



Original Article

The use of high-dose cervical spinal cord stimulation in the treatment of chronic upper extremity and neck pain

Trey A. Baird, Chris S. Karas

Department of Neurosurgery, Grant Medical Center, 111 S Grant Ave, Columbus, Ohio, USA.

E-mail: *Trey A. Baird - trey.baird@aol.com; Chris S. Karas - chris.karas@ohiohealth.com



***Corresponding author:**

Trey A. Baird,
Department of Neurosurgery,
Grant Medical Center, 111 S
Grant Ave, Columbus, Ohio
43215, USA.

trey.baird@aol.com

Received : 11 April 19

Accepted : 07 May 19

Published : 19 June 19

DOI

10.25259/SNI-249-2019

Quick Response Code:



ABSTRACT

Background: Dorsal column spinal cord stimulation is used for the treatment of chronic neuropathic pain of the axial spine and extremities. Recently, high-dose (HD) thoracic dorsal column stimulation for paresthesias has been successful. This study evaluates the utility of HD stimulation in the cervical spine for managing upper neck and upper extremity pain and paresthesias.

Methods: Three patients suffering from cervical and upper extremity chronic pain were assessed. Each underwent a two-stage process that included a trial period, followed by permanent stimulator implantation. Therapy included the latest HD stimulation settings including a pulse width of 90 μ s, a frequency setting of 1000 Hz, and an amplitude range of 1.5 amps–2.0 amps. Pain relief was measured utilizing relative percent pain improvement as self-reported by each patient before and after surgery.

Results: After permanent implantation, (range 15–21 months), all three patients continued to experience persistent pain and paresthesia relief (70%–90%).

Conclusions: In three patients, HD cervical spinal cord stimulation successfully controlled upper extremity chronic pain/paresthesias.

Keywords: Cervical stimulation, Dorsal column spinal stimulation, High-dose spinal cord stimulation, Paresthesia-free stimulation

INTRODUCTION

Within the past few decades, the use of dorsal column stimulation has increased as an alternative method for the long-term treatment of chronic neuropathic pain of the axial spine and extremities.^[4] Here, we explored the efficacy of high-dose (HD) cervical column stimulation in three patients. Our aim was to better define the appropriate programming needed to attain cervical paresthesia-/pain-free control.^[2]

CASE REPORTS

The three patients involved in this study averaged 48 years of age and included two males and one female [Table 1]. All patients presented with upper extremity pain and underwent cervical magnetic resonance (MR) studies to document sufficient space within the cervical canal to place a stimulator.

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

©2019 Published by Scientific Scholar on behalf of Surgical Neurology International

MR imaging findings

The MR for one patient showed that they have sustained a gunshot wound to the nerve roots; however, the spinal cord was intact, and there was no stenosis or significant degenerative disease. The second patient had as cervical degenerative foraminal disease with moderate central stenosis from C2 through C7; these contributed to cervicalgia and bilateral radiculopathy. Patient 3 did show no cervical degenerative changes (diagnosis of chronic regional pain syndrome).

Initial external trial

Each patient underwent a Stage 1 cervical spinal cord stimulator trial placement with externalized extension leads. This required two 1 × 8 percutaneous epidural arrays advanced to the c2/3 level bilaterally or eccentric to the affected side. A 5-day programming trial of both low-dose (LD) paresthesia and HD paresthesia-free therapy was applied. All three patients experienced >50% pain relief without paresthesias using pulse width 90 μs, frequency setting 1000 Hz, and amplitude range of 1.5 amps–2.0 amps. Stage 2 extension lead removal with generator connection and implantation (permanent) was performed in all three cases.

RESULTS

During the trial period, all patients experienced >50% pain relief (range 70%–90%) without paresthesias utilizing the HD program. Pain returned to baseline levels with the device off. LD therapy was less successful [Table 2]. Trial period results led to permanent cervical spinal cord stimulator implantation without any complications. All three patients continue to experience persistent and current paresthesia-free pain control (range 15–21 months).

