non-functional scar tissue was excised, Figure 3. Freeze dried tibialis anterior graft (joint operations) used for reconstruction after thawing in theatres and sizing it to the required length. The hallux was positioned in 10 degrees of dorsiflexion to ensure appropriate tension. The allograft was cut to the required length and attached to the intact proximal and distal sections of the EHL tendon using the Kessler technique, supported by epitenon sutures for additional reinforcement, Figure 4.

Case 2 (Patient B)

The patient is a 28-years-old female with no significant medical history. In December 2023 the patient was elbowed in the left foot during a taekwondo training sparring session. The area was initially bruised and tender, but this settled over the period of a few weeks with conservative treatment. In June 2024 the patient represented after experiencing a flare of symptoms, presented to hospital worsening pain and stiffness around the anterior ankle. On examination she was able to fully weight bear with no limitations in active dorsiflexion and plantarflexion of the ankle. She was unable to actively extend her great toe at the interphalangeal joint.

Magnetic resonance imaging (MRI) was arranged urgently, which confirmed the diagnosis of EHL tendon rupture. Proton density (PD) fat-saturated MRI sequence in three planes of the left foot revealed that the EHL tendon was retracted to the level of the tarsometatarsal joint and attenuation of the tendon proximally to the level of the ankle joint (Figure 5).

Surgery was performed 8 months after the injury. Options for treatment included reconstruction or a tenodesis procedure to the EHB. Again, similar to the previous case and her high level of competitive participation at international tournaments, she decided on the use of an allograft rather than autograft. The operation was performed under general anaesthesia, with the patient in a supine position with tourniquet. A zigzag incision was made over the dorsum of the foot to expose the EHL tendon and the neurovascular structures. Approximately 5 cm of non-functional scar tissue was present which was excised, Figure 6.

In this patient, freeze dried gracilis tendon (joint Operations) was used after thawing. The hallux was positioned in 5-10 degrees of dorsiflexion to ensure appropriate tension. The allograft was cut to the required length and attached to the intact proximal and distal sections of the EHL tendon using the Kessler technique, supported by epitenon sutures for additional reinforcement, Figure 7. Before closing the surgical wound in both patients, the hallux position was compared with the unaffected foot, demonstrating satisfactory alignment.

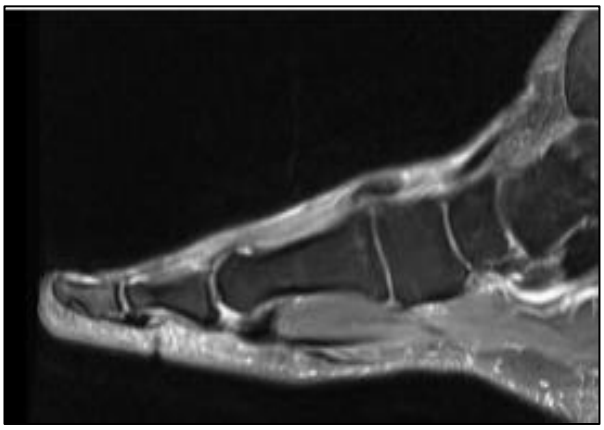

Figure 5: Magnetic resonance (MR) images showing extensor hallucis longus rupture and retraction.

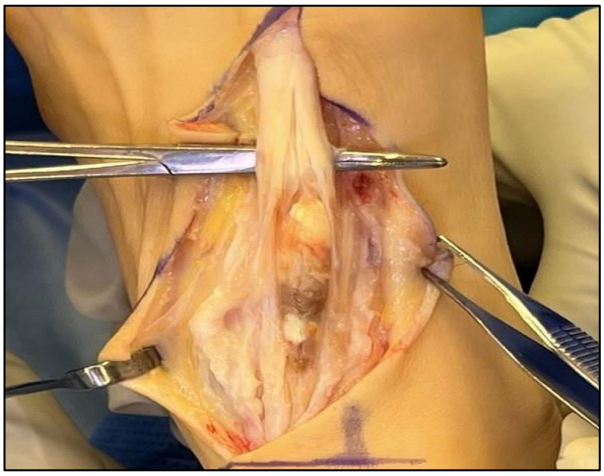

Figure 6: Intraoperative picture showing scarred tissue in patient B.

Figure 7: Final reconstruction of extensor hallucis longus with gracilis allograft.

Postoperative care

Postoperatively, the patients were immobilized in a below-knee back-slab. Two weeks after surgery, sutures were removed and the wound was reviewed.

Both patients remained non-weight bearing for four weeks and had supervised passive stretching with physiotherapy throughout this period.

Active range of motion was initiated at six weeks. Patients were reviewed at regular follow up 2 weeks, 4 weeks and 3 months and outcomes were noted with the American orthopedic foot and ankle society (AOFAS) hallux metatarsophalangeal-interphalangeal scale and foot and ankle ability measure (FAAM) scores, including the activities of daily living and sports subscales.

Table 1: Al-Qattan classification.

