Clinical Case Report

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Effect of intradiscal pulsed radiofrequency on refractory chronic discogenic neck pain

A case report

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Abstract

Rationale: Despite medication, exercise, and medical intervention, many patients complain of persistent discogenic neck pain. To manage discogenic neck pain, we performed intradiscal pulsed radiofrequency (PRF) stimulation in a patient with chronic discogenic neck pain refractory to oral medication and epidural steroid injection.

Patient concerns: A 26-year-old man presented with a numeric rating scale (NRS) score of 7 for chronic neck pain. His pain was worse when the neck was held in one position for a prolonged period. There was no pain in the upper extremities.

Diagnoses: Discography was positive at C4–5. Based on the pain characteristics, and the result of discography, we diagnosed him as having discogenic neck pain originating from C4–5.

Interventions: Intradiscal PRF on the C4–5 intervertebral disc was performed under C-arm fluoroscopy. The PRF treatment was administered at 2 Hz and a 20-ms pulsed width for 20 minutes at 60 V with the constraint that the electrode tip temperature should not exceed 42°C.

Outcomes: At the 2-week, and 1-month follow-up visits, the patient's pain was completely relieved. At 2, and 3 months after intradiscal PRF, the pain was scored as NRS 2. No adverse effects of intradiscal PRF stimulation were observed.

Lessons: Application of intradiscal PRF appears to be an effective and safe technique for treating chronic discogenic neck pain.

Abbreviations: NRS = numeric rating scale, PRF = pulsed radiofrequency, RF = radiofrequency.

Keywords: chronic pain, discogenic neck pain, intradiscal stimulation, pulsed radiofrequency

1. Introduction

Neck pain is a common complaint among the general population. It affects up to 66% of individuals in their lifetimes, and approximately 14% develop chronic neck pain.[1,2] Structures with a sensory nerve supply can be potential sources of neck pain, and include muscles, ligaments, bone, zygapophysial joints, and intervertebral discs.[3] Among these various pain sources, discogenic neck pain is thought to be an important, and common cause, and its prevalence has been reported at 16 to 20 %.[4,5] Abnormal nerve ingrowth and expression of painful nociceptors are known to be primary etiological factors in discogenic pain.[6] Several nonsurgical treatment modalities, including medication, exercise, and medical intervention, have been used for the management of discogenic neck pain.[7–9] However, many patients are unresponsive to these modalities.

Pulsed radiofrequency (PRF), a technique first described by Sluijter in the year 1997,[10] is known to be safe and effective in alleviating pain. The technique works by delivering an electrical field, and heat bursts to targeted nerves, or tissues without damaging those structures.[11–13] Conventional radiofrequency (RF) exposes target nerves, or tissues to continuous electrical stimulation, and ablates the structures by increasing the temperature around the RF needle tip.[14] In contrast to conventional RF, PRF applies a brief electrical stimulation followed by a long resting phase. Accordingly, PRF does not produce sufficient heat to result in structural damage.[15] The proposed mechanism of PRF is that the electrical field produced by PRF can alter pain signals.[16] Several studies on PRF treatment have demonstrated its effectiveness in alleviating neuralgia, muscle, and joint pain not responsive to conventional therapies.[17–20] In addition, several studies have reported that intradiscal PRF has beneficial effects in alleviating discogenic lower back pain.[21–27] It has been suggested that intradiscal PRF can reduce nociceptive input from the intervertebral disc. Although no studies have reported on the use of PRF for managing discogenic neck pain, we considered that intradiscal PRF may be effective for alleviating discogenic neck pain.

Here, we report a positive response to intradiscal PRF stimulation in a patient with chronic discogenic neck pain.

2. Case report

A 26-year-old man visited the Physical Medicine and Rehabilitation Department of a university hospital because of posterior

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Conflicts of interest None.

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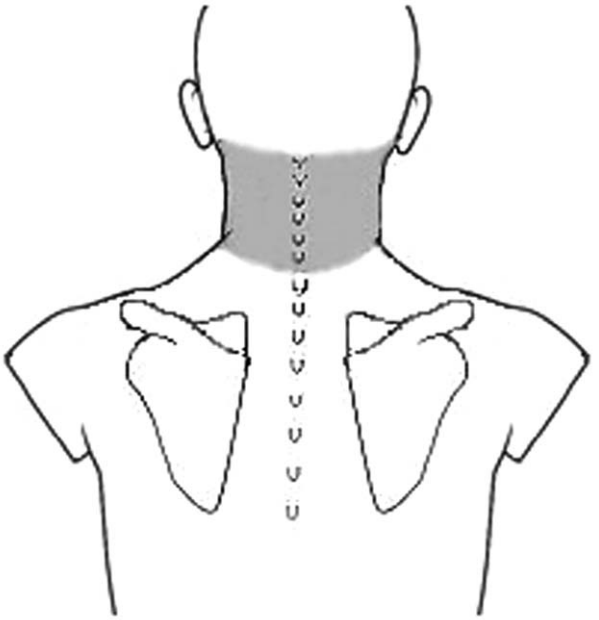

