



Dorsal root ganglion stimulation combined with spinal cord stimulation for effective treatment of postherpetic neuralgia - A case report -

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Background: Although spinal cord stimulation (SCS) can be a treatment option for intractable postherpetic neuralgia (PHN), obtaining proper stimulation at the thoracic dermatome is difficult. Dorsal root ganglion (DRG) stimulation may be an effective treatment for patients with insufficient efficacy in SCS only.

Case: A 54-year-old male with intractable PHN was referred to our clinic. Pain was localized to the distribution of the T1–3 dermatomes. SCS trial was conducted, and lead was placed within the epidural space over the C6–T1 level; however, the stimulation was inadequate for his pain site. Therefore, another lead was placed within the left T1 and T2 DRG for trial, and T1 DRG stimulation provided adequate stimulation. T1 DRG stimulation and SCS could cover the entire pain site with paresthesia, and his pain was decreased by over 50%.

Conclusions: DRG stimulation combined with SCS may be a good treatment option for intractable thoracic PHN.

Keywords: Dorsal root ganglion; Implanted nerve stimulation electrodes; Postherpetic neuralgia; Spinal cord stimulation.

Postherpetic neuralgia (PHN) is a neuropathic pain resulting from herpes zoster infection. Herpes zoster infection usually presents as an acutely painful vesicular rash that affects the dermatome. It usually resolves within a few weeks; however, it can be complicated by persistent neuropathic pain. A systemic review in 2014 reported that the estimated incidence of herpes zoster ranged between 3–5/1,000 persons per year in Asia, Europe, and North America and increases both with age and with impaired immunity. When neuropathic pain persists for more than 30–90 days after the appearance of the acute herpes zoster rash, it is called PHN [1].

The incidence of PHN after herpes zoster is 10% in people

over 40 years of age, 20–50% in those over 60 years, and rarely seen in people less than 30 years of age. This proportion increases with age, with more severe prodrome, rash, and pain during the acute phase of herpes zoster infection [2].

Pharmacological treatments for PHN include topical therapy and systemic medication with anticonvulsants, antidepressants, topical lidocaine, and opioids [3]. However, few PHN patients experience more than 50% pain reduction, and adverse effects are common, particularly in older patients [4]. In some cases of PHN, patients experience severe pain despite multi-drug medication, nerve block, and/or radiofrequency treatment. In these intractable cases, neuro-

surgical procedures such as electrical stimulation of the spinal cord, nerve roots, peripheral nerves, and brain can be considered [5].

However, effective thoracic spinal cord stimulation is particularly difficult compared to the cervical and lumbar regions due to challenges in targeting the tight dermatome level and cerebrospinal fluid (CSF) layer thickness [3]. In addition, it was effective in select cases. In this case, we stimulated thoracic dorsal root ganglion (DRG) stimulation combined with spinal cord stimulation (SCS) for intractable PHN and obtained good results.

CASE REPORT

Written informed consent was obtained from the patient for publication of this report. The patient was 54 years of age and male with no medical history. He had herpes zoster in the left back, chest, axillar, and upper arm (left T1–3 dermatomes), and pain was sustained on the affected site for 7 years. His pain score was 9–10 (0, no pain; 10, the worst pain imaginable). His pain was very severe and he had allodynia and hyperalgesia in the left axilla and upper arm. The pain was stabbing and electric shock-like. He received medical therapy with pregabalin 600 mg/day, milnacipran 100 mg/day, tramadol 200 mg/day, nortriptyline 10 mg/day, fentanyl patch 62 µg/h, and interventional therapy with epidural block, nerve root block, and radiofrequency treatment several times. However, he experienced pain relief for only a short term or not at all. Therefore, we decided to perform an SCS trial.

For the SCS trial, the skin was incised at the left T6–8 level and 15-gauge Tuohy needle was inserted using the paramedian approach via the left T4–5 interlaminar space. After the epidural space was confirmed with loss of resistance and C-arm fluoroscopy, an eight-electrode lead (Vectris surescan MRI lead, Medtronic, USA) was first installed within the left C4 level under C-arm fluoroscopy. The best position of the lead tip was the upper C6 level, which could cover the widest pain site with paresthesia. Even though we changed the lead tip position from C3 to C6, it stimulated only a small part of the pain site, such as the chest, except for the most painful site such as the axillar and upper arm. Therefore, we installed another lead to T1 and T2 DRG for trial after skin incision at the right T3–4 level. The needle was inserted via the T1–2 and T2–3 interlaminar spaces. T2 DRG stimulation did not fully provoke paresthesia in the pain site, and some stimulation overlapped with that of SCS. After additional T1 DRG

stimulation (2.2 mA, 500 ms, and 40 Hz) with spinal cord stimulation (4.4 mA, 500 ms, and 40 Hz), the patient received adequate paresthesia at the entire pain site, including the axilla and upper arm. During a 1-week trial period, his pain was relieved by more than 50% (pain score changed from 9–10 to 4). DRG stimulation combined with SCS could stimulate almost his pain lesion, including the most severe pain site. We implanted a permanent implantable pulse generator (IPG, Restoresensor Surescan MRI, Medtronic) in the subcutaneous pocket of the right upper chest (Fig. 1). The stimulator worked properly during hospitalization and had no complications. He was discharged from the hospital after 2 weeks and was able to cut off the fentanyl patch. After 2 months, his pain score was 3–4, and DRG stimulation with SCS was effective.

DISCUSSION

To our knowledge, this is the first report of DRG stimulation in Korea. There are few case reports of DRG stimulation for PHNs.