Zone	Al-Qattan classification
Zone 1	Injury at the insertion point on the distal phalanx.
Zone 2	The region between zones 1 and 3.
Zone 3	Located over the first metatarsophalangeal joint.
Zone 4	Dorsal foot area between zones 3 and 5.
Zone 5	Laceration of the tendon under the extensor retinaculum.
Zone 6	Proximal injuries on the lower leg, above the extensor retinaculum.

DISCUSSION

The extensor hallucis longus (EHL) tendon is essential for toe extension, stabilizing the foot during gait and maintaining balance. Although EHL tendon injuries are rare, accounting for about 1% of all foot injuries, they can significantly impact mobility, especially in physically active individuals.[7,8]

Chronic EHL injuries, typically those left untreated for six weeks or more, present unique challenges due to fibrosis, retraction and potential scarring at the injury site.[8] These changes often make end-to-end tendon repair impossible, necessitating alternative reconstructive methods, including tendon transfers or grafts.

Classification of extensor hallucis longus Injuries

The classification proposed by Al-Qattan, based on the zone of injury, provides a framework for determining the extent and optimal treatment approach for EHL tendon injuries.[3]

Zones range from the insertion site at the distal phalanx to areas proximal to the extensor retinaculum in the lower leg. Injuries closer to the muscle belly (Zones 5 /6) are more likely to require reconstructive methods, such as grafts, due to significant tendon retraction and tissue changes.

Treatment options for chronic extensor hallucis longus ruptures

Conservative approaches and cryotherapy

In cases where the rupture is distal, conservative management, including immobilization, is sometimes effective.

However, conservative management often leads to suboptimal outcomes in chronic cases, as retracted or fibrotic tendons are unlikely to heal without intervention.[9]

Surgical techniques

Direct repair

Acute EHL ruptures can often be treated with end-to-end repair using strong suture techniques like the Kessler method. However, for chronic ruptures, fibrosis and retraction often make direct repair unfeasible.[9]

Tendon transfers

Various tendon transfer techniques have been employed, including using the extensor digitorum longus (EDL) or peroneus longus. While effective in restoring toe function, tendon transfers alter the native anatomy and may impact gait biomechanics.[10]

Graft repairs

For chronic ruptures, grafts are frequently used. Options include autografts (e.g., semitendinosus, gracilis) and allografts. Autografts, while effective, carry risks of donor-site morbidity, such as pain and weakness at the donor site.[11]

Tenodesis to EHB

For large defects in the EHL tendon where end to end anastomosis is not possible and due to the proximity of the EHB being accessed from the same incision, the EHL can be tenodesed onto a transected EHB. This restores the movement of the 1st MTP joint without any adverse effects from the loss of the EHB function (also involved in hallux dorsiflexion).[2]

Allograft use in extensor hallucis longus reconstruction

Allografts present an alternative to autografts, as they eliminate donor-site morbidity and reduce surgical time. Studies comparing autografts and allografts in tendon reconstruction report similar functional outcomes with fewer complications associated with the allograft.[7]

Advantages of allografts[12]

Reduced donor-site morbidity

The use of an allograft avoids additional damage to the patient's own tissues, which can help in faster overall recovery.

Surgical efficiency

Allografts reduce the time needed to harvest the graft, leading to shorter operating times.

Strong, immediate fixation

Studies have shown that allografts provide sufficient tensile strength for load-bearing and early mobilization.[9]

Challenges and limitations[13]

Availability and cost

Access to allografts may be limited by costs and the specialized infrastructure required for procurement, sterilization and storage.

Immune response and disease transmission

Though rare, risks of immune rejection and disease transmission are considerations with allografts, necessitating stringent screening and sterilization processes.

Outcomes of extensor hallucis longus reconstruction with allografts

Few studies focus specifically on EHL reconstruction using allografts, but research on similar procedures in the foot and ankle supports the effectiveness of allografts in restoring function. In a recent case study on EHL reconstruction using a semitendinosus allograft, patients achieved nearly normal AOFAS scores and reported pain-free daily activities at follow-up.[14,15]

Additionally, the durability and tensile strength of allografts have been validated in studies on other tendons, such as the peroneal and Achilles tendons.[16] In our case report the AOFAS hallux Metatarsophalangeal-interphalangeal scale improved from 58 to 88 in patient A and 56 to 90 points in patient B. FAAM scores improved from 72% to 90% (activities of daily living subscale) and 62% to 90% (Sports subscale) in patient A and from 74% to 94% (activities of daily living subscale) and 64% to 92% (Sports subscale) in patient B.

An alternative approach in EHL reconstruction is a deep tendon transfer using the extensor digitorum longus from the second toe.[17] However, this method has been criticized due to altered biomechanical properties from rerouting the tendon, which can negatively impact force transmission and lead to suboptimal functional outcomes.[17,18] A newer approach utilizes scar tissue for EHL reconstruction. Kim et al, reported that appropriate tension applied to scar tissue could replicate the natural movement of the great toe, enabling EHL reconstruction without an autograft or allograft.[5] Scar tissue reconstruction has also shown success in the Achilles tendon.[16,19] Currently, there is no established consensus on the optimal surgical technique for EHL reconstruction.

