PAIN MEDICINE CASE REPORTS

ISSN 2768-5152

Volume 9, Number 2, pp. 137-141

A Rare Case of Spinal Cord Injury After Uncomplicated Implantation of a Spinal Cord Stimulator: A Case Report

Jimmy Wen, BA[1], Shannon Dwyer, BA[1], Sugamjot Badhan, BS[1], Ramy Khalil, BS[1], and Foad Elahi, MD[2]

Background: Spinal cord stimulation (SCS) is an efficacious, safe, and well-documented procedure for treating chronic refractory pain syndromes. We report a rare case of spinal cord injury (SCI) after SCS implantation in a 54-year-old woman.

Case Report: A 54-year-old woman underwent reimplantation of a new SCS following an acute L2 compression fracture that led to significant pain and dysesthesia. The intraoperative course was uncomplicated. Immediately postoperatively, the patient experienced an inability to move her right leg, with magnetic resonance imaging showing epidural fluid collections at the level of lead insertion; after subsequent removal of the SCS, the patient continued to experience paralysis in the right leg, with the development of painful neuropathy and allodynia. The patient was sent to acute rehabilitation, where her lower limb strength gradually improved, but has not returned to baseline.

Conclusions: This case provides a useful clinical and procedural case on postoperative SCI after an uncomplicated SCS implantation.

Key words: Back pain, intraoperative neuromonitoring, MRI, spinal cord injury, spinal cord stimulator

BACKGROUND

Chronic low back pain (LBP) is a significant contributor to professional, economic, and medical burden (1). A 2021 report (2) found that over 619 million people globally suffered from LBP, with projections estimating that figure to rise to 843 million people by 2050. For refractory cases, spinal cord stimulation (SCS) provides a viable alternative that has shown efficacy in improving quality of life and reducing opioid requirements (3,4). SCS is a relatively safe procedure but does carry infrequent yet serious complications, including device migration, infection, neurological changes, and epidural hemorrhages (5).

In this report, we present a unique case of a patient with a history of chronic back pain, lumbar fusion, and multiple SCS placements, who developed acute right lower extremity (RLE) paralysis, paresthesias, and significant allodynia following an SCS revision procedure. The patient provided informed consent to be included in this case report. This case report addresses the significance of precise intraoperative technique and the timely intervention of potentially serious complications associated with SCS.

CASE PRESENTATION

A 54-year-old female patient presented with a history of chronic LBP and bilateral leg pain following a motor vehicle accident with 2 lumbar spine fusions (L4-L5 anterior and L5-S1 posterior) 20 years ago and SCS placement in 2012. The SCS was replaced, in November 2022, with a

From: [1]California Northstate University College of Medicine, Elk Grove, CA; [2]California Center of Pain Medicine & Rehabilitation, Fair Oaks, CA

Corresponding Author: Jimmy Wen, BA, E-mail: jdoub2009@berkeley.edu
Disclaimer: There was no external funding in the preparation of this manuscript.
Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.
Patient consent for publication: Consent obtained directly from patient(s).
This case report adheres to CARE Guidelines and the CARE Checklist has been provided to the journal editor.
Accepted: 2025-02-03, Published: 2025-04-30

Nevro system (Nevro Corp., Redwood City, CA). In April 2023, the patient sustained an L2 vertebral compression fracture while riding a ferry and developed intermittent numbness and tingling bilaterally in her thighs and calves. Additionally, she had pain in the thoracic and lumbar spine with intermittent spasms in the medial thighs. She reported insignificant pain control from the Nevro system and noted a sensation of dysesthesias, leading her to turn the system off in June 2023. An epidural steroid injection was trialed, in October 2023, which led to a reported 65% relief for 3 months. She requested that her SCS be replaced with her previous system. A preoperative electrodiagnostic examination showed chronic right L2-L3 radiculopathy and mild subacute/chronic right-sided L4 and S1 radiculopathy.

In June 2024, the Nevro leads at T9 and T10 and the pulse generator were removed. Following this, the Abbott SCS lead at T9-T10 and pulse generator (Abbott, Plano, TX)were placed, but the T8-T9 lead was unsuccessful due to epidural scarring (Fig. 1).

