Surgical treatment of sural nerve entrapment aided by imaging- and electrography-based diagnosis: illustrative case

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BACKGROUND The sural nerve (SN) is a cutaneous sensory nerve that innervates the posterolateral side of the distal third of the leg and lateral side of the foot. The SN has wide variation in its course and is fixed to the subcutaneous tissue and superficial fascia. Idiopathic spontaneous SN neuropathy is rarely surgically treated because of the difficulty in detecting SN entrapment.

OBSERVATIONS Herein, the authors present a rare case of surgically treated spontaneous SN neuropathy. A 67-year-old male patient presented with right foot pain for several years. Magnetic resonance imaging and ultrasonography showed SN entrapment slightly proximal and posterior to the lateral malleolus. A nerve conduction study showed SN disturbance. After undergoing neurolysis, the patient’s foot pain was alleviated.

LESSONS Idiopathic SN neuropathy can be treated surgically when SN entrapment is detected with comprehensive evaluation methods.

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KEYWORDS sural nerve entrapment; neurolysis; peripheral neuropathy

The sural nerve (SN) is a cutaneous sensory nerve with a wide course variation that innervates the posterolateral side of the distal third of the leg and lateral side of the foot.1 SN disturbance causes pain and sensory abnormalities in the innervation area. The SN is fixed to the subcutaneous tissue and superficial fascia1 and may therefore be vulnerable to injury and can become compressed or entrapped.

Surgical treatment has been applied to secondary SN disturbance caused by trauma or tumor. However, in spontaneous and idiopathic cases, the efficacy of surgical treatment remains unknown, and surgery is not widely performed because it is difficult to detect the portion of SN entrapment.

Herein, we present a rare case of SN disturbance in which entrapment was detected preoperatively and successfully treated with surgical neurolysis.

Illustrative Case

A 67-year-old male patient (nonathlete) presented with tingling pain in his right foot for the past 5 years. At presentation, he had pain and hyperesthesia on the lateral side of his right foot, including his fourth and fifth toes and heel. He was mostly in pain and complained of pain-related insomnia. His maximum visual analog scale (VAS) pain score was 70 mm. Apart from this sensory impairment, there was no other neurological deficit; the appearance of his leg and foot was normal. The Tinel sign in the region posterior to the right lateral malleolus was unclear because it was sometimes positive without reproducibility. SN block was performed by administering a local anesthetic to this area, and the foot pain was significantly reduced temporarily. These findings indicated an SN disturbance there or distal to the site.

Neurophysiological and radiographic examination was performed. A nerve conduction physiology test showed decreased sensory nerve action potential amplitude in the dorsal SN. Conductivity was impaired between the posterior edge of the lateral malleolus and a 14-cm cranial distance from it. Magnetic resonance imaging (MRI) and ultrasonography were performed to investigate the deteriorated portion of the SN. In both examinations, the SN was focally narrow in the posterior and rostral regions of the lateral malleolus, consistent with the region where the SN block was effective (Fig. 1).

Entrapment of the SN was considered to cause foot pain, and neurolysis of the SN was performed. The patient was placed in the left lateral position. A 5-cm shallow-curved skin incision was made...
posteriorly to the right lateral malleolus with the patient under local anesthesia (Fig. 2A).

After incising the superficial sural aponeurosis longitudinally, the SN was identified and dissected from the surrounding fat and connective tissue from the caudal to the cranial direction. Because the patient had a sensory disturbance in the heel, the skin incision was extended 1 cm cranially, and the calcaneal branch of the SN was found. The SN proximal to the calcaneal branch was pale because of its entrapment by the surrounding fibrous tissue (Fig. 2B and C).

The pale portion of the SN was well-vascularized after incising the fibrous tissue, and neurolysis was completed.

After surgery, pain on the right was greatly improved by up to 10 mm on the VAS. Severe pain did not recur over 10 months after surgery (the VAS score was 30 mm or less).

