

Original article

Endoscopic tarsal tunnel syndrome surgery using the Universal Subcutaneous Endoscope system

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Received 6 December 2014; revised 4 August 2015; accepted 10 September 2015

Available online 2 November 2015

Abstract

Background/objective: Tarsal tunnel syndrome is a relatively rare entrapment neuropathy with the lateral and medial plantar nerves entrapped inside of the tarsal tunnel. When conservative treatment fails, standard open decompression of the nerve can be achieved by releasing the flexor retinaculum of the foot through a several-centimetre-long skin incision made along the tarsal tunnel. By contrast, we made a 1-cm portal incision at the proximal part of the medial ankle, and endoscopic tarsal tunnel release of the flexor retinaculum of the foot and part of the abductor hallucis muscle was achieved using the Universal Subcutaneous Endoscope (USE) system.

Methods: Our procedure was performed under local anaesthesia without a pneumatic tourniquet on an outpatient basis. The USE system was inserted into the tarsal tunnel at the proximal part of the medial ankle; the nerves, vessels, flexor retinaculum, tendons of the foot, and the abductor hallucis muscle were then endoscopically identified. Decompression of the lateral and medial plantar nerves entrapped inside of the tarsal tunnel was then achieved by releasing the flexor retinaculum of the foot and part of the abductor hallucis muscle with a push knife under complete endoscopic observation.

Results: Results from eight feet of five patients were compiled and analyzed. All showed improved clinical signs compared with their pre-operative condition.

Conclusion: Our less invasive endoscopic management for tarsal tunnel syndrome using the USE system produces sufficient results.

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Keywords: endoscopic neurolysis; endoscopic surgery; entrapment neuropathy; peripheral nerve; tarsal tunnel syndrome

Background

Tarsal tunnel syndrome is a relatively rare entrapment neuropathy. When the lateral and medial plantar nerves are entrapped inside of the tarsal tunnel, pain, paraesthesia, and/or sensory loss in the medial and/or the lateral branch area of the plantar aspect occurs. In some cases weakness or atrophy of the abductor hallucis muscle, and/or other foot intrinsic

muscles also controlled by the tibial nerve occurs. Clinical signs worsen at night and/or during the day due to overuse of the foot. There is positive percussion test (Tinel-like sign) at the tarsal tunnel. Electrophysiological examinations show decreased conduction velocity at the tarsal tunnel.

When conservative treatment fails, surgery is considered. The standard open procedure requires a several-centimetre-long skin incision along the tarsal tunnel. The wide skin incision and subsequent exploration enables the surgeon to directly observe nerves, vessels, and identify possible entrapment points. Healthy tissues, however, are coincidentally damaged during this open procedure.

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To minimise surgical invasion of healthy tissue in the treatment of tarsal tunnel syndrome, we applied an endoscopic procedure using the Universal Subcutaneous Endoscope (USE) system (Tact Medical Inc., Tokyo, Japan). The USE system consists of a standard 30° 4-mm oblique viewing arthroscope and a tapered 6–8-mm diameter transparent closed sheath (USE sheath). It has been developed and used in subcutaneous surgical treatments such as carpal tunnel syndrome, cubital tunnel syndrome, shoulder impingement syndrome, and benign bone tumours since 1986.^{1–7}

We compiled and analysed the clinical results of our endoscopic surgeries to verify the efficacy of this less invasive procedure for the treatment of tarsal tunnel syndrome.

Methods

We have retrospectively compiled, examined, and analysed the results from all of our patients who underwent endoscopic neurolysis using the USE system for tarsal tunnel syndrome since 2004.

Diagnosis was performed using clinical signs, such as tingling and touch sensation evaluated using 2g von Frey hair at the tibial nerve distribution area and manual muscle testing of the abductor hallucis muscle, Tinel-like sign at the tarsal tunnel, and electrophysiological test results (decreased motor nerve conduction velocity between the entrance and exit of the tarsal tunnel). Surgery was performed on patients who failed to show any signs of recovery following > 2 months of conservative treatment, e.g., the taking of nonsteroidal anti-inflammatory drugs and/or steroid injections directly into the tarsal tunnel. Indications for our endoscopic procedure also include idiopathic, haemodialysis-related tarsal tunnel syndrome. Space occupying lesions such as lipoma, ganglion, aneurysm, or anomalies do not serve as indications for our endoscopic procedure.