Upon awakening, she reported RLE paralysis with no paresthesias or contralateral lower extremity issues. A magnetic resonance imaging (MRI) of the thoracic spine showed postsurgical fluid collection, or pseudomeningocele, extending along the right dorsal epidural space from T12-L1 at the level of the SCS lead insertion into the spinal canal up to T11 (Fig. 2).

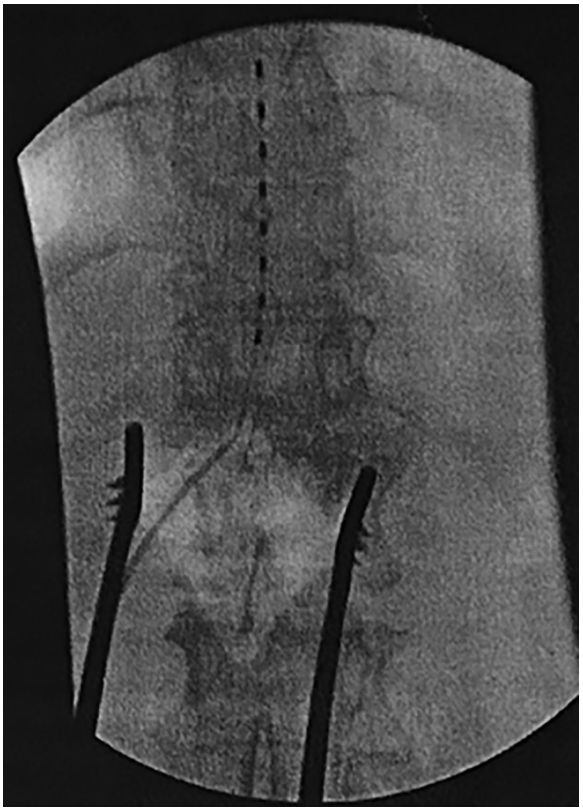

Fig. 1. Intraoperative radiography of spinal cord stimulator lead placement.

Moderate central canal stenosis with left anterior displacement of the conus medullaris with a mild mass event was noted, with a small T2 hyperintensity within the conus medullaris (Fig. 3). Later that day, she began experiencing right foot paresthesias and paralysis, and the patient agreed to remove the SCS. A repeat MRI of the thoracic spine, on the following day. showed a near-complete resolution of the epidural fluid collection. However, there was unchanged subtle T2 hyperintensity at T11-T12 on the right and T12-L1 at the right paracentral, suggesting a subtle conus medullaris contusion. She reported a constant sharp, shooting, and numbing sensation on the right bottom of the foot, lateral dorsum of the right foot, and posterior right knee. Upon examination, there was significant allodynia to tactile and thermal stimulation of the right leg in the distribution of right L4-S1 and possibly S2. The patient still reported RLE paralysis. She was put on Lyrica 100 mg orally t.i.d, baclofen 10 mg t.i.d, morphine extended-release 15 mg b.i.d, an intravenous drip, and acetaminophen/hydrocodone 10 mg/325 mg every 6 hours as needed, with a recommendation for intensive physical and occupational therapy.

The following day, she reported a 30% to 40% improvement in her right foot paresthesias. Her Lyrica was increased to 20 mg t.i.d., and baclofen was increased to 150 mg t.i.d. She continued to have improved paresthesia the next day, and notably, regained slight movement in the quadriceps and digits 2-5 (except the hallux). Postoperative day 4, she reported near complete resolution of her paresthesia, with a slightly painful sensation noted at the tips of all of her right foot digits. On the physical exam, she had 1/5 strength in her right quadricep and 0/5 in the remaining RLE. Postoperative day 5, she had transient upper extremity tremulousness, attributed to the increased Lyrica and baclofen. Upon physical exam, she had trace flexion of the right digits without antigravity movement in the hip, knee, and ankle. There was allodynia in the L5 and S1 distributions with diminished sensation in the L3 distribution.