Discussion

Observations

An imaging study previously reported secondary SN neuropathy due to compression of the mass lesion. Entrapment of the SN in spontaneous SN neuropathy has been rarely detected. We present a rare case of spontaneous SN entrapment neuropathy that was treated successfully with surgery based on an accurate diagnosis using neurophysiological and imaging studies.

Entrapment neuropathy is caused by nerve compression as the nerve passes through a narrow space. Carpal tunnel syndrome is one of the most common mononeuropathies in clinical practice. However, SN entrapment neuropathy is rare and sometimes misdiagnosed.1,2 SN entrapment is caused by a tumor, hematoma, trauma, and postoperative scar as secondary neuropathy.3,4,5 On the other hand, spontaneous SN neuropathy can be caused by fascial thickening in athletes and chronic compression by socks and heels.3,4 These SN entrapment neuropathies also occur predominantly in the region where the nerve pierces the fascia.1 In our patient, SN entrapment was not associated with compression by socks or heels, according to the patient's lifestyle. Additionally, the patient was normally built without physical training and was not an athlete. Therefore, the cause of SN entrapment was not identified and may be partially attributed to fascia thickening due to aging.

Conservative or surgical treatment of SN neuropathy has been reported before.3,4,6 The surgical approach is effective in secondary SN neuropathy due to compression of the space-occupying mass. In contrast, conservative treatment is commonly applied for spontaneous...
SN neuropathy. Avoiding the causes, such as compression by socks and heels, and taking bed rest provide symptom relief. Surgical treatment is not widely practiced due to unidentified causes of spontaneous neuropathy. However, Fable et al. previously reported a good surgical result in 18 athlete patients with SN entrapment. In all patients, SN neuropathy was attributed to superficial sural aponeurosis, thickened by a fibrous band where the SN passed. However, it was very proximal to the entrapment site in our patient. A second compression was observed in the 3-cm proximal region in a few patients. Surgery was performed according to symptoms, efficacy of the SN block test, or neurophysiological examination, although no entrapment was detected in any imaging study performed with computed tomography and echography. Although SN neuropathy in athletes may differ from that in nonathlete patients, it is essential to identify the location of entrapment using multiple modalities for the good outcome of surgery in patients with spontaneous SN neuropathy.

The symptom of SN neuropathy is pain and sensory disturbance in the distribution area of the SN, posterolateral part of the distal third of the leg, and lateral part of the foot and fifth toe without motor disturbance. These symptoms are similar to those of lumbar radiculopathy and can be misdiagnosed. The area of tenderness is distinctive and informative for identifying SN neuropathy. SN pain is typically localized in the midealf, just lateral to the musculotendinous junction of the Achilles tendon, felt with finger pressure, consistent with our patient’s pain. Tinel’s sign and nerve block help diagnose SN neuropathy in the same way as other entrapment neuropathies. MRI and ultrasonography are useful in diagnosing SN entrapment. Additionally, a neurophysiological examination is considered useful; a nerve conduction study showed that the sensory nerve action potential of the SN, which was also used in our patient, increased in its distal latency and decreased in amplitude. In our patient, entrapment and disturbance of the SN were confirmed using comprehensive evaluations of nerve block symptoms and consequences, nerve imaging, and physiological examination. Thus, adequate diagnosis of SN neuropathy and identification of the entrapment site are essential for surgical success.

Lessons

Spontaneous SN neuropathy due to entrapment is not well-known, and its morbidity can be underestimated. Surgical treatment may be effective in patients with SN neuropathy when SN entrapment is detected by comprehensive evaluation.

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References


Disclosures

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Author Contributions

Conception and design: Yagi. Acquisition of data: Yagi, Matsubara. Analysis and interpretation of data: Matsubara, Hemmi. Drafting the article: Yagi, Matsubara. Reviewed submitted version of manuscript: Hemmi. Approved the final version of the manuscript on behalf of all authors: Yagi. Study supervision: Uno.

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