SCS can be a treatment option for patients with intractable PHN. It is sometimes difficult to obtain proper stimulation by SCS for PHNs. Although the thoracic level is the most common zoster-affected dermatome, appropriate stimulation can be difficult because the depth of the CSF is greatest at the thoracic level. Moreover, medical costs are high for the

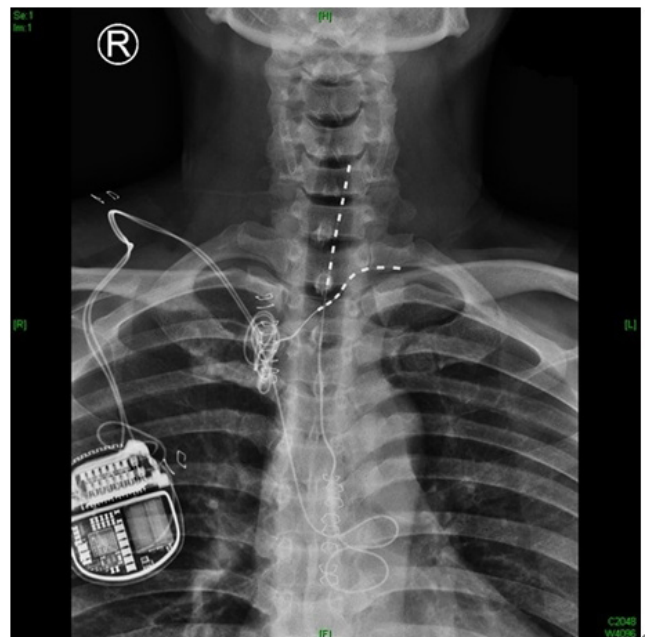


Fig. 1. X-ray of the patient with dual leads.

SCS [3]. Several methods have been used to identify patients who are likely to benefit from SCS. One study suggested patients with little or no sensory loss in the affected area [6], and another study suggested patients with persistent pain, regardless of epidural infusion [7]. Both studies showed significant pain reduction in PHN after SCS, and these findings might indicate that patients with PHN caused by central sensitization and those with preserved neuronal and dorsal column function would respond well to SCS. However, patients with marked sensory loss and constant pain without allodynia would not benefit from SCS, as deafferentation and degeneration of the dorsal column might be the dominant mechanism. Therefore, it is important to select patients who would benefit from SCS for PHN. The patient in this case had minimal sensory loss. We expected SCS with proper stimulation at the pain lesion to have a good effect. However, the SCS did not provide overall stimulation to the pain area. There was no stimulation to the most severe pain sites, such as the axilla and upper arm.

The limitations of SCS include incomplete or inconsistent coverage for certain body areas, and peripheral nerve stimulation is limited by surgical procedures and lack of selectivity for sensory and motor fibers [8]. Because DRG stimulation directly stimulates specific DRG, it can obtain proper stimulation in thoracic lesions. Therefore, it can compensate for the shortcomings of spinal cord stimulation, which is difficult to stimulate at a specific thoracic dermatome in PHN. Although further investigation of DRG stimulation for PHN is needed, it can provide proper stimulation for thoracic lesions. The central mechanisms of PHN include necrosis and scarring of neurons in the DRG and inflammation involving both the anterior and posterior horns of the spinal cord. However, PHN also involves a peripheral mechanism; therefore, peripheral nerve stimulation may be a possible treatment [9]. Yanamoto and Murakawa [10] showed that SCS with spinal nerve root stimulation method is expected to be useful for selective SCS in cases with failure to acquire stable stimulation by dorsal cord stimulation. Adrian et al. [11] showed that dorsal nerve root stimulation relieves pain, improves quality of life and functionality, and allows for medication reduction to a comparable degree as SCS and similar results in VAS scores for the SCS and dorsal nerve root stimulation group at all time points in the study. Both groups achieved a > 50% VAS reduction at 12 months. In PHN, peripheral nerve stimulation including the DRG may be a viable option, even at higher cervical spinal segments [12]. Theoretically, DRG stimulation offers several advantages

over SCS. It is established that the action of successful neuromodulation should be proximal to the site of the neural lesion. DRG stimulation would provoke stimulation much more exclusively in the pain site and corresponding segment, avoiding adjacent stimulation. It could be expected that a lower stimulation power would be necessary. It seems that DRG stimulation can be an effective option for patients who already have failed SCS trials or those who are not good candidates for SCS.

However, there are mixed results in the DRG stimulation of PHN treatment [10,12]. No comprehensive overview has been published so far, and no consensus exists regarding the recommendations for DRG stimulation in PHN. Stimulation of the affected ganglion itself may provoke immediate and unbearable pain, and the effect of the DRG may not last long [13].

This study has some limitations. First, in this case, DRG stimulation was performed due to insufficient SCS stimulation; therefore, the effectiveness or efficacy of DRG stimulation alone cannot be verified. However, this requires further evaluation. Second, this is a case report, and there is no randomized controlled trial and no consensus regarding SCS and DRG stimulation. Third, this case is only a short-term result. Long-term follow-up and further evaluation are required.

DRG stimulation combined with SCS may be a treatment option for intractable PHN without significant complications and inconvenience. DRG stimulation may compensate for the shortcomings of spinal cord stimulation, which is difficult to stimulate at a specific thoracic dermatome.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

DATA AVAILABILITY STATEMENT

The datasets generated during and/or analyzed during the current study are available.

AUTHOR CONTRIBUTIONS

Data curation: Min Jung Kim. Project administration: Jae Hun Kim. Writing - original draft: Seung Wan Hong. Writing - review & editing: Jae Hun Kim. Investigation: Seung Wan Hong, Min Jung Kim, Cheol Hwan Park, Sarah Park. Supervision: Jae Hun Kim.

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