She was discharged on postoperative day 17, and her RLE strength continued to gradually improve. However, there was no emerging dorsiflexion. Following physical

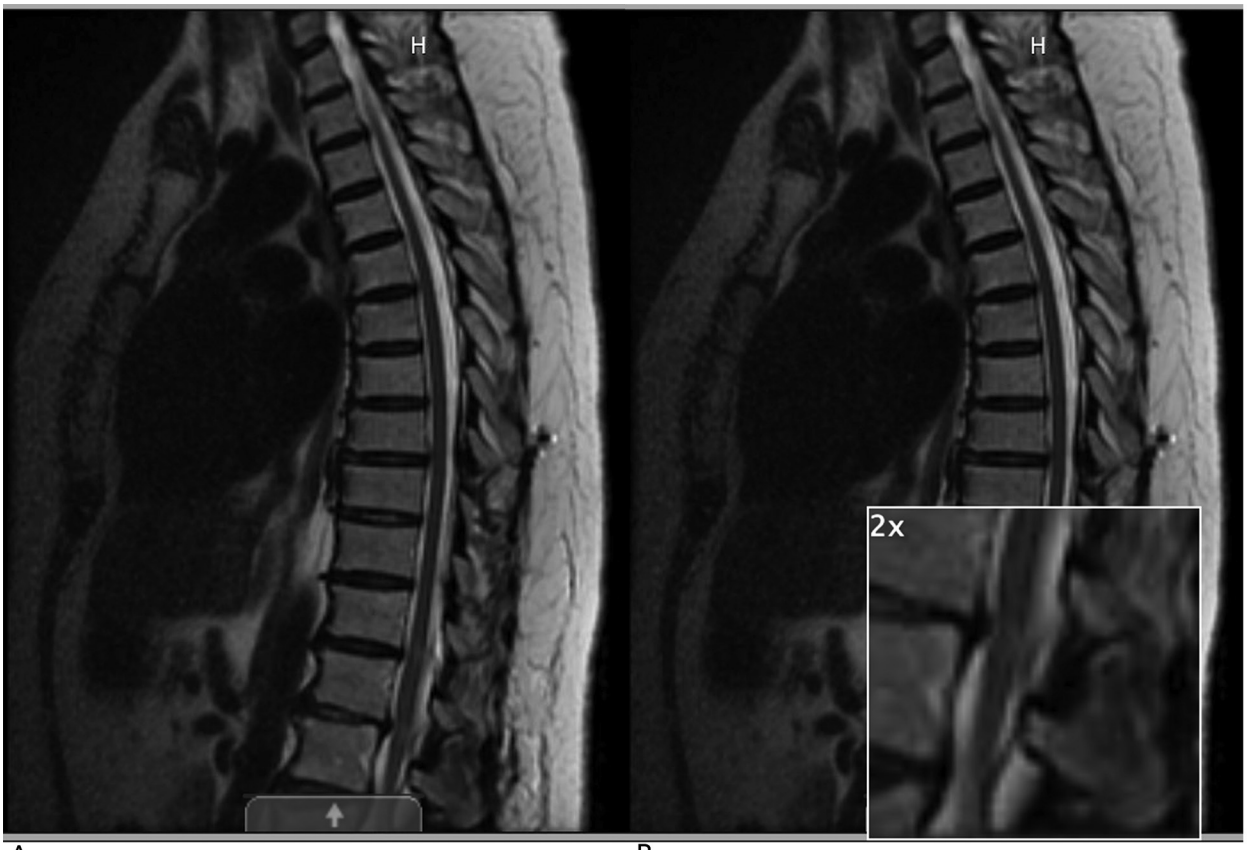

Fig. 2. An MRI depicting epidural fluid collection at T12-L1.

and occupational therapy, her mobility, strength, and pain reduction markedly improved.

DISCUSSION

Our report describes a rare case of spinal cord injury (SCI) following SCS implantation. During the implantation via a percutaneous catheter or needle, the surgeon must be careful in advancing the catheter to avoid SCI. Any obstacles encountered or difficulties in advancing the lead must be addressed by changing the direction of the lead to avoid the obstruction, as attempts to push past the obstacle can result in SCI. In this case, a possible etiology of SCI was during implantation with the needle, with the tip of the needle impacting the conus medullaris. However, there was no cerebrospinal fluid backup at T10-T11 that would be expected. Edema from the passage of the lead could explain the symptoms as mechanical compression of the spinal cord can have both immediate and secondary damage. Secondary damage occurs at the molecular level via immune-mediated reactions, oxidative damage, and excitotoxicity (6).

