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Case Reports and Series

Obtaining Adequate Tension for Extensor Hallucis Longus Tendon Rupture Repair Using Wide-Awake Surgery: A Case Report

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ABSTRACT

Wide-awake surgery has potential advantages for treating extensor or flexor tendon injury. We present a case of chronic extensor hallucis longus injury treated with turn-down reconstruction using wide-awake surgery with a selective nerve block. To the best of our knowledge, this is the first such case reported. The patient had dropped a knife proximal to the right hallux metatarsophalangeal joint. Because direct suturing was thought to be difficult, turn-down reconstruction was performed under a selective nerve block. At 8 months postoperatively, the hallux had 75° of extension in the metatarsophalangeal joint and –5° of extension in the interphalangeal joint, similar to those of the healthy foot. The Japanese Society for Surgery of the foot objective hallux scale score had improved from 87 to 100, and the subjective scores in the subcategories of pain and pain-related, physical functioning and daily living, and shoe-related in the self-administered foot evaluation questionnaire had improved from 82.8 to 94.4, 97.7 to 100, and 50 to 83.3, respectively. Turn-down reconstruction using wide-awake surgery with a selective nerve block can be used for chronic extensor hallucis longus rupture and can be expected to provide good results.

Reconstructive surgery with a tendon graft and/or tendon transfer has been commonly used to treat misdiagnosed extensor hallucis longus (EHL) tendon ruptures, for which primary suturing is difficult to perform. In general, tendon reconstruction has been performed using autologous tendon grafts from the semitendinosus tendon (1–3), with the peroneus tertius tendon reported as the transfer tendon (4). However, these procedures are invasive because the original function is sacrificed. Turn-down reconstruction has sometimes been used for large tendons such as the Achilles tendon. With either procedure, adjusting the tension of the tendon has usually been difficult because of the muscle relaxant effects of anesthesia. Wide-awake surgery performed with a selected nerve block makes it possible to activate the muscle during surgery, enabling application of the appropriate tension to the repaired tendon. Therefore, this type of nerve block has potential advantages in the treatment of extensor or flexor tendon injury (5,6). We report a case of chronic EHL injury treated with turn-down reconstruction under a selective nerve block.

Case Report

We report the case of a patient who had dropped a knife proximal to the right hallux metatarsophalangeal (MTP) joint. She had been treated by a local physician, who had only closed the skin. Approximately 2 months after the initial trauma, the patient noted dysfunction in dorsiflexion of the big toe and visited our hospital for consultation. She was suspected to have an EHL rupture (Fig. 1), and the computed tomography findings confirmed a defect in the tendon approximately 8 cm long.

Direct repair was thought to be difficult because of the large defect, and tendon transplantation would require sacrifice of the healthy tendon. Therefore, turn-down reconstruction was planned under selective nerve block. The necessity of using a selective nerve block to confirm the tension of the reconstructed tendon was explained to the patient, and she provided consent.

The selected nerve block protocol was as follows. Under ultrasound guidance, 5 mL of 0.6% ropivacaine was injected into the subperineurial region of the saphenous nerve approximately 5 cm distal to the knee, 3 mL was injected into the subperineurial region of the superficial peroneal nerve approximately 5 cm proximal to the branch of the medial dorsal and intermediate dorsal cutaneous nerves, and 3 mL was injected into the perineural region of the deep peroneal nerve at the ankle level (Fig. 2).

