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# Cerebrospinal Fluid Leak Following Explantation of Percutaneous Spinal Cord Stimulator Device: A Case Report

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**Background:** While spinal cord stimulation (SCS) is a safe and effective treatment for chronic pain, some patients require explantation of their devices due to complications or inadequate pain control. The rate of SCS implantation has steadily increased over the years; however, the complications of percutaneous lead extraction have not been well-documented in the scientific literature.

**Case Report:** We present an 86-year-old patient at our institution who developed an intraoperative cerebrospinal fluid (CSF) leak during SCS explantation. The leak was conservatively managed with tight surgical closure and placement of an abdominal binder. The patient tolerated the procedure well and only developed a minor headache which self-resolved.

**Conclusion:** Although rare, SCS lead extraction can cause CSF leakage from unintentional intraoperative dural tear. While most CSF leaks can be managed conservatively and do not require surgical repair, pain physicians need to be well-informed on how to manage CSF leaks that occur during SCS explantation.

**Key words:** Case report, cerebrospinal fluid leak, chronic pain, explantation, spinal cord stimulation

## BACKGROUND

Spinal cord stimulation (SCS) has been proven to be a very safe, effective, and opioid-free treatment for multiple chronic pain conditions including failed back surgery syndrome and complex regional pain syndrome (CRPS) (1-3). These devices exert their effects through neuromodulation of pain signaling via electrodes placed within the epidural space (4,5). Despite its therapeutic benefits, some patients require removal, or explantation, of their stimulator over the course of their lifetime. The explantation rate ranges around 20% to 30%, with the most common reason for explantation being inadequate pain control (1,3,6). While there have been studies describing the complications of SCS implantation, there is a dearth of scientific literature describing adverse effects related to SCS explantation, in particular percutaneous lead electrodes.

## CASE

An 86-year-old woman developed postlaminectomy syndrome after an L4-L5 laminectomy at an outside institution. After failing conservative management, she underwent a permanent Nevro (Redwood City, CA) SCS implant placement in 2017. She subsequently developed implantable pulse generator (IPG) site pain and underwent a SCS battery revision in October 2020. Despite revision, she continued to have recurring IPG site pain and worsening back pain. After a trial of SCS inactivation to rule out lead malfunction, the patient reported no drastic difference in back pain. Thus, she underwent SCS removal in January 2022.

During the case, we entered the skin at the lumbar midline region which was the site of the patient's past surgical incision. We bluntly dissected and opened the deep fascial layers until multiple loops of SCS leads

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were exposed. The suture anchors were released, and both leads were removed without any resistance. The tips of both leads were fully intact. Next, the prior incision site of the IPG in the patient's left flank was bluntly dissected until the IPG was exposed and the leads were free. The IPG along with the epidural percutaneous leads were then pulled out of the IPG pocket without any resistance. During closure of the deep fascial layers of the lumbar midline incision, we noticed continuous serous output concerning for CSF leakage. Multiple attempts were made to control the leakage with suctioning and cautery; however, the rate of serous flow did not decrease. The neurosurgery service was consulted intraoperatively and recommended to continue with tight closure and postoperative monitoring. Deep fascial and dermal layers were closed with 2-0 vicryl simple interrupted suture, followed by a 3-0 Monocryl™ running subcuticular suture to close the skin. During the closure process, the CSF output gradually decreased and resolved. Approximately 20 to 30 mL of CSF was lost during the procedure.

The patient tolerated the procedure well and remained stable after transfer to the recovery room. An abdominal binder was placed tightly on the patient to prevent further leakage as well as to enhance dural healing. The patient was alert and oriented, reporting significant improvement of pain at the previous IPG site and the typical region of her back pain. She did endorse a minor headache after the procedure in the recovery room for which she was instructed to lay flat for a few days and increase fluid and caffeine intake. On the telemedicine follow-up call she reported resolution of headache soon after discharge, with no further interventions needed.

## DISCUSSION

SCS implants have a well-established and safe role in the management of multiple chronic pain conditions. Commercially available SCS devices have either percutaneous electrode leads or surgical paddle leads. SCS percutaneous leads are minimally invasive and placed via an epidural needle, while paddle lead electrodes are placed surgically via a laminectomy. Despite efficacy, complications still arise, and some patients require removal of their stimulator over the course of their lifetime. SCS implantation complications and explantation rates have been well-documented in the literature.

