

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

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

Shinkyoung Kim<sup>a</sup>, Hyeungjune Kim<sup>b</sup>, Dong In Jo<sup>c</sup>, Sang-Jun Na<sup>d</sup>, Yoon-Sik Jo<sup>e,\*</sup><sup>a</sup> Department of Rehabilitation Medicine, Singil Rehabilitation Medicine Clinic, Seoul, Republic of Korea<sup>b</sup> Department of Orthopedic Surgery, Konkuk University School of Medicine, Chungju, Republic of Korea<sup>c</sup> Department of Plastic Surgery, Konkuk University School of Medicine, Chungju, Republic of Korea<sup>d</sup> Department of Neurology, Konyang University College of Medicine, Daejeon, Republic of Korea<sup>e</sup> Department of Neurology, Konkuk University School of Medicine, 6, Gwangmyeong 1-gil, Chungju-si, Chungcheongbuk-do, 27376, Republic of Korea

## ARTICLE INFO

## Article history:

Received 25 October 2017

Received in revised form 6 December 2017

Accepted 6 December 2017

Available online 12 December 2017

## Keywords:

Ganglion cyst

Nerve compression syndrome

Peripheral nerve

Electromyography

Magnetic resonance imaging

## 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.

© 2017 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 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

\* Corresponding author.

E-mail addresses: [yoonsic1214@naver.com](mailto:yoonsic1214@naver.com), [yoonsic@kku.ac.kr](mailto:yoonsic@kku.ac.kr) (Y.-S. Jo).

**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 (μV)
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 × 1.5 × 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-

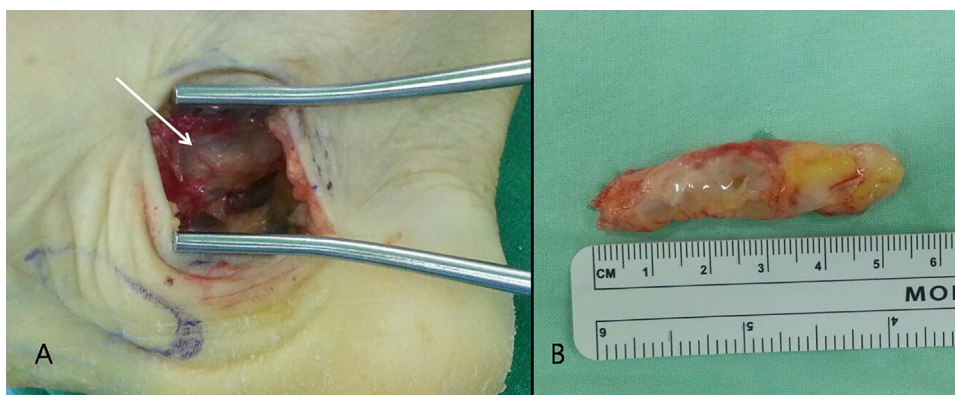
tal to the tarsal tunnel, which can provoke isolated medial plantar neuropathy.

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].

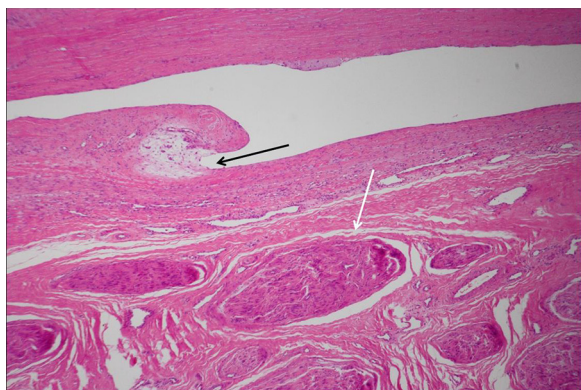
In our case, the cyst was localized inside the deep fascia, in the plantar vault between the metatarsal ball and the heel, which are weight-bearing areas of the sole; therefore, palpation was not an effective method for its detection. Various noninvasive diagnostic modalities are available for inspection 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.



**Fig. 2.** A, The surgical exposure reveals an elongated cystic mass (arrow). B, The resected 5.5-cm-long elongated cystic mass.