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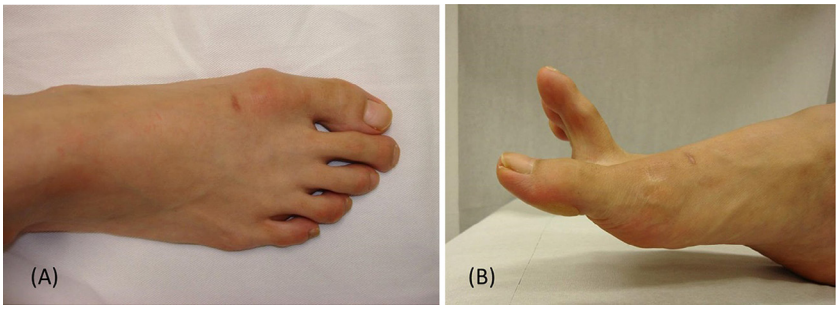

Fig. 1. *(A)* Clinical photograph showing injury scar just proximal to the metatarsophalangeal joint. *(B)* Clinical photograph showing that the patient cannot extend the hallux.

Surgery was performed with the patient in the supine position without a tourniquet. A dorsal incision was made along the route of the EHL from the level of the MTP joint to the ankle. Careful attention was given to avoid damage to the extensor retinaculum. The proximal side of the ruptured site had adhered to the superior extensor retinaculum (Fig. 3A). After sufficient dissection of the proximal EHL, the patient was requested to extend it to confirm smooth motion was present. A 3-cm defect of the EHL was noted, which we believed would be difficult to treat by direct suturing. A 7-cm split of the EHL was applied proximally from a point 2 cm proximal to the ruptured site. The medial side of the split tendon was turned down (Fig. 3B,C), and the split margins were strengthened by knotted sutures of 4-0 FiberWire® (Arthrex, Naples, FL). The turned tendon was passed through the extensor retinaculum and temporarily sutured to the distal portion of the EHL. The patient was then requested to move the hallux (Fig. 3D,E), and the appropriate suture placement was defined and fixed using the interlacing technique (Fig. 3F to H). A final check was made to confirm the smooth motion of the suture site under the extensor retinaculum by the patient herself.

A lower leg cast was applied with the ankle in a neutral position, with 5° of dorsiflexion of the big toe. To prevent tendon adhesion, passive dorsiflexion of the hallux was initiated on the second postoperative day under the direction of a physical therapist. After 3 weeks of casting, a fiberglass splint was applied only to the hallux for 2 additional weeks to avoid plantarflexion.

Subsequently, the patient was allowed to walk freely with a silicon insert for 2 months (Fig. 4). At 8 months postoperatively, the hallux had 75° of extension in the MTP joint and –5° of extension in the interphalangeal joint, similar to those of the healthy foot (Fig. 5). The preoperative Japanese Society for Surgery of the Foot objective hallux scale score was 87 and had improved to 100 at the 8-month follow-up examination. The self-administered foot evaluation questionnaire (SAFE-Q) was used for the subjective evaluation. The scores of the SAFE-Q in the subcategories of pain and pain-related, physical functioning and daily living, and shoe-related had improved from 82.8 to 94.4, 97.7 to 100, and 50 to 83.3, respectively. The scores in the subcategories of social functioning and general health did not improve postoperatively (7–9). The patient returned to her old life without any difficulty at the final follow up 1 year after surgery.

