

Case Reports

Peripheral Nerve Stimulation for the Treatment of Hemiplegic Shoulder Pain

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Hemiplegic shoulder pain (HSP) is a common comorbidity affecting stroke survivors. It can lead to chronic pain in a significant portion of patients. Prompt recognition and treatment may lead to improved outcomes, though it can be very challenging to treat. Peripheral nerve stimulation (PNS) has shown significant promise as a treatment modality for HSP. We present an interesting case of a patient with debilitating HSP that was unresponsive to a variety of medications and prior neuromodulation therapies. We report our experience utilizing the SPRINT PNS system and our outcomes treating a patient with refractory HSP.

INTRODUCTION

Hemiplegic shoulder pain (HSP) is a common comorbidity affecting stroke survivors and can lead to chronic shoulder pain complaints.^{1,2} The pain typically occurs with activity and movement of the arm and can lead to impaired functionality and debilitating chronic pain. Prompt recognition and treatment may lead to improved outcomes, though nearly 20–30% of patients who have suffered a significant stroke continue to have shoulder pain years after the incident.^{1–3} Peripheral nerve stimulation (PNS) has shown significant promise as a treatment modality for HSP, with studies demonstrating dramatic improvement in pain scores in patients with debilitating HSP.^{4–6} We present an interesting case of a patient with debilitating HSP who was unresponsive to various medications and neuromodulation therapies. The patient was offered a temporary 60-day PNS system. (SPRINT PNS System [SPR Therapeutics, Inc., Cleveland, Ohio]). We report our experience utilizing the SPRINT PNS system and our outcomes in treating patients with refractory HSP.

CASE DESCRIPTION

The patient was a 67-year-old female with a past medical history significant for an ischemic stroke in 2015 with residual left-sided hemiparesis. She developed HSP with a debilitating left-sided shoulder. She consistently rated her pain as 10/10 on a numerical rating scale. The patient participated in physical therapy, occupational therapy, and medication management, including acetaminophen, nonsteroidal anti-inflammatories, neuropathic pain medications, muscle relaxers, and opioid therapy without significant improvement. Another pain provider previously managed the

patient and attempted various injections and spinal cord stimulation without success. The patient was offered intramuscular electrical stimulation of the deltoid muscle utilizing the SPRINT PNS System. She was agreeable and consented to the procedure.

The patient was prepped and draped in a sterile fashion. The acromion process was palpated on the left side. Then an entry point was identified and marked below the acromion process at the axillary nerve motor points of the deltoid muscle.⁷ The entry point was infiltrated with 2mL of 2% lidocaine. The stimulating needle electrodes were inserted and advanced into the belly of the deltoid muscle to stimulate the axillary nerves. Contraction of the deltoid muscle confirmed appropriate placement. Two leads were placed in the deltoid muscle and secured with surgical glue and adhesive bandages. The device representative adjusted the stimulation programming to optimize therapy.

The patient was seen in the clinic 2 weeks after the procedure and reported a 50% improvement in her pain scores. She reported significant satisfaction as this was the first therapy that provided her with any appreciable benefit. Additionally, at the one-month follow-up, the patient reported benefit with 60% improvement in her pain scores. The patient continued the therapy for the full 60-day period and noted a 65% improvement in pain at the end of treatment. The leads were subsequently removed, and at her follow-up appointment 1 month after lead removal, she continued to report a 65% improvement in her pain scores and satisfaction with the therapy.

DISCUSSION

HSP is a common complaint among stroke survivors. The onset of HSP may be related to the severity of motor impairment and affects up to 60% of patients following stroke.³ In

many cases, HSP is multifactorial and can be attributed to pathologies including nerve impingement, rotator cuff dysfunction, tendinopathy, bursitis, adhesive capsulitis, complex regional pain syndrome, spasticity, and contractures.⁸ Recent studies have shown that central sensitization may play a significant role in chronic shoulder pain after stroke, which can last long after the inciting cause has resolved.^{9,10} Our case demonstrates that PNS can result in significant improvement in pain for chronic HSP. Additionally, this therapy can be beneficial even in those patients who have tried and failed other neuromodulation therapies. The SPRINT PNS system is unique in that this therapy is utilized for 60 days and then removed after therapy. The system can provide sustained pain relief long after removal. Our patient continues to report pain relief 1 month after lead removal, with other cases demonstrating relief up to 13-months and potentially longer.¹¹

PNS is efficacious in the treatment of pain in patients with chronic HSP.¹² For the treatment of HSP, PNS is used to target the terminal branches of the axillary nerve to stimulate motor nerves and create contractions of the deltoid muscle.⁶ It is theorized that PNS modulates nociceptive input by stimulating myelinated primary afferents and decreasing the response of the dorsal horn neurons to unmyelinated nociceptors. This may lead to prolonged pain reduction via neuromodulation.^{6,13}

There is limited but growing evidence to support the early use of PNS for HSP. Chae et al. studied the efficacy of PNS in reducing HSP in eight patients, with the primary

outcome measure being the worst pain in the last week on a numeric scale of 0-10.⁶ On average, patients had a 70% reduction in pain at the end of treatment and a 61% reduction in pain 4 weeks after the end of treatment.⁶ Similarly, Wilson et al. performed a randomized controlled clinical trial of twenty-five participants with HSP to evaluate PNS for pain relief.¹⁴ They found that patients who received PNS had significantly greater pain reduction than those who received the current standard of care at 6 weeks and 12 weeks after treatment.¹⁴ Our case demonstrates that PNS can significantly improve pain for chronic HSP with sustained results after SPRINT PNS lead removal. Additionally, the SPRINT PNS system is easy to utilize, minimally invasive, and completely reversible.

CONCLUSION

Neuromodulation with the SPRINT PNS system can benefit patients with HSP that is refractory to conservative measures and other neuromodulation therapies. The SPRINT device was implanted for 60 days and then removed at the end of therapy. The system is minimally invasive and completely reversible. Additionally, it can provide sustained pain relief long after removal. Our case demonstrates the utility of this device in treating debilitating HSP that is unresponsive to other forms of treatment, including neuromodulation.

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