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Case Report

Successful relief of central poststroke pain with BurstDR spinal cord stimulation: A case series

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Received: 18 August 2023
Accepted: 18 January 2024
Published: 23 February 2024

DOI
10.25259/SNI_696_2023

Quick Response Code:

ABSTRACT

Background: Central poststroke pain (CPSP) is a commonly undertreated condition that can negatively impact a patient's quality of life. The efficacy of spinal cord stimulation (SCS) for the treatment of CPSP is not established due to limited studies.

Case Description: Here, two patients, ages 42 and 75, sustained strokes resulting in CPSP. After failed medical management, both underwent placement of paddle-lead SCS systems utilizing BurstDR stimulation that successfully resulted in pain resolution.

Conclusion: Two patients with CPSP were successfully treated with paddle lead SCS with BurstDR programming.

Keywords: BurstDR, Central poststroke pain, Neuropathic pain, Spinal cord stimulation, Stroke

INTRODUCTION

Central poststroke pain (CPSP) is a commonly undertreated poststroke sequela that can significantly decrease a patient's quality of life.[7] It is characterized by pain and altered sensation after a stroke without another discernible cause due to a lesion of the central nervous system.[6] Spinal cord stimulation (SCS) is a newer neuromodulatory treatment whose efficacy in treating CPSP is not well established. Here, we utilized BurstDR SCS in two patients to better establish the efficacy of SCS in providing pain relief for CPSP patients.

CASE 1

A 42-year-old female originally presented with a ruptured right middle cerebral artery (MCA) aneurysm treated with successful aneurysm clipping and subsequent cranioplasty [Figure 1]. She then developed significant left upper extremity (LUE) and left lower extremity (LLE) CPSP (8/10 pain level) that was not relieved with Neurontin or Cymbalta. Nine months after her original surgery, she underwent a thoracic laminectomy and implantation of a 5-column paddle lead SCS system with somatosensory evoked potential monitoring (i.e., this followed a prior successful thoracic SCS trial resulting in 90% LLE pain relief) [Figure 2a]. As the thoracic stimulator significantly relieved LLE pain, the patient later underwent a cervical laminectomy and implantation

of a 5-column paddle lead SCS system to address her LUE pain [Figure 2b]. Although, three months later, the cervical SCS system had to be removed due to infection, it was reimplanted following infection resolution. With the combined SCS systems, the patient reported 80–90% pain relief (i.e., using BurstDR programming) [Figure 3].

CASE 2

A 75-year-old female had an ischemic stroke involving the M1 segment of the right MCA. Following endovascular treatment, she was discharged to inpatient rehabilitation on aspirin and Plavix. One week later, she additionally sustained a left thalamic MCA stroke, resulting in weakness, an abnormal gait, aphasia, and a CPSP [Figure 4]. Two years later, she was evaluated for SCS placement to address persistent right-sided hemibody numbness and allodynia (10/10 pain level) despite the administration of Lyrica, Cymbalta, and Neurontin. Ten months following the initial consultation, she underwent a C1 laminectomy with implantation of a high cervical 5-column paddle lead SCS system (i.e., following a prior successful SCS trial) [Figure 5].

Figure 1: Noncontrast computed tomography of the head showing right intraparenchymal and subarachnoid hemorrhage due to aneurysm rupture of the right middle cerebral artery in patient 1.

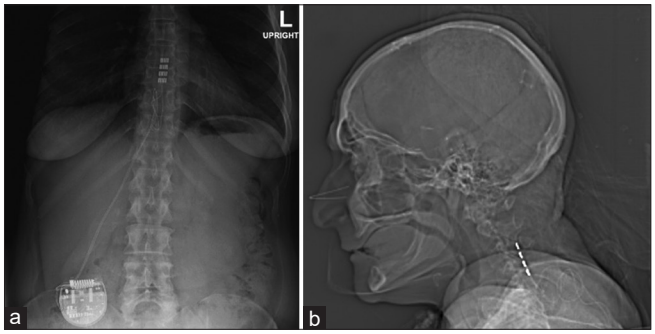

Figure 2: (a) Thoracic and (b) cervical X-rays of the spine showing placement of the thoracic and cervical paddle leads in patient 1.

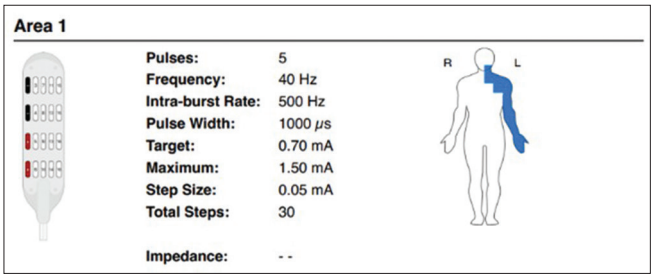

Figure 3: Cervical spinal cord stimulator settings used for satisfactory pain relief in the left upper extremity of patient 1.