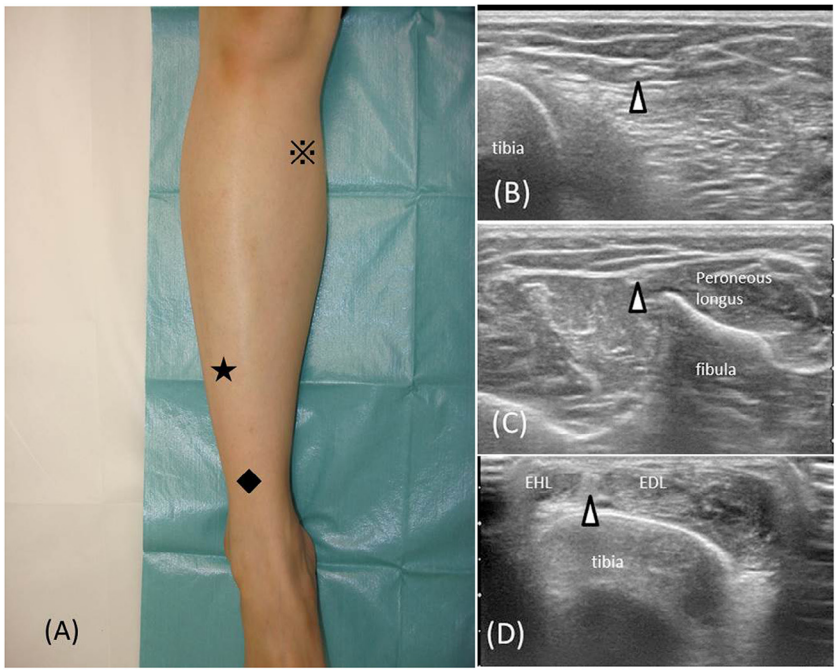

Fig. 2. *(A)* An ultrasound-guided nerve block was performed for the saphenous nerve *(cross-hatch symbol)*, superficial peroneal nerve *(star)*, and deep peroneal nerve *(diamond)*. *(B)* The saphenous nerve *(arrowhead)* was observed using ultrasonography. The *(C)* superficial peroneal and *(D)* deep peroneal nerves were observed using ultrasonography, and perineural injection of the anesthetic agent was performed. EDL, extensor digitorum longus; EHL, extensor hallucis longus.

Fig. 3. *(A)* Intraoperative view showing the proximal end of the extensor hallucis longus (EHL) under the superior extensor retinaculum. *(B)* Intraoperative view showing the ~3-cm defect of the EHL tendon. *(C)* The EHL tendon was split in half (width) from the proximal side of the ruptured tendon. Temporary suture of the tendon was applied, and the patient was instructed to *(D)* plantarflex and *(E)* dorsiflex the hallux intraoperatively. *(F)* Schematic diagram showing the design of the turn-down approach in the proximal section of the EHL tendon. *(G)* Schematic diagram showing one half of the proximal section of the EHL turned down and connected to the distal section using an interlacing technique. *(H)* The first metatarsophalangeal joint was positioned in slight dorsiflexion.

Discussion

Reconstruction of chronic tendon rupture is challenging because of contracture or degeneration of the ruptured tendon. Direct repair usually results in hypertension of the tendon, which prevents plantarflexion (1). Kass et al (10) reported the problem of gliding at the site of tendon repair under the extensor retinaculum and indicated that entrapment by the extensor retinaculum should be avoided. In our patient, active motion by the patient made it possible to confirm the release of any adhesions, the optimal tension of the reconstructed tendon, and smooth gliding under the extensor retinaculum intraoperatively.

Sarrafian et al (11) reported that the peripheral ankle–foot block they used consisted of 7 to 10 mL of bupivacaine to the posterior tibial nerve, 5 mL to the deep peroneal nerve, and 5 mL to the superficial peroneal, saphenous, and sural nerves, using a total of 20 to 25 mL to perform a nerve block at the ankle level. Our selective nerve block targeted the superficial peroneal, deep peroneal, and saphenous nerves

Fig. 4. A silicon insert was used to avoid plantarflexion of the first metatarsophalangeal joint and repeat rupture of the tendon for 2 months after removal of the fiberglass splint.

