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## Isolated medial plantar neuropathy caused by a large ganglion cyst diagnosed with MRI: A case report

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## ABSTRACT

**INTRODUCTION:** Although ganglion cysts are common soft tissue tumors, nerve compression syndrome caused by a ganglion cyst in the lower extremities is very rare. Herein, we report a 57-year-old man who presented with hypoesthesia in the sole of his right foot for 6 months. We believe that reporting this rare case will help clinicians update their knowledge on possible causes of the plantar neuropathy, and avoid diagnostic delay.

**PRESENTATION OF CASE:** The patient had pain and numbness in the inner right sole, as well as a tingling and dull sensation. Tenderness around the area of abnormal sensation was not evident. Percussion at the abductor tunnel gave a positive Tinel's sign in the medial plantar nerve. No mass was palpable in the right foot. Based on the electrophysiological findings, we diagnosed medial plantar nerve entrapment in the right foot. Magnetic resonance imaging (MRI) was conducted to identify a 5.5-cm long elongated cystic lesion as the cause of entrapment. The patient underwent surgical removal of the cystic mass, with histologic examination confirming the diagnosis of a large ganglion cyst.

**DISCUSSION:** The feasibility of nerve conduction studies and electromyography for detection of nerve entrapment is still controversial. MRI is considered the best diagnostic modality, if biopsy is not feasible. **CONCLUSION:** We suggest that foot imaging and electrophysiological studies should be considered for patients with isolated median plantar neuropathy to exclude the presence of space-occupying lesions, especially when conservative treatment is not effective.

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## 1. Introduction

Although ganglion cysts are common soft tissue tumors, compression neuropathy caused by a ganglion cyst is rare. Several cases of ulnar and median nerve compression due to ganglion cysts have been reported [1,2]. Approximately 2%–17% of all ganglion cysts occur in the foot, with the dorsal aspect the most common and accounting for approximately 70%–80% [3]. In contrast, the incidence of such cysts on the plantar aspect is rare and estimated to be approximately 2% [3]. However, ganglion cysts that result in peripheral nerve compression in the lower extremities are much rarer [4]. In the present report, we present a case in which a large ganglion cyst caused compression neuropathy of the isolated medial plantar nerve. This case report has been reported in line with the SCARE criteria [5].

## 2. Presentation of case

A 57-year-old man presented with hypoesthesia in the sole of right foot, which had persisted for 6 months. The patient had pain and numbness in the inner right sole, as well as a tingling and dull sensation. The patient had been treated with conservative management for 6 months in a private clinic. While the pain decreased, the numbness intensified. For the past 2 months, hypoesthesia in the inner sole was prominent. Since the last month, the patient did not feel his inner sole while walking. The patient had no relevant medical or surgical history. Physical examinations revealed intrinsic muscle hypotrophy in the right foot, and a manual muscle test revealed a decline in the abduction of the big toe to grade 2, while the flexion of the big toe declined to grade 3. Tenderness around the area of abnormal sensation was not evident; however, the area of hypoesthesia and numbing pain was relatively clearly defined. Percussion at the abductor tunnel gave a positive Tinel's sign in the medial plantar nerve (MPN). No mass was palpable in the right foot.

Routine nerve conduction studies (NCS) verified that the right peroneal, posterior tibial, sural, and superficial peroneal nerves

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**Table 1**

Summary of nerve conduction studies.

Motor		Latency (ms)	CMAP (mV)
medial plantar	Right	3.0 (Range; <5.4)	1.0 (Range; >3.5)
	Left	3.1 (Range; <5.4)	17.0 (Range; >3.5)
lateral plantar	Right	5.5 (Range; <6.3)	11.0 (Range; >3.0)
	Left	5.4 (Range; <6.3)	12.2 (Range; >3.0)
Sensory		Latency (ms)	SNAP ( $\mu$ V)
medial plantar	Right	absent (Range; <5.5)	absent (Range; >3.0)
	Left	3.50 (Range; <5.5)	11.4 (Range; >3.0)
lateral plantar	Right	4.05 (Range; <6.3)	13.6 (Range; >3.0)
	Left	4.80 (Range; <6.3)	14.8 (Range; >3.0)

CMAP; compound muscle action potential, SNAP; sensory nerve action potential.

were normal. Compared with the left MPN, the compound muscle action potential amplitude was notably lower in the right MPN, and the sensory nerve action potential was absent in the right MPN (Table 1).

Needle electromyography showed an increased insertional activity in the abductor hallucis, flexor digitorum brevis, and flexor hallucis brevis, which are all within the innervation region of the MPN. Based on these tests, we diagnosed MPN entrapment in the right foot. Magnetic resonance imaging (MRI) was conducted to identify the cause of entrapment, and we observed a 5.5-cm long elongated cystic lesion (Fig. 1). The patient was transferred to the department of orthopedic surgery to surgically remove the mass. During the operation, a  $5.5 \times 1.5 \times 0.5$  cm gray and white, collapsed cyst was removed (Fig. 2). Biopsy confirmed that the mass was a ganglion cyst (Fig. 3). The patient was discharged after his symptoms improved, with improvements maintained through 3 months of follow-up.

### 3. Discussion

In the foot, the MPN is a sensorimotor nerve that provides sensation to the medial sole, plantar portions of the first through third toes, and medial half of the fourth toe. In addition, it provides motor innervation to the abductor hallucis, flexor hallucis brevis, flexor digitorum brevis, and first lumbrical muscles. This condition can be easily diagnosed based on the typical history of neuromas that develop after transection or severe crushing injury of the MPN. The MPN can be compressed in isolation along its pathway dis-

tal to the tarsal tunnel, which can provoke isolated medial plantar neuropathy.

Peripheral nerve lesions caused by ganglion cysts are infrequent findings [6]. Ganglion cysts are benign mucinous masses that originate from the synovial joint, tendon, and bursa [7]. They occur as solitary, fluid-filled, multi-lobed, or multilocular masses. The ganglion comprises three components: an encapsulated cyst or main cyst, main cyst branches called ganglial pseudopods, and capsular cysts, also called microcysts, which are regions of contact between the ganglion and fibrous capsule of the tendon sheath [7]. Ganglion cysts can cause pain and localized swelling around the lesion; they may also trigger neuropraxia or neuralgia, if they occur near the peripheral nerve. Ganglion cysts are frequently found in nerves innervating multiple small joints of the hand and wrist [8]. Peripheral neuropathies caused by ganglion cysts in the lower extremities are rare [9]. Most frequently, these ganglion cysts are located in the common peroneal nerve and its branches at the level of the fibular neck [10].

In our case, the cyst was localized inside the deep fascia, in the plantar vault between the metatarsal ball and the heel, which are weight-bearing areas of the sole; therefore, palpation was not an effective method for its detection. Various noninvasive diagnostic modalities are available for inspection of suspected soft tissue tumors, including ultrasonography, computerized tomography (CT), MRI, NCS, and electromyography (EMG) testing. Among these, MRI is considered the best diagnostic modality, if biopsy is not feasible [11]. MRI scans can identify the confines of the lesion preoperatively, and pathological examination of the excised



**Fig. 1.** Sagittal fat saturated proton density weighted (A) and axial T2-weighted (B) magnetic resonance images of the foot show an elongated cystic lesion (arrow) in the medial aspect of the plantar fascia.

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