Clinical Case Report

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Management of neuropathic pain induced by cubital tunnel syndrome using pulsed radiofrequency

Two case reports

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Abstract

Rationale: Recently, pulsed radiofrequency (PRF) has been applied to alleviate neuropathic pain caused by various peripheral nerve pathologies. This report describes and discusses the cases of 2 patients with cubital tunnel syndrome who responded well to PRF for the management of neuropathic pain.

Patient concerns: Patients 1 and 2 presented with numeric rating scale (NRS) scores of 4 and 3 for neuropathic pain due to right cubital tunnel syndrome, respectively.

Diagnoses: Cubital tunnel syndrome was confirmed by nerve conduction study/electromyography.

Interventions: PRF stimulation of the right ulnar nerve was performed at the medial epicondyle level under the guidance of ultrasound.

Outcomes: At the 2-week and 1-, 2-, 3-, and 6-month follow-up assessments after the PRF procedure, the pain of patient 1 was completely relieved. In patient 2, at the 2-week follow-up, the pain was completely relieved, and at the 1-, 2-, 3-, and 6-month follow-up assessments, the NRS score was 1. No adverse effects were observed in either patient.

Lessons: PRF on the ulnar nerve seems to be a useful tool for treating neuropathic pain due to cubital tunnel syndrome.

Abbreviations: ADM = abductor digiti minimi, MRI = magnetic resonance image, NCS = nerve conduction study, NRS = numeric rating scale, PRF = pulsed radiofrequency, US = ultrasound.

Keywords: cubital tunnel syndrome, neuropathic pain, pulsed radiofrequency, ulnar nerve

1. Introduction

Cubital tunnel syndrome is known to be the second most common entrapment neuropathy in the upper extremity.[1,2] This condition results from pressure or stretching of the ulnar nerve behind the medial epicondyle at the elbow. Clinically, patients with cubital tunnel syndrome can experience sensory deficit in the ring and small fingers and occasionally weakness in the distribution of the ulnar nerve.[1,2] In addition, many patients report neuropathic pain on the medial side of the elbow, forearm, and hand. Such neuropathic pain interferes with activities of daily living and reduces the quality of life. Clinicians can manage this neuropathic pain with either conservative or surgical treatment. However, conservative treatment is generally considered a priority before surgical treatment. As a conservative treatment, splint, modality, oral medication, and local steroid injection can be applied.[3] However, despite the variety of conservative treatment methods, some patients report persistent neuropathic pain.

Pulsed radiofrequency (PRF) is a technique first described by Sluijter in 1997 and known to be safe and effective in alleviating pain.[4] This technique delivers an electrical field and heat bursts to targeted nerves without damaging these structures.[5,6] Conventional RF thermocoagulation exposes the target nerves or tissues to continuous electrical stimulation and ablates the structures by increasing the temperature around the RF needle tip.[7] In contrast to RF, PRF applies brief electrical stimulation followed by a long resting phase. Therefore, PRF does not produce sufficient heat to cause structural damage.[8] The proposed mechanism of PRF is that the electrical field produced in this method can alter pain signals.[9] To date, PRF has been reported to successfully modulate several types of peripheral neuropathic pain.[10] However, to the best of the authors' knowledge, the use of PRF to manage ulnar neuropathic pain at the elbow induced by cubital tunnel syndrome has not yet been reported in the literature.

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In this report, 2 cases of successful application of ultrasound (US)-guided PRF for alleviating neuropathic pain caused by cubital tunnel syndrome are discussed.

2. Case report

Two patients with neuropathic pain due to cubital tunnel syndrome were recruited for this study. Informed written consent was obtained from the patients for publication of this case report and accompanying images. The study was approved by the Institutional Review Board of Yeungnam university hospital.

