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Effect of Intradiscal Pulsed Radiofrequency Application Duration on the Cervical Discogenic Pain

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Abstract

Background: Cervical Discogenic Neck Pain (CDNP) caused by abnormal nerve in growth into annular and the expression of pain nociceptors. To treat discogenic neck pain, Intradiscal Pulsed Radiofrequency (ID-PRF) could be used in management of chronic CDNP.

Objective: This study aimed to investigate the efficacy of percutaneous ID-PRF in chronic CNDP.

Methods: In this retrospective study, thirty-four patients were included and allocated into two groups according to the duration time of the PRF procedure they underwent (7 min group = 16 *vs*. 15 min group = 18 patients). The principal outcome measures were pain score, evaluated with the Numeric Rating Scale (NRS), and the Oswestry Disability Index (ODI) at three different time points: Baseline, at 2 weeks after the procedure 2-weeks and at 6-month after. The degree of achievement was determined as a reduction in NRS of ≥ 50% or an ODI reduction of ≥ 40%.

Results: At 2 weeks and 6 months after the procedure, retrospectively, NRS was found to be significantly reduced (P<0.05) in both groups, but no significant differences were found between the groups. It was also found that ODI scores is significantly lower in treatment groups when compared to the control, but the difference between the groups were not significant. At the 6 months after procedure, 12 patients (75.0%) and 14 patients (77.8%) were found to have decrease in the NRS by more than 50% among the 7-min group and 15-min group, respectively, while there was no significant difference in the percentage of patients who had decrease in ODI more than 40% between the two groups (P=0.243).

Conclusion: ID-PRF was shown to have significant efficacy in management of CDNP regardless of the duration of ID-PRF (7 min *vs*. 15 min).

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Introduction

Chronic neck pain is a common clinical problem among general population [1] and reported prevalence between 14% and 41% [2]. Chronic neck pain can be induced by anatomical predisposition, including facet joint irregularity, disc pathology, neck muscle and ligament [3]. The prevalence of zygapophyseal joint pain was 55% and discogenic pain was 16% [4]. Among chronic neck pain, discogenic neck pain could be caused by abnormal nerve in growth into annular and the expression of pain nociceptors [5,6]. Several methods were introduced to treat discogenic neck pain [7-9].

Percutaneous radiofrequency treatment was first introduced in the 1980s [10] and distinguished into two type of radiofrequency: Continuous radiofrequency stimulation [11] and Pulsed Radiofrequency (PRF) [12] stimulation by means of an electromagnetic arena. PRF consists of a high-intensity electromagnetic current delivered in pulses, allowing heat to disperse through the latent period so that neurodestructive heats cannot be extended [13].

It is reported that the Intradiscal PRF (ID-PRF) is applied to an in lumbar discogenic pain [14-16]. It has been proposed that percutaneous ID-PRF may reduce nociceptive input from the intervertebral disc [17]. In adding, numerous studies have related the beneficial effects of ID-PRF on discogenic low back pain [14,17-20].

While the application of percutaneous jellified ethanol, platelet-rich plasma, and inter laminar epidural injection in cervical discogenic neck pain were reported [21-24], the study on ID-PRF has not yet been reported. The only one case of ID-PRF treatment was reported [20].

A high-voltage and long-duration PRF, which is assumed to be 15 min to 20 min is recommended [14,20].

The present analysis aim to investigate the effect of the application percutaneous monopolar ID-PRF in the management of chronic discogenic neck pain.

Methods

A total of 34 patients with treatment conducted between January 2018 and September 2020 were included in this retrospective study. The patients were allocated into groups based on the duration of the procedure they underwent: 7 min or 15 min.

The study procedure was permitted by the Institutional Review Board. The inclusion criteria were: 1) axial neck pain; 2) single level; 3) sitting neck pain; 4) single level degenerative disc in Magnetic Resonance Imaging (MRI); 5) positive response to provoking discogram [25] and 6) neck pain that had not responded to conventional handlings (pharmacotherapy and physical therapy) inside the prior 4 to 6 weeks. The exclusion criteria were as follows: 1) Neck pain induced by pressure on the paraspinal muscles; 2) cervical herniated intervertebral disc; 3) cervical spinal stenosis; 4) facet origin pain; 5) myelopathy; 6) pain due to infection; and 7) bleeding tendency.

Data on age, sex and length of pain of each patient was contained. The primary outcome measures were the pain score using the Numeric Rating Scale (NRS), and the Oswestry Disability Index (ODI) measured before, at the 2 weeks after and 6-months after the treatment. Degree of achievement was described as a decrease in NRS of ≥ 50% or an ODI reduction of ≥ 40%.

Procedure

All patients were intravenously injected with antibiotics in prior to the procedure. The ID-PRF, a single needle placement procedures performed on the patients laying on the fluoroscopy table in the supine position with pillow under their neck. The disc level for the treatment was selected based on the findings of MR.

Betadine was used for the disinfection of the skin entry site. With fluoroscopy, the target disc was found using metal indicator. The skin entry site was infiltrated with 1% lidocaine. With second and third digits of left hand second, the trachea and esophagus medially displaced. On fixed two digits, the PRF needle (NeuroTherm, 20 G, 15 cm length, 20 mm active tip) was percutaneously progressed and was located on the affected disc with an anteroposterior view (Figure 1A). In fluoroscopic lateral view, PRF needle advanced to posterior margin of affected disc (Figure 1B). Anteroposterior and lateral fluoroscopic projections were used to confirm whether the introduced needle was properly placed.