Novel alternatives and emerging research

Some recent studies have explored the use of scar tissue or synthetic materials in tendon reconstruction. Scar tissue reconstruction has shown promise in Achilles tendon repair and may be a feasible alternative for patients with limited allograft availability or those who prefer a non-graft approach.[5,14,20] Synthetic grafts are also being investigated but require further study to confirm their long-term efficacy and safety in tendon reconstruction

CONCLUSION

While chronic EHL injuries are rare, the associated functional impairments are significant, particularly in active individuals. Allografts have emerged as a viable solution in EHL reconstruction, offering robust functional outcomes with fewer complications compared to autografts. However, more research is needed to determine the long-term effectiveness of allografts specifically in the EHL and to identify best practices in surgical technique and postoperative care.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Lezak B, Summers S. Anatomy, bony pelvis and lower limb, extensor hallucis longus muscle. 2019.
2. Wellens EK, Soni C, Karanjia H. Primary transfer of extensor hallucis brevis tendon for repair of extensor hallucis longus tendon rupture. Foot Ankle Surg Techn, Reports Cases. 2023;3(4):100332.
3. Al-Qattan MM. Surgical treatment and results in 17 cases of open lacerations of the extensor hallucis longus tendon. J Plastic, Reconstructive Aesthetic Surg. 2007;60(4):360-7.
4. Kass JC, Palumbo F, Mehl S, Camarinos N. Extensor hallucis longus tendon injury: an in-depth analysis and treatment protocol. J Foot Ankle Surg. 1997;36(1):24-7.
5. Kim WJ, Jung KJ, Ahn H, Yeo ED, Lee HS, Won SH, et al. Reconstruction of a neglected, extensor hallucis longus tendon rupture using interposed scar tissue: a case report and literature review. International J Envir Res Public Health. 2021;18(22):12157.

6. Legnani C, Borgo E, Macchi V, Ventura A. Autograft versus allograft tenodesis for chronic ankle instability: a single-center retrospective comparative study. J Comp Eff Res. 2020;10(1):5-11.
7. Wong JC, Daniel JN, Raikin SM. Repair of acute extensor hallucis longus tendon injuries: a retrospective review. Foot Ankle Spec. 2014;7(1):45-51.
8. Jaffe D. Restoration of extension of the great toe after an untreated, retracted extensor hallucis longus rupture: A Case Report. JBJS Case Connect. 2019;9(4):348.
9. Kurashige T. Chronic extensor hallucis longus tendon rupture treated with double-bundle autograft of extensor hallucis capsularis: A case report. SAGE Open Med Case Rep. 2019;7:2050.
10. Kitaoka HB, Alexander IJ. Tendon transfers for hallux extension and flexion. Clin Orthop Related Res. 268;2:191-9.
11. Scranton PE, Silva MJ. Tendon grafting for repair of foot and ankle tendons. J Am Acad Orthop Surg. 2012;13(6):395-403.
12. Deese JM, Parks BG. Graft selection in foot and ankle tendon reconstruction: Autograft versus allograft. Foot Ankle Int. 2014;32(4):429-35.
13. Krych AJ, Dahm DL. The impact of allograft preparation on disease transmission. Sports Med. 2012;38(1):47-57.
14. Taylor DC, Behn AW. Use of allografts in complex foot and ankle reconstructions. J Bone Joint Surg. 2012;101(2):186-93.
15. Oseni-Olalemi O, Seo S, Thomas R, Rabadi D, Kirakosian A. Repair of ruptured extensor hallucis longus tendon with a semitendinosus tendon allograft: A case report. Foot Ankle Surg: Techniques, Rep Cases. 2024;4(1):100365.
16. Mook WR, Parekh SG, Nunley JA. Allograft reconstruction of peroneal tendons: operative technique and clinical outcomes. Foot Ankle Int. 2013;34(9):1212-20.
17. Bastías GF, Cuchacovich N, Schiff A, Carcuro G, Pellegrini MJ. Technique tip: EDL-to-EHL double loop transfer for extensor hallucis longus reconstruction. Foot Ankle Surg. 2019;25(3):272-7.
18. Wong JC, Daniel JN, Raikin SM. Repair of acute extensor hallucis longus tendon injuries: a retrospective review. Foot Ankle Specialist. 2014;7(1):45-51.
19. Yasuda T, Shima H, Mori K, Kizawa M, Neo M. Direct repair of chronic Achilles tendon ruptures using scar tissue located between the tendon stumps. JBJS. 2016;98(14):1168-75.
20. Drogset JO, Størset KH, Nitteberg TM, Gifstad T. Clinical outcome after knee ligament reconstruction with tendon allografts. J Experim Orthopaed. 2021;8:1-9.

Cite this article as: Sidhu GAS, Bodgner I, Bhamra JS. Extensor hallucis longus tendon rupture and reconstruction using allograft tendon: a case report and literature review. Int J Res Orthop 2025;11:889-94.