Patient 1 was a 39-year-old man who visited the department of physical medicine and rehabilitation at Yeungnam University hospital due to pain of a tingling and piercing nature on the medial side of the right elbow, forearm, and hand over a period of 1 year. His pain was not controlled by oral medication (meloxicam 15 mg, pregabalin 150 mg, acetaminophen/tramadol hydrochloride 1300/150 mg) and an ulnar nerve block with 5 mg dexamethasone, which was performed 3 months before the visit to the department. The numeric rating scale (NRS) score was 4 out of 10. Upon physical examination, blunted sensation on the medial side of the right hand and slight weakness on the right fifth finger abductor were found. A nerve conduction study (NCS) and electromyography were performed. The NCS finding of the right ulnar motor nerve with the abductor digiti minimi (ADM) muscle indicated reduction of the conduction velocity (35 m/s) between the medial epicondyle and 2 cm below the medial epicondyle. The amplitude of the sensory nerve action potential of the right ulnar nerve was significantly decreased (8 μV). Decreased recruitment and positive sharp (1+) were found on the ADM. However, no abnormal findings were observed on elbow magnetic resonance imaging (MRI). The patient was diagnosed with cubital tunnel syndrome. PRF stimulation was performed using the aseptic technique on the right ulnar nerve at the level of the medial epicondyle. After identifying the right ulnar nerve at the medial epicondyle level using a 12 MHz linear probe (ACUSON S2000; Siemens, Seoul, Republic of Korea), the catheter needle (22-gauge active curved-tip electrode) was inserted and the sensory simulation test was performed using an RF generator (RFG4; Cosman Medical Inc., MA). Under US guidance, the catheter needle was placed close to the right ulnar nerve (Fig. 1), and the patient reported dysesthesia and a tingling sensation at the ulnar nerve innervation area with <0.2 V stimulation. The PRF treatment was administered at 5 Hz and 5 ms pulsed width for 360 seconds at 45 V under the constraint that the temperature of the electrode tips did not exceed 42°C. Two weeks after the PRF procedure, the patient's pain was completely relieved (NRS: 0). At the 1-, 2-, 3-, and 6-month follow-up assessments after the procedure, the previously reported pain had not recurred. No adverse effect was reported after the PRF procedure.

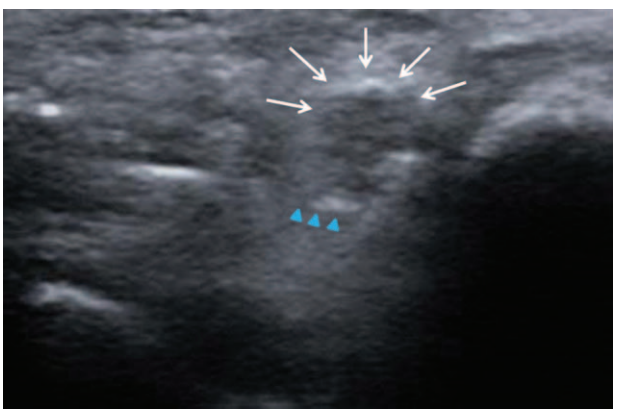

Figure 1. Transverse ultrasound image of the right ulnar nerve. The white arrow indicates the right ulnar nerve, and the blue arrowheads indicate the catheter needle.

Patient 2 was a 40-year-old man who visited the department of physical medicine and rehabilitation at Yeungnam University hospital due to pain of a tingling and piercing nature on the medial side of the right elbow, forearm, and hand over a period of 10 months. The NRS score was 3. He was taking oral medication (meloxicam 15 mg, pregabalin 150 mg, acetaminophen/tramadol hydrochloride 650/75 mg), and an ulnar nerve block with 10 mg triamcinolone was conducted 4.5 months before the visit to the department. After the block, the NRS score was reduced from NRS 5 to NRS 3. Upon physical examination, hypoesthesia was observed on the medial side of the right hand, but no definite weakness was found. On the right ulnar motor NCS, a slow conduction velocity (38 m/s) was observed between the medial epicondyle and 2 cm below the medial epicondyle, and decreased amplitude (12 μV) was observed on the right ulnar sensory NCS. In addition, decreased recruitment and positive sharp (1+) were observed on the ADM. As in patient 1, no abnormal findings were observed on the elbow MRI. The patient was diagnosed with cubital tunnel syndrome. We performed PRF stimulation on the right ulnar nerve at the epicondyle level under the guidance of US using the same procedure as in patient 1. Two weeks after PRF stimulation, the patient's pain was completely relieved. At 1, 2, 3, and 6 months after the procedure, the patient had only slight tingling pain in the medial hand (NRS: 1). No adverse effects of PRF stimulation on the ulnar nerve were noted.