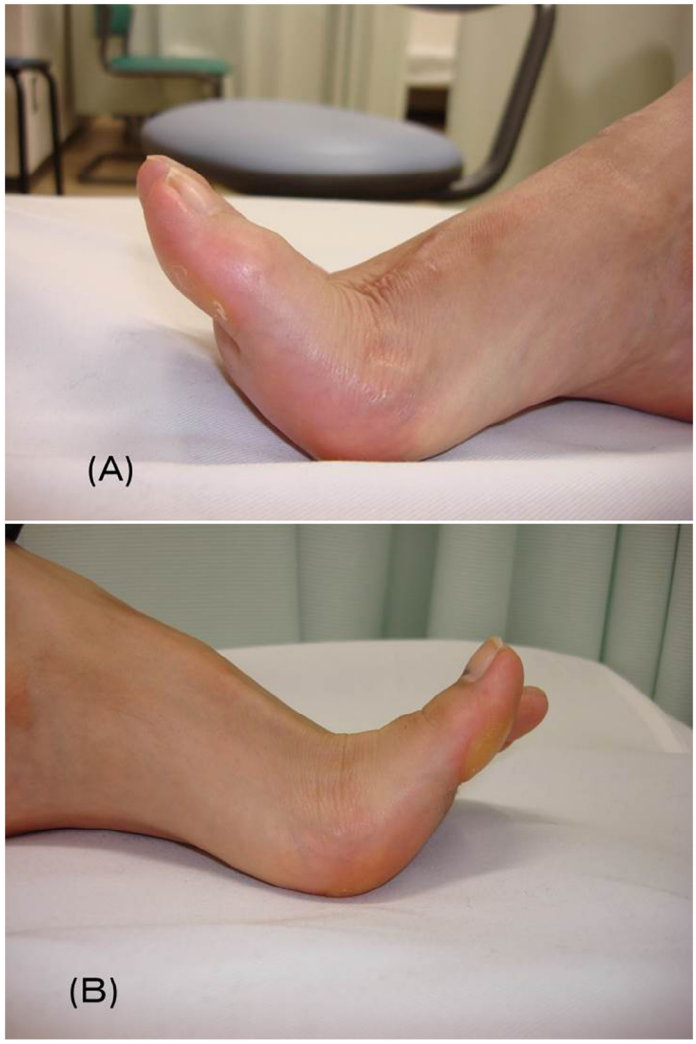

Fig. 5. The range of dorsiflexion of the hallux at the final follow-up examination on the *(A)* affected side was the same as that on the *(B)* unaffected side.

in a proximal position, and ultrasound guidance enabled the use of less local anesthetic agent by confirming sufficient administration in the subperineurial region. The nerve block can be used for surgery of the dorsal part of foot, and the anesthetic effects are long lasting, one of the advantages of this anesthetic method.

Free tendon grafting requires sacrifice of a healthy tendon, and tendon transfer changes the course of power transmission, which can lead to functional decline. The advantage of our reconstruction technique was preservation of the running course of the tendon, despite the large defect present in the tendon.

Weakness of the reconstructed tendon is a concern with this method. Lindholm (12) reported satisfactory results after turn-down Achilles tendon reconstruction. Some differences exist between the Achilles and EHL tendons regarding function, location, size, and power; therefore, it would be difficult to compare ruptures of these tendons and their treatment. However, we believe the turn-down reconstruction technique is appropriate for the EHL tendon because it manages a lighter load than that managed by the Achilles tendon. Lau and Myerson (13) also reported satisfactory postoperative results after split tendon grafting for postoperative hallux varus deformity without a marked decline in the strength of the EHL tendon. In the present case, a favorable range of motion had been obtained at 8 months postoperatively, and the restored extensor muscle strength was equivalent to that of the healthy side. Numerous studies have reported that the immobilization period should be 3 to 6 weeks postoperatively after repair of chronic EHL rupture (2,3,14). However, Skoff (15) reported good outcomes with early mobilization therapy and the use of a dynamic splint. In our patient, early passive dorsiflexion exercise was applied to prevent adhesion formation, and plantarflexion was not performed to avoid repeat rupture, leading to favorable restoration of function.

In conclusion, we performed turn-down reconstruction for a chronic EHL injury using wide-awake surgery with a selective nerve block. Ultrasound-guided selective nerve block enabled adjustment of the appropriate tension of the reconstructed tendon through active motion of the tendon intraoperatively. The Japanese Society for Surgery of the Foot hallux scale score improved postoperatively, and the scores for certain subcategories of the SAFE-Q also improved postoperatively. Turn-down reconstruction using wide-awake surgery with selective nerve block can be used for chronic EHL ruptures and can be expected to provide good results.

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