Recent literature (7) has reported an overall complication rate of 31.9% to 43%. The most common complication seen is electrode/lead migration, but recent anchoring techniques have been successfully utilized to improve the lead implant's stability (5-7). Other complications have also been noted: hematoma, infection, cerebrospinal fluid leak, and case reports of syrinx formation, foreign body reaction, and fibrosis (6). Hardware complications are generally easily revised through revision procedures, but less common complications (e.g., infection, neurological effects) must be promptly diagnosed and treated. Recent findings (5) have found a decrease in the incidence of biological and infectious complications. SCI is a rare but feared complication, but a recent systematic review (8) of 71,172 patients found an overall low incidence rate of 0.42% within 45 days of implantation (n = 302). Variables that were associated with a significantly increased odds ratio of developing SCI

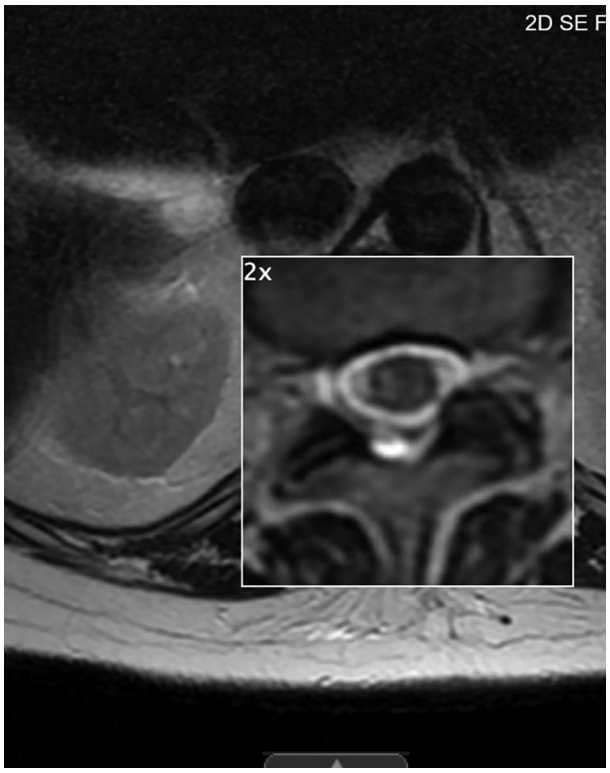

Fig. 4. An MRI showing T2 hyperintensity within the conus medullaris.

were male gender (1.31, 95% CI: 1.04 to 1.65, $P = 0.02$), diagnosis of osteoporosis within 1 year (1.75, 95% CI: 1.15 to 2.66, $P < 0.01$), diagnosis of cervical spinal canal stenosis within 1 year (1.99, 95% CI: 1.37 to 2.90, $P < 0.001$), and diagnosis of thoracic spinal canal stenosis within 1 year (4.00, 95% CI: 2.63 to 6.09, $P < 0.0001$) (7). Additionally, preexisting signs of myelopathy can increase the risk of SCI from SCS or any procedure that involves neuraxial puncture or instrumentation as the increased pressure can further compress the spinal cord (9).

Neurological injuries can present with a variety of symptoms, including paraplegia, bowel/bladder incontinence, and paresthesias. Several case reports or case series (10-12) have described SCI caused by epidural hematomas, spinal cord contusion, progressive or delayed spinal cord compression, and electrode lead mass effect. Mamun et al (10) describe a severe neurological complication following SCS implantation, with the patient experiencing American Spinal Injury Association Impairment Scale C incomplete paraplegia and neurogenic bladder. Postoperative thoracic spine MRI found T2 hyperintensity from T9-T10 to T11-T12, with disc osteophytes, facet hypertrophy, and ligamentum flavum thickening noted. Despite discharge to SCI-rehabilitation and skilled nursing facility, there was minimal improvement in symptoms (10). Wang et al (11) reported a case of an 82-year-old patient following an L1-L2 SCS implantation who experienced an inability to stand or ambulate following the procedure. Imaging showed T12-L1 stenosis and a new annular tear, which was theorized to occur after removal of trial leads. However, her symptoms progressively improved after 7 days (11). Smith et al (12) reported a patient who underwent an SCS implantation at T8-T9 but presented postoperatively with progressive numbness and weakness in bilateral lower extremities. Thoracic spine MRI showed new thoracic disc herniation, spinal cord edema, and multilevel calcified disc herniations with thoracic spinal stenosis. Upon removal of the SCS, the patient continued to have uncontrolled pain and lower extremity weakness, requiring the usage of assistive devices for ambulation (12). Numerous changes in the approach to the implantation of SCS have been developed, and intraoperative neuromonitoring has successfully decreased neurological injury postoperatively (5). Nonetheless, strict monitoring of adverse effects and early intervention are essential in preventing or decreasing the rate and severity of complications.

