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Thoracic Level Peripheral Nerve Stimulation for Midback Pain: A Case Report

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Background: PercThoracic spinal pain (TSP) is a poorly understood phenomenon with a large prevalence and impact on patient quality of life, similar to that of lumbar pain. Often conservative therapies for managing TSP are ineffective or short-lasting. Peripheral nerve stimulation (PNS) offers a promising alternative to other invasive options for management of TSP, though additional investigation into the effectiveness of PNS in managing patients with intractable back pain is necessary.

Case Report: A 73-year-old patient with a history of atrial fibrillation, dyslipidemia, chronic obstructive pulmonary disease, depression, osteoporosis, gastroesophageal reflux disease, and neuropathic foot and neck pain presented with a complaint of burning midthoracic back pain. The patient underwent implantation of a SPRINT® Peripheral Nerve Stimulator bilaterally at the T9 level for management of midthoracic back pain. Despite accidental lead removal, the patient experienced 98% overall relief in her midthoracic back and did not return to the clinic for additional pain management following a 2-month follow-up appointment.

Conclusion: This report provides additional evidence to support PNS as an effective and safe pain management option for patients with chronic thoracic back pain.

Key words: Midback pain, peripheral nerve stimulation, thoracic back pain, thoracic peripheral nerve stimulation, thoracic spinal pain

BACKGROUND

Thoracic spinal pain (TSP), defined as pain experienced in the area of the upper or middle back between vertebrae T1-T12, is a poorly understood phenomenon with a concerningly large prevalence and impact on patient quality of life (1). Estimates of the prevalence of TSP in high-risk workers range from 7% to 38%, while estimates within the general population have been reported as high as 15% (1,2). The prevalence of TSP increases significantly with age, which is a cause for concern given a rapidly aging population with progressively increasing life expectancies (2). While lumbar and cervical pain have historically received more attention than thoracic pain, evidence suggests that TSP places a similar burden on patient activity and quality of life; understanding the common mechanisms and options for treatment of this pain have therefore become increasingly important. The thoracic spine is a common site for inflammatory, degenerative, metabolic, infective, and neoplastic conditions, all of which further contribute to the burden of pain and limited movement experienced by the patient (3). Given the often-chronic nature of the pain experienced by patients with TSP, it is critical that clinicians investigate effective, safe, and lasting methods to offer patients relief. Common nonpharmacologic, conservative therapies for managing chronic pain of this nature include physical therapy, therapeutic exercise, psychological therapy, acupuncture, and transcutaneous nerve stimulation (4). More invasive modalities for pain

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management include epidural injections, intercostal nerve blocks, intrapleural blocks, paravertebral blocks, and cryoablation of the intercostal nerves (5). While more invasive efforts may be effective when conservative management fails, they often only provide temporary relief and come with other negative effects ranging from infection, local anesthetic toxicity, and trauma (5).

Peripheral nerve stimulation (PNS) has been previously explored as an option for improving quality of life and pain in patients with intractable lumbar back pain, and there is growing evidence to suggest that it may also be effective in managing patients with thoracic back pain (6). A small case series conducted by Goroszeniuk et al (7) showed that direct subcutaneous targeted neurostimulation via a percutaneously implanted neurostimulator bypassing the spinal cord and peripheral nerves was effective in relieving pain and improving quality of life for patients with various presentations of thoracic back pain. A subsequent prospective study of 20 patients with chronic thoracic pain further found that PNS provided significant pain reduction at 12 months following the procedure, with further evidence to suggest significant improvements in patient quality of life (8). Ten of the patients studied reported some level of improvement in their ability to work following the procedure, one of whom was able to return to their pre-injury function following PNS treatment (8). The complications reported in this study were consistent with common complications from PNS procedures, including lead migration, pain at the site of implantation, and infection at the implantation site (8,9). Though there is increasing evidence to support the use of PNS in managing patients with intractable thoracic back pain, additional investigation is necessary to provide increasing evidence for its safety and effectiveness. In this case report, we discuss a patient who underwent implantation of a SPRINT® Peripheral Nerve Stimulator to improve intractable midthoracic back pain.

CASE

This was a 73-year-old woman with a history of atrial fibrillation, dyslipidemia, chronic obstructive pulmonary disease, depression, osteoporosis, gastroesophageal reflux disease, and neuropathic foot and neck pain who presented to the interventional pain clinic with midthoracic back pain. The patient suffered a wedge compression fracture. Pain was rated at 3 to 10 out of 10 on the visual analog scale (VAS). The pain was constant and described as burning and tight in nature. The pain improved with lying down and worsened upon standing. The patient tried physical therapy, chiropractic appointments, and massages as nonmedication treatment options. She was also taking 6 tablets of 50-mg tramadol for pain and 600 mg of gabapentin twice a day mainly for neuropathy in her feet. Interventionally, she had undergone 6 facet joint injections (FJI) at the T8-9-10 levels at an outside pain clinic, which initially provided 50% relief but lost their effect with repeated injections.

The patient underwent implantation of a SPRINT® Peripheral Nerve Stimulator (PNS) bilaterally at the T9 level on January 25, 2021 (Fig. 1). Eleven days following PNS placement, the patient reported that the left lead was accidentally "pulled out" a few days prior, but that there was still significant pain relief utilizing only the contralateral lead. The patient reported that she had been able to lessen her tramadol usage from 6 tablets to only one or 2 daily. At the 2-month postprocedure follow-up for device removal, the patient reported 98% overall relief in her midthoracic back pain. The only negative reports from the patient were minor itching from the dressings and slight left-sided stiffness/pain. The patient continues to have pain improvement and has not reported back to the clinic for additional pain management.