In 2015, Hayek et al (1) performed a retrospective study analyzing 8 years of SCS implantation and associated complications. Of 345 patients, the complication rate was 34.6%, and the rate of explantation was 23.9%. IPG site discomfort, which was present in our patient, was the most common complication (11.1%), followed by lead migration (8.5%). This is in contrast with previous studies which have shown that lead migration has been the most common complication (5). The study also highlighted that the most common reason for explantation was loss of pain relief (41%), also consistent with our patient's experience. In 2019, Simopoulus et al (6) performed a 15-year analysis of the explantation of percutaneous SCS devices. Of 356 patients, the explantation rate was 30%. Reasons for explantation included ineffective pain control (28%), biological complications (26.6%), paresthesia limitations or side effects (26.6%), and hardware complications (13.3%). IPG site pain was categorized as a hardware complication. Of note, 4 out of 5 patients in this study had the generator in the buttock region, which was where the IPG initially was for our patient before it was replaced.

In the current literature, CSF leakage related to SCS implants is very rare, comprising only 0.3% to 7% of SCS complications (2,5). Leaks can occur via accidental dural puncture when placing percutaneous leads through an epidural needle, or a dural tear can be created from a laminectomy during surgical lead placement. Since CSF leaks are such rare occurrences, there is no standard of care for management of CSF leaks caused by SCS. Some studies recommend conservative management as the initial step over surgical repair (2,5). Bendersky et al (5) highlighted that small dural punctures typically heal spontaneously with bed rest and application of a tight abdominal binder over the IPG site for 2 to 3 weeks. During the first 24 to 48 hours, conservative measures based on reduction of differential pressures across the dural puncture site can be greatly beneficial (5). In refractory cases, an epidural blood patch can be used to treat symptomatic CSF leakage presenting as headaches. Surgical exploration is rarely needed and has only been reported in a few cases.

There have been few case reports on complications from SCS explantation. In 2020, Hussain et al (4) reported a case of incidental durotomy causing CSF leakage, but it was from placement of a surgical paddle lead electrode. Ali et al (7) documented a case in 2019 involving syrinx formation and resulting spinal cord injury from percutaneous SCS lead removal. Maldonado

et al (8) is the first and only retrospective study that we found in the scientific literature that examined the complications of SCS electrode removal, although they included only patients with surgical paddle lead electrodes. Out of 68 patients, 8 patients (11.75%) had postoperative complications. One out of the 8 patients developed a CSF leak that required surgical exploration and dural repair. To our knowledge, this is the first case of a CSF leak from percutaneous SCS explantation in the scientific literature. The proposed mechanism for this complication has not been well documented in the literature. We theorize that it may be due to underlying fibrosis of the SCS percutaneous leads. This fibrotic thickening can possibly extend to the patient's dura and can cause an incidental tear while the percutaneous leads are being pulled out during the procedure.

## CONCLUSION

Approximately 50,000 new spinal cord stimulators are implanted worldwide annually (9). As the rate of SCS implants continues to rise, pain physicians need to be well-equipped to manage its complications. Although rare, CSF leaks can occur both during implantation as well as explantation of a SCS device. In our case, the CSF leak was managed conservatively via reduction of differential pressures across the dural tear site with tight closure and placement of an abdominal binder. Future studies with larger samples are needed to better understand how to manage and prevent complications such as CSF leaks during SCS explantation. This case offers insight regarding the management of intraoperative CSF leakage during SCS explantation and may be especially relevant for providers in community settings without access to urgent neurosurgical consultation.

## REFERENCES


1. 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.
2. Eldrige JS, Weingarten TN, Rho RH. Management of cerebral spinal fluid leak complicating spinal cord stimulator implantation. *Pain Pract* 2006; 6:285-288.
3. Patel A, Kafka B, Al Tamimi M. Pseudomeningocele and percutaneous intrathecal lead placement complication for spinal cord stimulator. *J Clin Neurosci* 2019; 59:347-349.
4. Hussain NS, Bissell JN, Gospodarev V, Hussain A. Spinal cord stimulator paddle lead surgery complicated by cerebrospinal fluid leak and fistula formation. *Cureus* 2020; 12:e7619.
5. Bendersky D, Yampolsky C. Is spinal cord stimulation safe? A review of its complications. *World Neurosurg* 2014; 82:1359-1368.
6. Simopoulos T, Aner M, Sharma S, Ghosh P, Gill JS. Explantation of percutaneous spinal cord stimulator devices: A retrospective descriptive analysis of a single-center 15-year experience. *Pain Med* 2019; 20:1355-1361.
7. Ali SS, Bragin I, Khan AY, Tokuno H, Tankha P. Spinal cord stimulator explant and revision complicated by syrinx formation: A case report and literature review. *Cureus* 2019; 11:e5299.
8. Maldonado-Naranjo AL, Frizon LA, Sabharwal NC, et al. Rate of complications following spinal cord stimulation paddle electrode removal. *Neuromodulation* 2018; 21:513-519.
9. Dougherty MC, Woodroffe RW, Wilson S, Gillies GT, Howard MA, Carnahan RM. Risk factors and survival analysis of spinal cord stimulator explantation. *Neuromodulation* 2021; 24:61-67.