Current indications for SCS include failed back surgery syndrome, complex regional pain syndrome, angina pectoris, peripheral neuropathy, and peripheral ischemia. SCS is generally reserved for patients with refractory chronic pain who failed treatment with medications, physical therapy, and other mental or procedural modalities (13). An interesting variable to consider is psychosocial characteristics, as severe levels of psychosocial issues affect the clinical outcomes of SCS despite the clinical recommendation for the procedure (14).

The main limitation inherent to this study is that it is a case report of one patient. Studies with larger sample sizes and comparisons with a placebo or an active comparator can better characterize the risk of SCI at varying follow-up lengths. Despite these limitations, this study highlights the possibility of SCI after SCS implantation and is worth taking into consideration when counseling patients about the procedure and during the procedure itself.

CONCLUSIONS

In this case report, we outlined a rare SCI sequela following an uncomplicated SCS implantation for chronic back pain in a patient who previously achieved significant pain relief with a prior SCS. The importance of intraoperative neuromonitoring and postoperative care is paramount to the success of this procedure.

REFERENCES

1. Chang D, Lui A, Matsoyan A, Safaee MM, Aryan H, Ames C. Comparative review of the socioeconomic burden of lower back pain in the United States and globally. *Neurospine* 2024; 21:487-501.
2. GBD 2021 Low Back Pain Collaborators. Global, regional, and national burden of low back pain, 1990-2020, its attributable risk factors, and projections to 2050: A systematic analysis of the Global Burden of Disease Study 2021. *Lancet Rheumatol* 2023; 5:e316-e329.
3. Palmer N, Guan Z, Chai NC. Spinal cord stimulation for failed back surgery syndrome -- patient selection considerations. *Transl Perioper Pain Med* 2019; 6:81-90.
4. Dydyk AM, Tadi P. Spinal cord stimulator implant. In: *StatPearls [Internet].* StatPearls Publishing, Treasure Island, FL 2024.
5. Koushik SS, Raghavan J, Saranathan S, Slinchenkova K, Viswanath O, Shaparin N. Complications of spinal cord stimulators–a comprehensive review article. *Curr Pain Headache Rep* 2024; 28:1-9.
6. Baranidharan G, Bretherton B, Black S. A case series of new radicular pain following the insertion of spinal cord stimulator. *Br J Pain* 2022; 16:450-457.
7. Garg I, Wang D. Complications of spinal cord stimulator trials and implants: A review. *Curr Pain Headache Rep* 2023; 27:837-842.
8. Hussain N, Gill J, Speer J, et al. Evaluating the incidence of spinal cord injury after spinal cord stimulator implant: An updated retrospective review. *Reg Anesth Pain Med* 2022; 47:401-407.
9. Singleton JM, Hefner M. Spinal cord compression. In: *StatPearls [Internet].* StatPearls Publishing, Treasure Island, FL 2024. www.ncbi.nlm.nih.gov/books/NBK557604/
10. Mamun N, Dzierzak E, Goon M, Delgado-Lebron J. Spinal cord stimulator implantation with immediate post-operative paraplegia: Case report. *Interv Pain Med* 2023; 2:100251.
11. Wang D, Qureshi M, Smith J, Khetani N. Spinal cord compression related to spinal cord stimulator. *Pain Med* 2018; 19:212-214.
12. Smith CC, Lin JL, Shokat M, Dosanjh SS, Casthely D. A report of paraparesis following spinal cord stimulator trial, implantation and revision. *Pain Physician* 2010; 13:357-363.
13. Garcia K, Wray JK, Kumar S. Spinal cord stimulation. In: *StatPearls [Internet].* StatPearls Publishing, Treasure Island, FL 2024.
14. Thomson S, Helsen N, Prangnell S, et al. Patient selection for spinal cord stimulation: The importance of an integrated assessment of clinical and psychosocial factors. *Eur J Pain* 2022; 26:1873-1881.