3. Discussion

In the current study, 2 cases of successful treatment of PRF stimulation on the ulnar nerve at the elbow level for alleviating neuropathic pain due to cubital tunnel syndrome were reported.

At the elbow level, the ulnar nerve penetrates structures that comprise the cubital tunnel. The roof of the cubital tunnel is formed by Osborne ligament, which originates from the medial epicondyle to the olecranon process, and the fascia connecting the humeral and ulnar heads of the flexor carpi ulnaris.[3] The floor is comprised of the medial collateral ligament and elbow joint capsule. The walls on either side consist of the medial epicondyle and olecranon. When the elbow joint is flexed, the height of the cubital tunnel is decreased, which increases the pressure on the ulnar nerve. Ulnar nerve compression or entrapment occurs most frequently in this area.[3] In the current patients, reduction of conduction velocity of the ulnar motor nerve occurred between the medial epicondyle and 2 cm below the medial epicondyle, and no abnormal findings were found on MRI. Considering these findings, the ulnar nerves in these patients seem to have been compressed in the cubital tunnel.

For the management of the neuropathic pain caused by cubital tunnel syndrome, the patients were administered oral medication and received steroid injections. However, the effects were not sufficient to control the pain. For controlling the residual neuropathic pain, PRF stimulation was performed on the ulnar nerve at the level of the medial epicondyle. The effect of PRF stimulation has not been fully elucidated. However, several

possible mechanisms have been postulated. Cosman and Cosman[11] reported that PRF uses low-frequency electrical stimulation of the neurons, which results in long-term depression of synaptic transmission. Therefore, the application of PRF stimulation seems to result in inhibition of nociceptive stimuli from the ulnar nerve. Hagiwara et al[12] also reported that when the electromagnetic field of PRF is applied to peripheral nerves, the activity of the noradrenergic and serotonergic descending pain inhibitory pathways is enhanced while the excitatory C-fibers are inhibited. Cho et al[13] observed downregulation of microglial activity in the spinal dorsal horn of a rat model of lumbar disc herniation after PRF on the dorsal root ganglia. Microglia release several cytokines and chemokines that mediate pain signaling, which results in the progression to chronic neuropathic pain.[13] Accordingly, the downregulation of microglia should inhibit the development of chronic neuropathic pain.

Several previous studies have reported the effects of PRF on neuropathic pain from various peripheral nerve pathologies, including cervical or lumbar radicular pain, postherpetic neuralgia, trigeminal neuralgia, occipital neuralgia, pudendal neuralgia, meralgia, carpal tunnel syndrome, tarsal tunnel syndrome, and Morton neuroma.[10,14] However, thus far, no study has been conducted on the effects on cubital tunnel syndrome.

In conclusion, this study describes 2 patients with neuropathic pain due to cubital tunnel syndrome who successfully responded to PRF on the ulnar nerve to reduce their pain. The results indicated that PRF on the ulnar nerve can be a useful tool for controlling neuropathic pain caused by cubital tunnel syndrome. This is the first report to demonstrate the effective use of PRF for controlling pain induced by cubital tunnel syndrome. However, this study is limited because it is a case study. Further studies involving a larger number of cases are necessary for the clear elucidation of the effect of PRF.

Author contributions

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Methodology: Soyoung Kwak, Daeun Jeong.
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Writing – review & editing: Min Cheol Chang.

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