**Fig. 3.** Histological section of the specimen shows the fibrous wall of the ganglion cyst with focal myxoid changes (black arrow) and peripheral nerve bundles (white arrow) (hematoxylin and eosin staining, 40 $\times$ ).

lesion is necessary to identify the nature of the tumor accurately. As described in this case report, ganglion cysts appear hypointense or isointense on T1-weighted MRI sequences, and homogeneously hyperintense on T2-weighted sequences with faint rim enhancement of the cyst wall after gadolinium contrast medium administration [7]. Taken together, we confirmed that the medial plantar neuropathy in our case was caused by a large ganglion cyst.

The feasibility of NCS and electromyography for detection of nerve entrapment is still controversial [12]. However, in our case NCS and electromyography can help to rule out isolated medial plantar neuropathy, which is a more distal injury of the tarsal tunnel, and induces hypoesthesia in the medial sole area [13].

#### 4. Conclusion

To our knowledge, this is the rare report about a unique case of isolated medial plantar neuropathy caused by a large ganglion cyst. Accordingly, 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.

#### Conflict of interest

On behalf of all authors, confirm that there is no conflict of interest.

#### Funding

There is no funding source.

#### Ethical approval

Given that this is a case report with no identifiable information included in the manuscript, ethical approval was not obtained.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Authors contribution

YS J, SK drafted the manuscript and conducted the literature search. HK participated in the surgical procedure. SK, SJ N and YS J reviewed the manuscript. DI J advised as to the surgical procedure. SJ N provided the final approval for publication. All authors read and approved the final manuscript.

#### Guarantor

Yoon-Sik Jo is the guarantor of this case report.

#### References

- [1] G. Erkin, H. Uysal, I. Keles, C. Aybay, S. Ozel, Acute ulnar neuropathy at the wrist: a case report and review of the literature, *Rheumatol. Int.* 27 (2006) 191–196.
- [2] J.W. Strickland, J.B. Steichen, Nerve tumors of the hand and forearm, *J. Hand Surg. Am.* 2 (1977) 285–291.
- [3] J. Pontious, J. Good, S.H. Maxian, Ganglions of the foot and ankle: a retrospective analysis of 63 procedures, *J. Am. Podiatr. Med. Assoc.* 89 (1999) 163–168.
- [4] R.J. Greer-Bayramoglu, A.S. Nimigan, B.S. Gan, Compression neuropathy of the peroneal nerve secondary to a ganglion cyst, *Can. J. Plast. Surg.* 16 (2008) 181–183.
- [5] R.A. Agha, A.J. Fowler, A. Saeta, I. Barai, S. Rajmohan, D.P. Orgill, SCARE Group, The SCARE statement: consensus-based surgical case report guidelines, *Int. J. Surg.* 34 (2016) 180–186.
- [6] R. Ozden, V. Uruc, A. Kalaci, Y. Dogramaci, Compression of common peroneal nerve caused by an extraneural ganglion cyst mimicking intermittent claudication, *J. Brachial Plex. Peripher. Nerve Inj.* 8 (2013) 5.
- [7] N.M. Desy, K.K. Arami, R.J. Spinner, Ganglion cysts and nerves, *Neurosurg. Q.* 16 (2006) 187–194.
- [8] L.E. Thornburg, Ganglions of the hand and wrist, *J. Am. Acad. Orthop. Surg.* 7 (1999) 231–238.

- [9] M. Erdil, K. Ozkan, F.U. Ozkan, K. Bilsel, I. Turkmen, S. Senol, S. Sarar, A rare cause of deep peroneal nerve palsy due to compression of synovial cyst – case report, *Int. J. Surg. Case Rep.* 4 (2013) 515–517.
- [10] E.D. Stamatis, N.E. Manidakis, P.P. Patouras, Intraneural ganglion of the superficial peroneal nerve: a case report, *J. Foot Ankle Surg.* 49 (2010) 400, e1–4.
- [11] H. Koga, S. Matsumoto, J. Manabe, T. Tanizawa, N. Kawaguchi, Definition of the target sign and its use for the diagnosis of schwannomas, *Clin. Orthop. Relat. Res.* 464 (2007) 224–229.
- [12] M. Fredericson, S. Standage, L. Chou, G. Matheson, Lateral plantar nerve entrapment in a competitive gymnast, *Clin. J. Sport Med.* 11 (2001) 111–114.
- [13] M.A. Saeed, P.F. Gatens, Compound nerve action potentials of the medial and lateral plantar nerves through the tarsal tunnel, *Arch. Phys. Med. Rehabil.* 63 (1982) 304–307.

#### Open Access

This article is published Open Access at [sciencedirect.com](https://www.sciencedirect.com). It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.