DISCUSSION

These three patients indicate the feasibility of using HD cervical spinal cord stimulation to elicit paresthesia free pain control. One study in literature also reports the effective use of HD stimulation in both the cervical and dorsal spinal column for the sole purpose of pain control.^[1] Notably, all three patients like some found in literature disliked the paresthesias that accompanied LD stimulation in the programming trial; this led some in the other studies to defer therapy.^[5] In the future, more extensive studies should be conducted to determine the long-term effects of HD cervical spinal cord stimulation.

Risks and complications

These stimulators were placed in the same location as dorsal column stimulators. To date, there are no known complications of HD stimulation programming. A meta-analysis of surgical complications for spinal cord stimulator placement reports mean complication rates as follows: lead migration (15.49%), lead fracture/malfunction (6.37%), pain at the site (6.15%), infection (4.89%), battery failure (1.7%), major neurologic deficit (0.25%), and hardware erosion (7%).^[3] Further studies are required to investigate the long-term safety of HD stimulation.

CONCLUSIONS

Three patients underwent HD cervical spinal cord stimulation and attained pain-/paresthesia-free treatment of upper extremity/neck chronic pain generators. However, the significant risks and complications of these procedures must be carefully taken into account when choosing to use this treatment modality for pain alone.

Table 1: Patient information.

| Patient | Pathology/diagnosis | Location of pain | Gender | Age |
|---------|--|---------------------------|--------|-----|
| 1 | Posttraumatic neuropathy | Right Upper Extremity | Male | 43 |
| 2 | Cervical degenerative foraminal and central stenosis | Bilateral upper extremity | Male | 68 |
| 3 | Chronic regional pain syndrome | Left upper extremity | Female | 32 |

Table 2: Results of stimulation.

| Therapy received | Patient 1 | Patient 2 | Patient 3 |
|------------------|---------------------------------|---------------------------------|---------------------------------|
| HD therapy | (–) P Optimal pain relief | (–) P Optimal pain relief | (–) P Optimal pain relief |
| LD therapy | (+) P Suboptimal pain relief | (+) P Suboptimal pain relief | (+) P Suboptimal pain relief |

HD indicates high-dose therapy. LD indicates low-dose therapy. (–) P denotes the absence of paresthesias during stimulation. (+) P denotes the presence of paresthesias during stimulation

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Al-Kaisy A, Palmisani S, Smith TE, Carganillo R, Houghton R, Pang D, *et al.* Long-term improvements in chronic axial low back pain patients without previous spinal surgery: A Cohort

- analysis of 10-kHz high-frequency spinal cord stimulation over 36months. *Pain Med* 2018;19:1219-26.
2. De Jaeger M, van Hooff RJ, Goudman L, Valenzuela Espinoza A, Brouns R, Puylaert M, *et al.* High-density in spinal cord stimulation: Virtual expert registry (DISCOVER): Study protocol for a prospective observational trial. *Anesth Pain Med* 2017;7:e13640.
3. Eldabe S, Buchser E, Duarte R. Complications of spinal cord stimulation and peripheral nerve stimulation techniques: A review of the literature. *Pain Med* 2015. Available from: <https://academic.oup.com/painmedicine/article/17/2/325/2460710>. [Last accessed on 2019 Apr 27].
4. Hegarty D. Spinal cord stimulation: The clinical application of new technology. *Anesthesiol Res Pract* 2012;2012:375691.
5. Sweet J, Badjatiya A, Tan D, Miller J. Paresthesia-free high-density spinal cord stimulation for postlaminectomy syndrome in a prescreened population: A Prospective case series. *Neuromodulation* 2016;19:260-7.

How to cite this article: Baird TA, Karas CS. The use of high-dose cervical spinal cord stimulation in the treatment of chronic upper extremity and neck pain. *Surg Neurol Int* 2019;10:109.