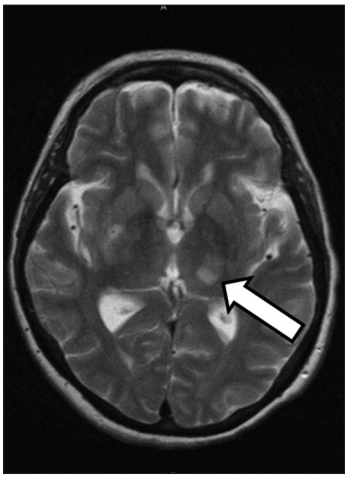

Figure 4: T2 brain magnetic resonance imaging showing left thalamic infarct (arrow) after the second stroke in patient 2.

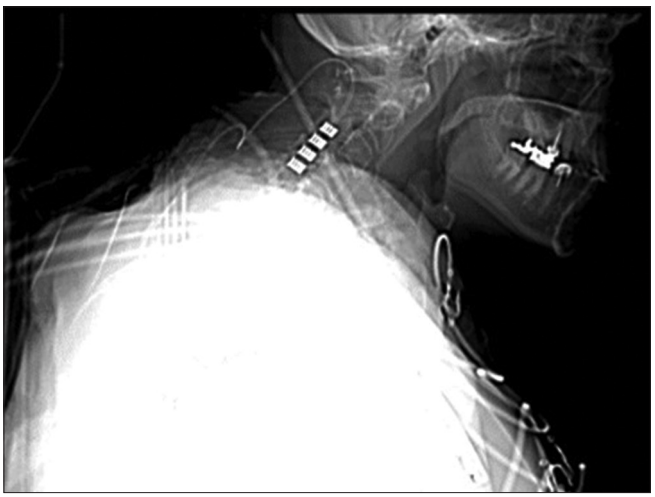

Figure 5: Lateral X-ray showing placement of a high cervical paddle lead in patient 2.

Table 1: Summary of case series treating CPSP with SCS.

Author (n=number of CPSP patients with SCS implant)	Average age (years)	Success rate (%)	Average follow-up (months)
Hosomi *et al.* 2021 (*n*=106)[3]	62.8	59.4	24 (median)
Aly *et al.* 2010 (*n*=10)[1]	61.8	77.8	28
Simpson 1991 (*n*=11)[8]	Not reported	63.6	Not reported
Lopez *et al.* 2009 (*n*=5)[5]	51	100	88
Yamamoto *et al.* 2016 (*n*=19)[11]	58.5	63.2	24
Tanei *et al.* 2019 (*n*=12)[9]	61	66.7	67.3
Katayama *et al.* 2001 (*n*=45)[4]	Not reported	7	Not reported
Tanei *et al.* 2012 (*n*=8)[10]	63.8	62.5	12
Current study (*n*=2)	58.5	100	14.5*

*Follow-up period for case 1 starts at follow-up with the thoracic stimulator, 20 months. CPSP: Central poststroke pain, SCS: Spinal cord stimulation

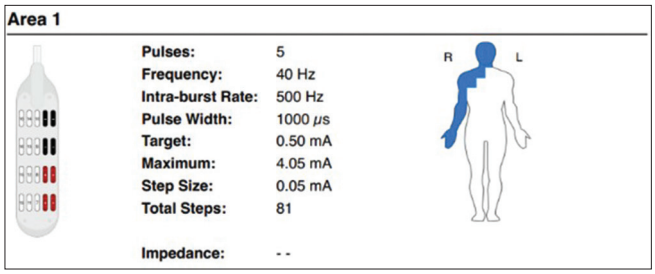

Figure 6: Cervical spinal cord stimulator settings used for satisfactory pain relief in the right upper extremity of patient 2.

Nine months postoperatively, the right hemibody pain and function of the right upper and lower extremities had improved (i.e., using BurstDR programming) [Figure 6].

DISCUSSION

Mechanism of CPSP and treatment with SCS

CPSP occurs when a stroke results in a lesion of the spinothalamic tract (STT) of the central nervous system.[6] Tonic SCS treats neuropathic pain by stimulating inhibitory interneurons in the dorsal horn of the spinal cord, decreasing pain by activating the lateral STT. Burst SCS activates the interneurons and supraspinal areas involved in the emotional processing of pain (i.e., through activation of both the medial and lateral STT).[2] The difference in the mechanisms of BurstDR versus tonic stimulation explains the significant pain relief in these two patients.

CPSP treated with SCS

We identified eight case series of CPSP patients treated with SCS [Table 1]. In 2021, Hosomi *et al.* evaluated 106 CPSP patients who underwent permanent implantation of SCS systems (i.e., the only study to include treatment with BurstDR SCS). They showed a greater association with pain relief compared to the group receiving tonic SCS, but the BurstDR group only included 12 patients.[3] Notably, all other studies used tonic stimulation to treat patients for both hemorrhagic and ischemic strokes.

CONCLUSION

We present two cases of CPSP successfully treated with the implantation of paddle lead SCS with BurstDR programming.

Ethical approval

Institutional review board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

Dr. Nestor D. Tomycz: Dr. Nestor D. Tomycz serves as a consultant for and receives grant support from Abbott Neuromodulation. He serves on the surgeon advisory board for Boston Scientific. The remaining authors have no conflicts of interest to report.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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How to cite this article: Busch NL, Esplin N, Patterson M, Tomycz ND. Successful relief of central poststroke pain with BurstDR spinal cord stimulation: A case series. Surg Neurol Int. 2024;15:60. doi: 10.25259/SNI_696_2023