Eight feet of five cases (3 men and 2 women) were included in this study. One case had no apparent cause (2 feet) and four were haemodialysis-related (6 feet). The mean age at the time of operation (standard deviation; SD) was 62.4 (12.1) years old (range, 44–75 years) and mean follow up period (SD) was 14.4 (10.9) months (range, 3.6–32 months).

Surgeries were performed under local anaesthesia (5 ml of 2% lidocaine containing epinephrine is applied to the skin incision area and 10 ml of 1% lidocaine containing epinephrine is injected into the tarsal tunnel) on an out-patient basis. If the patients complained of referred pain to the foot and/or if blood returned into the syringe during administration of local anaesthetic agent, we stopped the injection and changed the injection area to avoid nerve and vessel injuries. A pneumatic tourniquet is not used so that we can identify blood circulation of the artery and vein during surgery thus avoiding vascular injury. A 1-cm portal skin incision was made at the proximal part of the flexor retinaculum of the foot. The USE system was inserted into the tarsal tunnel through the portal (Figure 1). Correct positioning of the foot is crucial when placing the tip of the USE system because correct positioning of the foot allows us to advance from the portal to the proximal part of

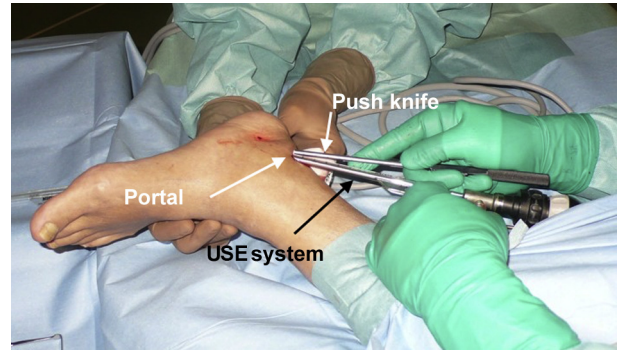


Figure 1. The Universal Subcutaneous Endoscope system and a push knife are inserted into the tarsal tunnel. The photograph shows the correct operative position of the foot. USE system = Universal Subcutaneous Endoscope system.

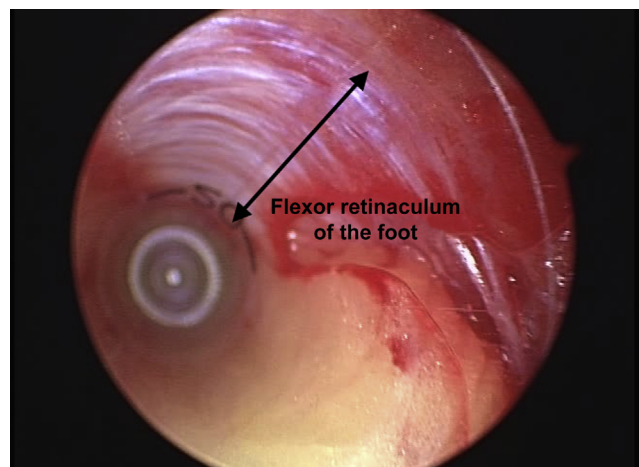


Figure 2. Endoscopic internal view of the flexor retinaculum of the foot.

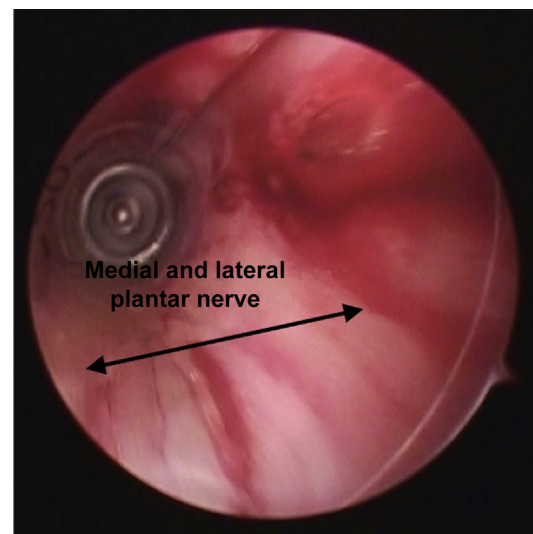


Figure 3. Endoscopic view of the medial and lateral plantar nerve.

the abductor hallucis muscle, i.e., the proximal part (entrance) of the abductor canal. The flexor retinaculum of the foot (Figure 2), nerves (Figure 3), and vessels were endoscopically identified in order to avoid injury to nerves and vessels due to

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