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Palsy of the posterior interosseous nerve treated by targeted ultrasound-guided perineural hydrodissection

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Abstract

Perineural hydrodissection is a minimally invasive technique using an injection of fluid to dissect the perineural plane and tissue space. This report describes a case of palsy of the descending branch of the posterior interosseous nerve (PIN) which was recovered by targeted ultrasound-guided perineural hydrodissection. Ultrasonographic examination was performed, and multiple stenotic lesions interrupted by hyperechoic bands within the fascicles of the PIN were found. Using ultrasonography, perineural hydrodissection was performed four times every other week. Fifteen weeks after the first hydrodissection, there was no restriction in the patient's thumb and fingers movement, and ultrasonography revealed that multiple stenotic lesions had improved. Today, surgical treatment is recommended for patients with complete nerve constriction. However, there is no standardized approach for patients with incomplete or without nerve constriction. Ultrasound-guided perineural hydrodissection is a noninvasive and easy method. This procedure could be a useful diagnostic and therapeutic modality for the management of the disease.

Introduction

Palsy of the posterior interosseous nerve (PIN) is rare. The PIN is the terminal branch of the radial nerve and is principally a motor nerve. It has two main terminal branches: the medial recurrent branch and the lateral descending branch. Palsy of the descending branch of the PIN manifests the loss of function of the abductor policis longus, extensor pollicis brevis, extensor pollicis longus, and extensor indicis proprius. The management of an isolated PIN palsy remains controversial. Today, surgical treatment is recommended for patients with complete nerve constriction[(1)]. However, there is no standardized approach for patients with incomplete or without nerve constriction. Non-operative management is usually used as the initial treatment, and surgical treatment is performed in case of previous therapeutic failure[(2)].

Perineural hydrodissection, a new treatment for peripheral neuropathy, is a minimally invasive technique using an injection of fluid to dissect the perineural plane and tissue space. Even though its definite effect has not been sufficiently proven, it has been reported as a potentially useful treatment for various peripheral nerve entrapment syndromes[(3–5)].

To our knowledge, there is no report of PIN palsy due to hourglass-like fascicular constriction, treated by perineural hydrodissection. Here, we present a case of palsy of the descending branch of the PIN, which was recovered by a novel procedure of targeted ultrasound-guided perineural hydrodissection.

Case report

An 80-year-old man presented to us with the inability to extend his right thumb and index finger. The patient's symptom began five or more years before he presented to the hospital, when he developed gradual weakness in thumb extension. The weakness increased progressively

Fig. 1. *An 80-year-old man with an inability to extend his right thumb and weakness in extension of the right index finger*

with time. Seven months before his initial visit, he experienced a sudden onset of pain in the dorsolateral aspect of the right forearm without any apparent cause. Although the pain diminished in a natural course, his index finger was also involved, and motor activity was impaired. He visited our hospital complaining of difficulty in performing daily activities.

At the initial visit, physical examination showed the patient's inability to extend his thumb and weakness in extension of the index finger (Fig. 1). Extensors of the wrist, radial-ulnar deviator of the wrist, and finger extensors had normal power. The patient had no sensory deficit, rheumatoid arthritis, or history of trauma. No medications were taken. Plain X-ray of the upper extremities and magnetic resonance imaging of cervical spine revealed no lesions. Electromyography of the extensor indicis proprius showed only denervation potentials and no voluntary motor unit potential. Sensory nerve conduction velocity of the superficial radial nerve was normal. Ultrasonographic examination (Sonimage HS1, Konica Minolta, Tokyo, Japan) was performed, and multiple stenotic lesions interrupted by hyperechoic bands within the fascicles of the PIN were found 5 cm distal to the lateral epicondyle. The multiple stenotic lesions were located at the distal end of the supinator muscle, and nothing was found at the entrance point of the supinator (Fig. 2). We suspected that these lesions were hourglass-like constrictions in the PIN.

As five or more years had passed since the initial symptoms appeared, we suggested surgical exploration and tendon transfer to the patient. However, the patient requested a less invasive treatment, so we decided to perform ultrasound-guided perineural hydrodissection.