Figure 1. Location of the patient's perceived pain.

neck pain over a period of 16 months (Fig. 1). The patient provided informed consent for participation in the study. The study was approved by the local Institutional Review Board of our hospital. His numeric rating scale (NRS) score was 7 out of 10. His pain continued all day and was aggravated when the neck was held in one position for a prolonged period. He did not have pain in the upper extremities. On physical examination, no sensory or motor deficits of the upper extremities were detected. A Spurling test was negative. On cervical magnetic resonance imaging (MRI), central disc protrusion and a high-signal intensity zone at C4–5 were observed (Fig. 2). The patient had previously received a cervical medial branch blocks and RF neurotomy of the bilateral third occipital nerves when treated in another hospital. No short- or long-term effects were manifest. We conducted 2 cervical epidural steroid injections and diagnostic blocks on the cervical facet joint injections (from C2 – 3 to C5 – 6). The patient did not exhibit any short- or long-term effects as a result of these procedures (NRS was unchanged). The patient did not respond to physical therapy or medication (15 mg meloxicam, 325/37.5 mg acetaminophen/tramadol hydrochloride, 10 mg nortriptyline). Considering the patient's pain characteristics, and unresponsiveness on all conducted procedures, we theorized that his pain was associated with discogenic neck pain. We conducted provocative discography to confirm the diagnosis. During discography at C4–5, the patient reported concordant pain, which closely resembles symptomatic pain in nature and location. Thus, we diagnosed him as having discogenic neck pain originating from C4–5.

Twenty-two months after pain onset, we conducted intradiscal PRF at the C4–5 disc under the guidance of C-arm fluoroscopy (Siemens, Seoul, Korea). The monopolar PRF procedure was performed with a 22-gauge curved-tip cannula (SMK Pole needle, 100 mm with a 10-mm active tip, Cotop International BV) from the patient's right hand side. The patient was placed in a supine position for the procedure with his neck extended by placing a cushion beneath his shoulder. Using fluoroscopy, we identified the target disc and an appropriate skin site for needle trajectory. After displacing the trachea medially, and the right carotid artery laterally, using the second and third digits, the catheter was inserted into the space between the trachea, and the right carotid artery. The catheter was then carefully advanced into the C4–5 disc. After confirming catheter tip placement at the C4–5 disc with anteroposterior and lateral fluoroscopic views (Fig. 3), PRF treatment was applied using an RF generator (Cosman G4, Burlington, MA, US). The parameters used for the PRF stimulation were as follows: 2 Hz, 20 ms pulse width, and 60 V for 20 minutes.

The follow-up period was 3 months. At the 2-week and 1-month follow-up visits, the patient reported that his discogenic neck pain was completely relieved (NRS, 0). At 2 and 3 months after intradiscal PRF, the pain was scored as NRS 2. No adverse effects of intradiscal PRF were noted.

3. Discussion

In this case report, we describe a patient with chronic discogenic neck pain who exhibited a successful response to intradiscal PRF stimulation. Our patient's pain completely disappeared for 1 month following the PRF stimulation procedure, and the degree

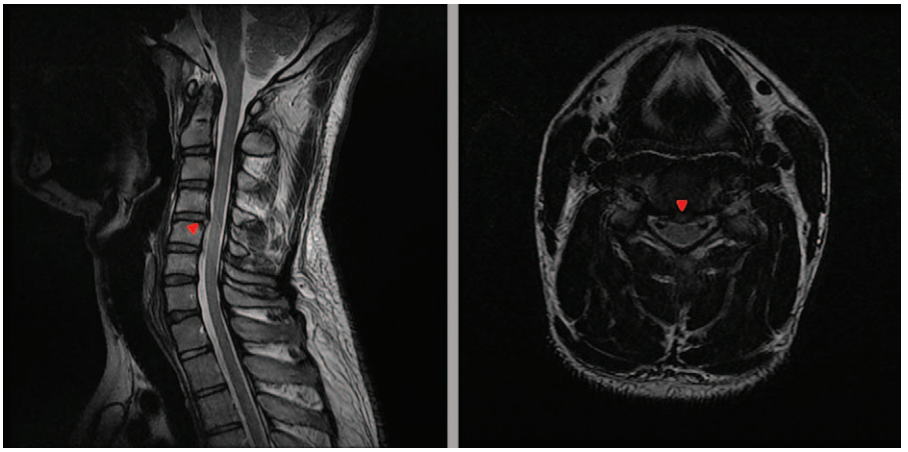

Figure 2. Sagittal and axial T2-weighted cervical spine magnetic resonance imaging at 1 year after pain onset showed central disc protrusion and a high-signal intensity zone at C4–5 (red arrow heads).

