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Spinal Cord Stimulator Migration and Malfunction in the Setting of Upper Extremity Complex Regional Pain Syndrome: A Case Report

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Background: Common long-term complications for neuromodulation include lead migration, loss of efficacy of therapy, and lead malfunction. The following case describes pitfalls of lead migration and preventative steps to decrease risk of this complication.

Case Report: This is an independent case study following the outcome of one patient diagnosed with complex regional pain syndrome that had failed conservative therapy. She underwent implantation of a spinal cord stimulator (SCS) with > 90% relief. Loss of relief was described on follow-up. On reimaging, the SCS had migrated cephalad and this was likely the cause of the malfunction.

Conclusions: Lead migration can occur at any time, even years after initial implantation. Recommendations from the literature and gained from this case include heightened vigilance and suspicion when a patient encounters sudden failure of pain relief, low threshold for new imaging to assess lead location, and use of mechanical anchoring devices.

Key words: Neuromodulation, spinal cord stimulator, CRPS, chronic regional pain syndrome, pain, chronic pain, case report

BACKGROUND

Neuromodulation is a well-studied treatment modality for chronic neuropathic pain, utilizing leads usually placed in the epidural space to deliver energy pulses. Though the method of action is not thoroughly understood, it is theorized that these energy pulses stimulate large A-beta nerve fibers; thus, interrupting the pain signals from the periphery carried by smaller C and A-delta fibers (1). Another theory is the activation of inhibitory gamma-aminobutyric acidergic and cholinergic spinal interneurons as increased amounts of the neurotransmitters have been seen in animal models utilizing spinal cord stimulars (SCS) (2). While failed lower back surgery is the most common indication, there is also use in other chronic pain syndromes, including diabetic and ischemic peripheral neuropathy, refractory angina, and complex regional pain syndrome (CRPS).

The use of neuromodulation in CRPS has been demonstrated to be effective in review of the literature. While it is shown to reduce pain and decrease long-term costs of treatments (3), SCS therapy is not without its complications. Common long-term complications for neuromodulation include lead migration, loss of efficacy of therapy, and lead malfunction. The following case describes the pitfalls of lead migration and preventative steps to decrease the risk of these complications.

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CASE PRESENTATION

A 38-year-old woman with a history of Turner syndrome and thoracic outlet syndrome treated with first rib resection 5 years prior presents to the clinic with progressive left-hand pain. On visitation to the chronic pain clinic 5 years later, the pain is mostly located in the left hand and radiates intermittently throughout the left hand and up her arm. She described this pain as a constant sharp, throbbing, burning, and electric shock sensation. She had sensations of numbness and tingling in the left hand. Nothing was described to alleviate the pain, while increased activity worsens it. She described lack of sleep and frustration caused by this pain. Interval therapies included nonsteroidal anti-inflammatory drugs, multiple steroid injections, physical therapy, acetaminophen-codeine, and gabapentin, as well as the first rib resection, all with no relief.

Utilizing the Budapest Criteria, a set of accepted guidelines adopted by the International Association for the study of Pain (IASP) in 2004, the patient reported motor, sensory, sudomotor, and vasomotor changes. Objectively, she had decreased range of motion, allodynia, swelling, and increased pigmentation of her left hand. Bone scan also showed decreased flow consistent with left distal upper extremity CRPS. Neuromodulation was offered as a treatment option. The patient underwent a stimulator trial, with leads implanted at C2. At her lead pulling appointment, she reported > 90% relief during the trial, as well as improved function and mobility. On observation, the swelling and redness in her left hand had decreased significantly.

Given the success of the trial, surgical implantation of cylindrical leads was performed, with 0-Ethibond (Ethicon, Somerville, NJ) utilized for anchoring the leads to the fascia. Follow-up at 3 months showed continued successful treatment. However, on her 6-month postimplantation visit, she stated that the stimulator rapidly and spontaneously stopped providing adequate relief. On fluoroscopic evaluation, caudal lead migration was noticed. Revision surgery was performed, again with 0-Ethibond anchoring the leads to the fascia, making sure to have extra slack, as well as extra sutures. Once again, successful pain relief and improved function for the patient were obtained.

The patient has provided consent for this case to be published in accordance with the Health Insurance Portability and Accountability Act privacy regulations, and all personal identifiers were removed from this case report.