The nerve was identified using ultrasonography, and a 27-gauge needle was guided in real time and in plane until the tip was adjacent to the nerve. We injected 0.1% lidocaine solution (1 mL of 1% lidocaine combined with 9 mL of saline) until the nerve was surrounded with fluid and was separated from the surrounding tissue. Approximately 5 mL of 0.1% lidocaine solution was injected (Fig. 3). One week after the hydrodissection, the patient reported an improvement in extension of the index finger; however, there was little improvement in his thumb. Since the symptoms had improved, we performed perineural hydrodissection four times, every other week. Eight weeks after the first hydrodissection, thumb extension was found to have slightly improved. Ten weeks after the first hydrodissection, the patient regained almost full range of motion in his thumb. Fifteen weeks after the first hydrodissection, there was no restriction in his thumb and fingers movement. The active thumb and index finger extension were identical to the contralateral side. Ultrasonography revealed that multiple stenotic lesions were slightly improved (Fig. 4). At one-year follow-up, his thumb and fingers were still in a good condition (Fig. 5), and ultrasonography revealed no recurrence of PIN

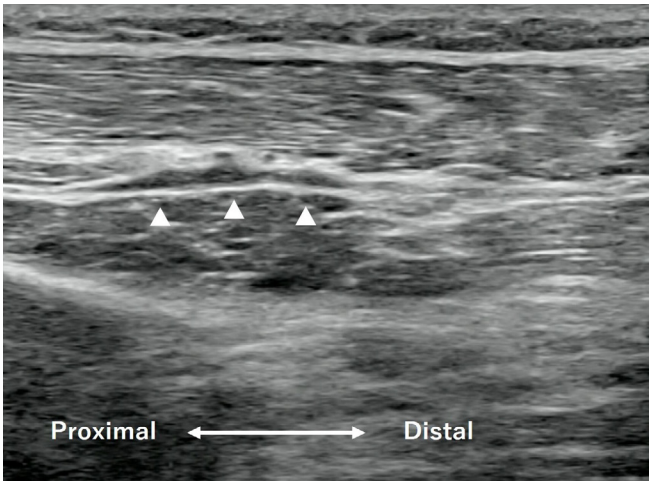

Fig. 2. *A longitudinal image of the proximal dorsal forearm. There were multiple constrictions of the PIN at the level of the distal end of the supinator muscle. The constrictions were bordered by swelling of the PIN (arrowheads)*

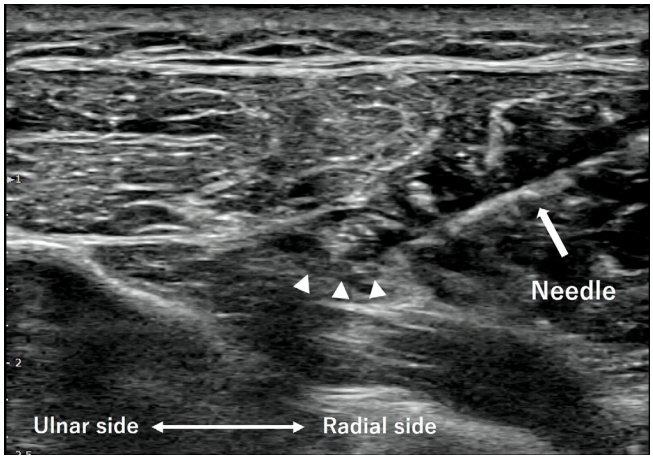

Fig. 3. *A transverse image at the level of the distal end of the supinator muscle. A 27-gauge needle tip was guided adjacent to the PIN nerve and approximately 5 mL of 0.1% lidocaine solution was injected around the nerve (arrowheads). Hyperechoic bands were detached from the nerve*