We applied ID-PRF with a frequency of 5 Hz, a pulse width of 5 ms, the amplitude of 60V, and a extreme heat of 42°C, for either patients with 7 min or 15 min treatment by means of the NT1100 generator (NeuroTherm, Middleton, MA, USA). After the end of the procedure, the PRF needle was removed after procedure and the patients were transferred to the recovery room.

Wilcoxon signed-rank exam was used in assessments of increase in NRS and ODI scores before and after the procedure. A statistical significance was established when P-value is <0.05.

Results

Thirty-four patients were included in this study were divided into two groups based on the duration of PRF application (7-min group; 16 patients. 15-min group; 18 patients). Data on the patient character are presented in Table 1. It is found that NRS and ODI were significantly reduced in a time-dependent manner in both groups (Table 2, 3). Mean post-treatment pain scores were found to be significantly lower (P=0.000) in both groups at the follow-up period of 2 weeks and 6 months, respectively, while the variances among the groups were insignificant (Table 2). The ODI scores were also significantly reduced when compared to that of baseline scores; however, the differences between the groups were insignificant (Table 2). At the 6-months follow-up examination, 12 patients (75.0%) in the 7-min group and 14 patients (77.8%) in the 15-min group were shown to have decrease by more than 50% in their pain score (P=0.17). No

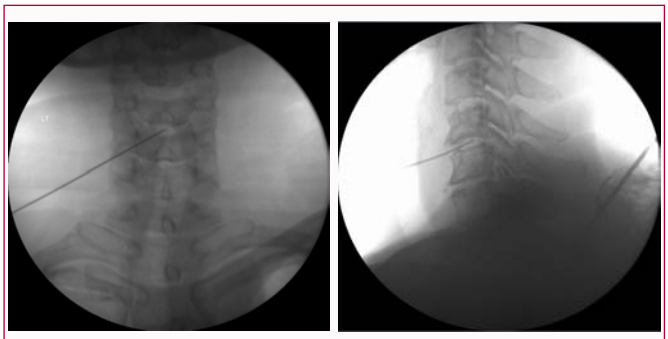

Figure 1: A) Pulsed radiofrequency needle was placed into the C5-6 disc in c-arm anteroposterior view. B) Lateral view.

Table 1: Summary of patient's characteristics.

N=34	7 min (n=16)	15 min (n=18)	P value
Age (yrs)	54.2 ± 7.3	56.4 ± 6.7	0.58
Gender (M:F)	7:09	10:08	0.97
Pain Duration (Months)	10.2 ± 14.7	12.7 ± 10.2	0.29
Procedure			
C45	4 (25%)	3 (16.7%)	0.51
C56	10 (62.5%)	13 (72.2%)	
C67	2 (12.5%)	2 (11.1%)	

Table 2: Changes of Numeric Rating Score scale (NRS) and Oswestry Disability Index (ODI).

N=34	Pain	Pre-treatment	Post 2 weeks	Post 6 months	P value
7 min	NRS	7.4 ± 0.9	3.1 ± 1.7	2.8± 1.4	0
(n=16)	ODI	55.1 ± 4.7	24.6± 7.9	24.7± 7.1	0
15 min	NRS	7.3 ± 0.8	2.7 ± 1.9	2.4 ± 1.2	0
(n=18)	ODI	55.6± 5.0	23.2± 8.4	23.2± 6.9	0
P value		0.71	0.92	0.74	

Table 3: The number who obtained the percentage improvement of pain at post-procedure 6 months.

N=34	Reduction	7-min (n=16)	15 min (n=18)
NRS	<49	4 (25.0%)	4 (22.2%)
	≥ 50	12 (75.0%)	14 (77.8%)
	P value	0.172	
ODI	<39	5 (31.3%)	4 (22.2%)
	≥ 40	11 (68.7%)	14 (77.8%)
	P value	0.243	

significant difference was found between the degree of reduction ODI score in each groups (P=0.24) (Table 3).

No severe problems, including epidural hemorrhage, dural or neural damages, or pollution, were noted in any group.

Discussion

The outcomes of this report show that significant pain relief can be achieved with either 7-min or 15-min application of ID-PRF. There was little reported to ID-PRF treatment for chronic discogenic neck pain. Only one case ID-PRF had achieved decreased the numeric rating scale at 3-months follow up [20].

Chronic neck pain occurred from severe factors, such as cervical intervertebral, facet join, atlantoaxial joints and neck muscle, etc. Cervical intervertebral disc was innervated sinuvertebral nerve by posterior vertebral plexus, anterior vertebral plexus, and vertebral nerve [3]. If degenerative change occurred in the disc, disc-innervating nerve potentially extending into the internal third of the annulus fibrosus and the nucleus [5,6,26]. It was can cause discogenic neck pain.

The mechanism of ID-PRF is not fully understood. It could be possibly suggested that ID-PRF may reduce nociceptive input derived from the intervertebral disc and the induce of a cellular and immune response and inhibit evoked synaptic activity [27,28]. Park et al. [16], reported intradiscal pulsed radiofrequency was effective in patient with chronic discogenic low back pain [16].

There was difficult to diagnosis discogenic pain [29]. In our study, pre-procedure provocative cervical discogram was performed. Cervical discogram was useful methods for diagnosis cervical discogenic neck pain [25]. Inclusion criteria of this study were not guaranteed pure disco-origin pain. It was not easy to distinguish discogenic pain from facet pain, or muscle/ligament pain, etc.

This study is limited in that it has small sample size and the lacks control group. We may also not fully full rule out the pain from facet pain or muscle pain. Evaluation with MRI should be not conducted in follow-up to assess the potential of ID-PRF to prevent or to aggravate disc degeneration.

It is concluded that the application of ID-PRF is efficient for the conduct of discogenic neck pain regardless of ID-PRF application duration (7-min *vs.* 15-min).

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