DISCUSSION

This case highlights the potential therapeutic benefit of PNS for thoracic back pain, specifically due to a vertebral compression fracture. The patient had variable pain ranging from a 3 to a 10 on the VAS that found little relief with conservative treatment modalities such as physical therapy, massages, and medications; interventions appeared to be effective initially but soon did not provide any relief. This use of the SPRINT® PNS system, despite the instance of accidental lead removal, provided this patient with nearly complete pain relief.

It is important to note that the electrical leads of the PNS device can be safely kept in situ for 60 days (10). While the patient in the presented case was scheduled for device removal at the 2-month follow-up, or 60 days post operation, one of the device's leads was accidentally removed only 11 days into treatment. Even with the lead removal, there was significant ongoing improvement in the patient's pain. Accidental removal of PNS leads is a well-documented potential complication for any patient undergoing PNS treatment for any reason (9). For example, in a study on PNS for the treatment of postamputation pain, Rauck et al (11) observed accidental dislodgement of leads in 2 out of

the 14 patients being studied. While uncomfortable to the patient and a potential risk to the integrity of pain relief provided by the PNS system, the overall risk to the patient's long-term health is low.

The mechanism by which PNS provides pain relief remains poorly understood. The leading theory, gate control theory, proposes that pain relief is provided by neuromodulation via the inhibition of fibers that modulate pain following the subcutaneous stimulation of fibers within the spinal cord (12). However, there remains a population of patients who do not see effective pain relief from PNS. Previous studies have hypothesized that patients with a history of large skin incisions and multilevel surgical histories may not see improvement in pain from PNS due to damage to subcutaneous nerves that limits the ability to stimulate terminal sensory afferent fibers via PNS (13).

This case was of particular interest given that the patient had a rather comprehensive history of interventions for pain management. While prior initial FJI had provided her with some pain relief, the relief was only temporary and required continued pharmacologic management. The effectiveness of PNS in relieving this patient's pain suggest that there may be candidates with intractable thoracic back pain who will see significantly more pain reduction from PNS compared to other invasive techniques. Furthermore, the patient's history of pain improvement from FJI prior to PNS placement may provide evidence to support PNS use in patients with previous relief from epidural injections, nerve blocks, or cryoablations, serving a similar role to confirmatory nerve blocks in other procedure protocols.

While this case report offers another account of PNS use to manage patients with intractable thoracic back pain, further clinical studies are necessary to build upon this and other similar results. Further research into the best securement of PNS leads and how providers can better educate their patients to prevent the accidental removal of leads should be investigated. Additionally, further clinical studies might focus on the use of PNS in patients who have undergone previous nerve blocks or injections with some relief, as PNS may provide patients with greater pain relief than other alternatives. This patient also presented with intermittent pain that ranged from moderate to severe. It is possible that patients with more constant, severe pain would see different results from PNS intervention. Future studies should investigate a wide breadth of clinical presentations in order to determine the appropriate candidates for PNS implantation, as investigations into the use of PNS implantation in thoracic back pain syndromes remains limited relative to those referencing the use of PNS implants for lumbar pain.

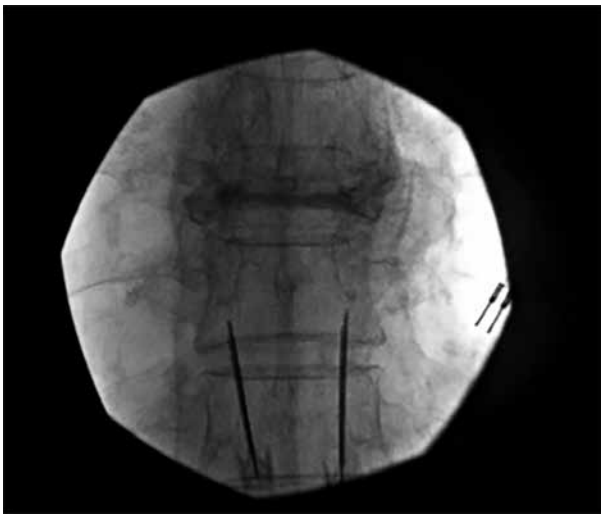

Fig. 1. represents a radiographic image of the lead placement for the SPRINT® Peripheral Nerve Stimulator device at the level of the T9 spinous processes.

CONCLUSION

This case report discusses a 73-year-old woman with intractable thoracic back pain secondary to compression fracture who underwent PNS implantation for pain modulation. Despite the accidental removal of one of the PNS leads 11 days following the procedure, the patient reported 98% improvement in her pain after 2 months. This report provides additional evidence to support PNS as an effective and safe pain management option for patients with chronic thoracic pain. Large clinical studies should be conducted to further investigate the safety of PNS for thoracic spine pain as well as the patient populations that might benefit the most from its use.

Authors Contributions

JMM: Contributed to the literature review and manuscript writing

RBK: Contributed to the literature review and manuscript writing

KJF: Contributed to the literature review and manuscript writing

AA: Contributed to the literature review and manuscript writing

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