DISCUSSION

Consideration of implanting SCSS is recommended by the Neurostimulation Appropriateness Consensus Committee (NACC) "after failure to achieve therapeutic goals with pharmaceutical or injection therapies for cervical radicular pain and upper extremity CRPS (4)." However, there are long-term complications that may present themselves with the use of permanent SCSS. The most common complications noted in the literature are hardware related, such as lead migration or breakage, causing loss of effectiveness of therapy. A review by Eldabe et al (5) placed the overall rate of SCS migration at 10% to 25%. Another review by Hayek et al (6) of 345 patients noted hardware issues to make up 74.1% of all complications. When this occurs, the patients encounter sudden return of pain and loss of relief to the targeted area, as the patient presented in this case did. On top of the failed therapy, these complications can lead to increased costs and need for revision surgery. Causes of migration can be hypothesized as due to mechanical stress from strenuous activity, fall/trauma, or lack of or insufficient anchoring (5). The case described possibly had migration secondary to the mechanical forces in the neck as the range of motion is increased relative to the lumbar region; however, there is not conclusive evidence to state that cervical leads migrate more often than thoracic or lumbar leads.

The NACC has recommendations regarding the best practices for cervical neurostimulation, including surgical technique and management of complications. Specific recommendations regarding anchoring include anchoring to the thoracodorsal fascia and accounting for the mobility of the anchoring site (4). Kumar et al (7) also have more specific recommendations for anchoring, including use of size 0 black braided nylon anchored to the deep fascia, and the placement of a strain relief loop to allow for some slack to the lead and decrease chances of tugging with movement.

New hardware and techniques are continually being described to avoid this complication. New mechanical anchors have been developed and may have an important role to play, with a case series by Justiz et al (8) of 66 patients showing no incidence of lead migration after a mean follow-up of 38 weeks utilizing a novel anchor device. North et al (9) details the efficacy of injecting adhesive around the lead anchor, virtually eliminating any cases of lead migration in their case series with a mean follow-up of 2.86 years. Laminotomy has been thought to be superior in regards to lead migration

compared to percutaneous placement. However, a study (10) comparing laminotomy with percutaneous placement using mechanical anchoring showed no significant difference in lead migration outcome, solidifying the efficacy of anchoring the leads mechanically with less invasive placement.

CONCLUSIONS

A case presentation of lead migration in a patient treated with a SCS for CRPS type I has been described. Lead migration can occur at any time, even years after initial implantation. Recommendations from the literature and gained from this case include heightened vigilance and suspicion when a patient encounters sudden failure of pain relief, low threshold for new imaging to assess lead location, and use of mechanical anchoring devices. New anchoring techniques and implanting devices continue to attempt to bring down the incidence of this painful and costly complication.

REFERENCES

1. Garcia K, Wray JK, Kumar S. Spinal cord stimulation. In: Kumar S (ed). *StatPearls [Internet]*. StatPearls Publishing, Treasure Island, FL, 2022.
2. Prager JP. What does the mechanism of spinal cord stimulation tell us about complex regional pain syndrome? *Pain Med* 2010; 11:1278-1283.
3. Kumar K, Malik S, Demeria D. Treatment of chronic pain with spinal cord stimulation versus alternative therapies: Cost-Effectiveness analysis. *Neurosurgery* 2002; 51:106-115; discussion 115-116.
4. Deer TR, Russo M, Grider JS, et al. The Neurostimulation Appropriateness Consensus Committee (NACC): Recommendations on best practices for cervical neurostimulation. Neuromodulation 2022; 25:35-52. Erratum in: *Neuromodulation* 2022; 25:482.
5. Eldabe S, Buchser E, Duarte RV. Complications of spinal cord stimulation and peripheral nerve stimulation techniques: A review of the literature. *Pain Med* 2016; 17:325-336.
6. Hayek SM, Veizi E, Hanes M. Treatment-Limiting complications of percutaneous spinal cord stimulator implants: A review of eight years of experience from an academic center database. *Neuromodulation* 2015; 18:603-608; discussion 608-609.
7. Kumar K, Buchser E, Linderoth B, Meglio M, Van Buyten JP. Avoiding complications from spinal cord stimulation: Practical recommendations from an international panel of experts. *Neuromodulation* 2007; 10:24-33.
8. Justiz R III, Bentley I. A case series review of spinal cord stimulation migration rates with a novel fixation device. *Neuromodulation* 2014; 17:37-40; discussion 40-41.
9. North RB, Recinos VR, Attenello FJ, Shipley J, Long DM. Prevention of percutaneous spinal cord stimulation electrode migration: A 15-year experience. *Neuromodulation* 2014; 17:670-676; discussion 676-677.
10. Kim DD, Vakharyia R, Kroll HR, Shuster A. Rates of lead migration and stimulation loss in spinal cord stimulation: A retrospective comparison of laminotomy versus percutaneous implantation. *Pain Physician* 2011; 14:513-524.