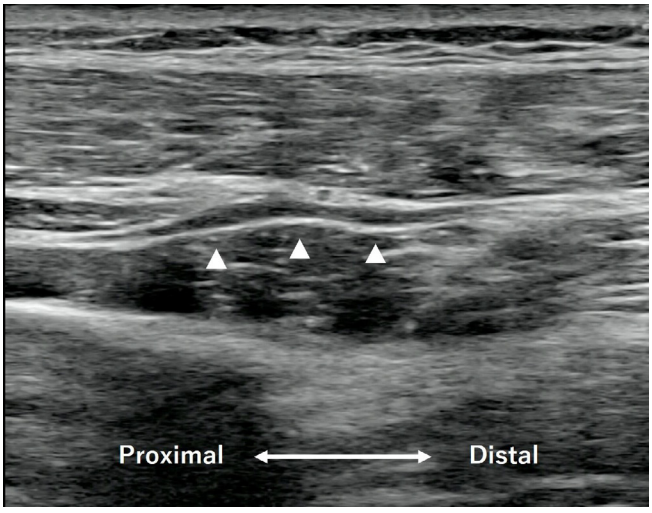

Fig. 4. *A longitudinal image of the proximal dorsal forearm 15 weeks after the first hydrodissection. The PIN appears quite swollen (arrowheads), but the multiple constrictions are no more evident*

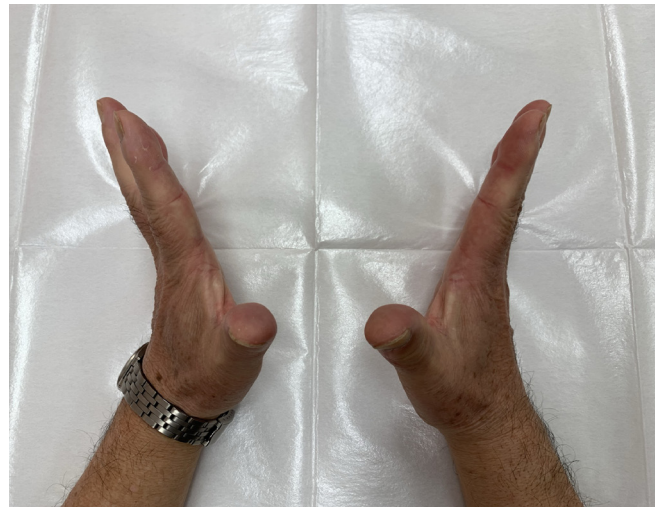

Fig. 5. *No restriction in the patient's thumb and fingers movement one year after the first hydrodissection*

stenosis. Electromyography and a nerve conduction study recorded the compound muscle action potential from the extensor indicis proprius muscle, and the motor nerve conduction velocity was normal (54.8 m/s).

Discussion

At the distal portion of the supinator, the PIN divides into a recurrent branch (which innervates the extensor digitorum communis, extensor digiti minimi, and extensor carpi ulnaris) and a descending branch (which innervates the abductor policis longus, extensor pollicis brevis, extensor pollicis longus, and extensor indicis proprius from proximal to distal)[6]. In our patient, ultrasonography revealed fascicular constriction at the distal end of the supinator muscle, and the patient had weakness in thumb extension and index finger extension. Therefore, hourglass-like fascicular constriction at the descending branch was considered as the main cause[1,7].

Perineural hydrodissection is a minimally invasive technique to dissect the perineural plane and tissue space. Currently, there are no high-level studies to determine the effectiveness of hydrodissection; however, low-level studies have demonstrated some effectiveness[3–5]. In the present study, the patient's symptom began five or more years previously, and 15 weeks after the first hydrodissection, the symptom was fully recovered, with ultrasonography depicting an improvement of the multiple stenotic lesions (Fig. 4). It is unlikely that this result occurred in a natural course, and we believe that this procedure contributed to separating the nerve from the surrounding tissue, fascia, and adjacent structures, leading to a positive outcome.

The effectiveness of nerve exploration for a long-term PIN palsy is unknown. Currently, tendon transfer is recommended if there has been no improvement in 7 months in patients aged >50 years and within 12 months in patients aged <50 years[8]. Ochi *et al*. reported a patient doing well with neurolysis performed 17 years after the onset of symptoms[9], and Werner *et al*. reported patients improving after marked delays to treatment[10]. Thus, PIN may recover nerve function even with a long surgical delay.

Today, surgical treatment is recommended for patients with complete nerve constriction[1]. However, there is no standardized approach for patients with incomplete or without nerve constriction. Ultrasound-guided perineural hydrodissection is a noninvasive and easy method to perform at outpatient clinics. We believe that this procedure could be a useful alternative diagnostic and therapeutic modality for the management of the disease before surgery.

Conflict of interest

Authors do not report any financial or personal connections with other persons or organizations, which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

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