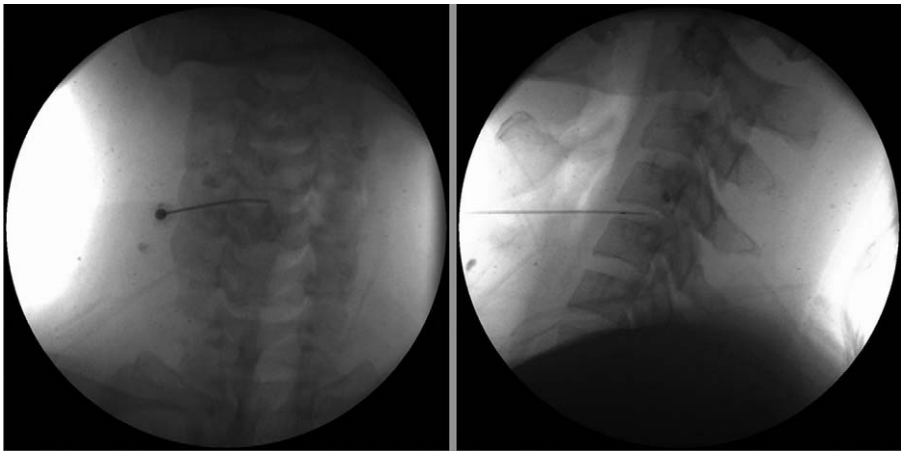

Figure 3. Fluoroscopy-guided confirmation of the catheter tip placement at the C4–5 disc.

of pain was reduced by approximately 70% over the pretreatment level at 2- and 3-month follow-up visits.

The sensory fibers that innervate the intervertebral disc are mainly nociceptive, and the disc is innervated by branches of the sinuvertebral nerve, nerves derived from the ventral rami of spinal nerves, and nerves derived from gray rami communicates.[6] They are found mostly in the periphery of the annulus fibrosus.[6] However, in discs producing discogenic pain, these nociceptive nerve fibers grow into inner parts of the annulus fibrosus, and even into the nucleus pulposus.[28,29] This inner growth can cause or aggravate discogenic neck pain.[30] Minimally invasive intradiscal procedures, such as percutaneous laser decompression and RF, have been used to denervate nociceptive nerve fibers in the cervical disc.[31] However, high temperatures during these procedures can shrink the disc.[32] Conversely, the targeted tissue temperature is maintained at or below 42°C during PRF procedures.[20,33] Thus, PRF stimulation does not produce sufficient heat to cause significant structural damage of cervical discs.[11–13]

The mechanisms underlying the pain-alleviation effect of PRF stimulation remain unclear. However, the main mechanism is thought to be neuromodulation by an electrical field.[34] Application of PRF to the dorsal root ganglion or epidural space can affect cellular function in the dorsal horn independently of thermal effects.[35,36] PRF is reported to decrease microglial activity in the spinal dorsal horn.[35,37] Since microglia contribute to the occurrence of chronic pain by releasing several cytokines and chemokines that mediate pain signaling, downregulation of microglia could possibly control chronic pain. Additionally, PRF is known to enhance various descending inhibitory pathways, especially, involving the noradrenergic, and serotonergic pathways.[38]

Seven previous studies reported the positive effects of intradiscal PRF stimulation in managing lumbar discogenic low back pain.[21–27] In most of those studies, intradiscal PRF significantly reduced pain for at least 6 months. However, there has been no study on the effect of PRF in controlling discogenic neck pain. Although this is a case study, our report is the first to show the effective use of PRF for managing discogenic neck pain.

In conclusion, we report a patient with chronic discogenic neck pain who showed a good response to intradiscal PRF administered to alleviate pain. The effects of intradiscal PRF were sustained for at least 3 months. The results of this study showed that PRF can be a useful option for controlling chronic discogenic neck pain, especially, in patients who are unresponsive to medications, and other procedures. However, our study is limited because it is a single-case study. Further studies involving more number of cases are needed to clearly elucidate the effects of intradiscal PRF on patients with discogenic neck pain.

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Author contributions

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Investigation: Min Cheol Chang.
Methodology: So Young Kwak, Min Cheol Chang.
Supervision: Min Cheol Chang.
Visualization: So Young Kwak.
Writing – original draft: So Young Kwak.
Writing – review & editing: Min Cheol Chang.

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