

SAFE IMPLEMENTATION OF SPINAL CORD STIMULATION IN A PATIENT WITH A VENTRICULOPERITONEAL SHUNT: A CASE REPORT AND REVIEW OF PROCEDURAL CONSIDERATIONS

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- Background:** Spinal cord stimulation (SCS) is a treatment approved for the management of chronic pain refractory to conservative medical treatment. Ventriculoperitoneal (VP) shunts can pose unique challenges during spinal procedures. This case highlights the careful considerations when evaluating patients with VP shunts for SCS and contributes to the growing body of evidence supporting the safe use of neuromodulation therapies in this medically complex population.
- Case Report:** A 58-year-old woman with communicating hydrocephalus status post VP shunt placement presented with refractory lower back pain despite conservative medical therapy. Subsequently, the patient had permanent SCS placement under general anesthesia without any complications. At follow-up, the patient reported excellent pain control with no evidence of shunt malfunction or neurological compromise.
- Conclusions:** SCS may be safely performed in patients with VP shunts following multidisciplinary evaluation and careful procedural planning. This case adds to the limited literature supporting neuromodulation as a treatment for chronic pain in medically complex patients.
- Key words:** Spinal cord stimulation; ventriculoperitoneal shunt; chronic pain; neuromodulation; hydrocephalus
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BACKGROUND

Spinal cord stimulation (SCS) is a neuromodulation therapy that is approved for the management of chronic pain refractory to conservative medical treatment (1). The device involves the implantation of electrodes in the epidural space alongside a pulse generator delivering controlled electrical impulses to the spinal cord to modulate neural signaling and to reduce pain perception (2). SCS is most commonly indicated for failed back surgery syndrome, complex regional pain syndrome, and painful diabetic neuropathy, offering meaningful analgesia and functional gains when conservative care fails. Given the complexity of patient selection and risks associated

with SCS, the American Society of Regional Anesthesia and Pain Medicine (ASRA), in collaboration with the Neurostimulation Appropriateness Consensus Committee, have established evidence-based recommendations for the safe and effective use of SCS. Current consensus guidelines emphasize appropriate patient selection for SCS, including psychosocial screening and consideration of individual patient characteristics prior to trial stimulation (3). They also outline contraindications including active infection, coagulopathy, and inability to operate the device due to cognitive or psychiatric instability, each necessitating thorough assessment to safeguard patient safety and optimize outcomes. Among the

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medically complex scenarios where the application of SCS poses a significant clinical dilemma is in patients with implanted neurosurgical devices such as ventriculoperitoneal (VP) shunts.

A VP shunt is a medical device surgically implanted to treat hydrocephalus by diverting excess cerebrospinal fluid (CSF) from the brain ventricles to the peritoneal cavity in the abdomen. It mainly consists of a catheter placed in the ventricle of the brain connected to a valve and a distal catheter that drains the CSF into the peritoneal space to decrease intracranial pressure. In patients undergoing spinal procedures, VP shunts pose unique challenges due to altered CSF dynamics and risks of shunt malfunction (4). Although epidural access is generally considered safe with several case studies and series supporting the use of epidural anesthesia in patients with VP shunts, less literature exists regarding SCS use in these patients. This case highlights important multidisciplinary considerations and adds to the limited but growing body of evidence supporting SCS use in patients with VP shunts.

CASE PRESENTATION

The patient is a 58-year-old woman with a past medical history significant for HIV receiving highly active antiretroviral therapy (HAART) with undetectable viral load, communicating hydrocephalus status post VP shunt placement and revision, chronic lumbar facet arthropathy, and major depressive disorder. The patient presented to the pain clinic with refractory lower back pain which had persisted for 9 years without inciting trauma and was described as constant, aching, burning, and throbbing in nature, rated at 8/10 in intensity. The pain radiated bilaterally to the buttocks and was exacerbated by walking and prolonged standing while lumbar extension relieved the pain.

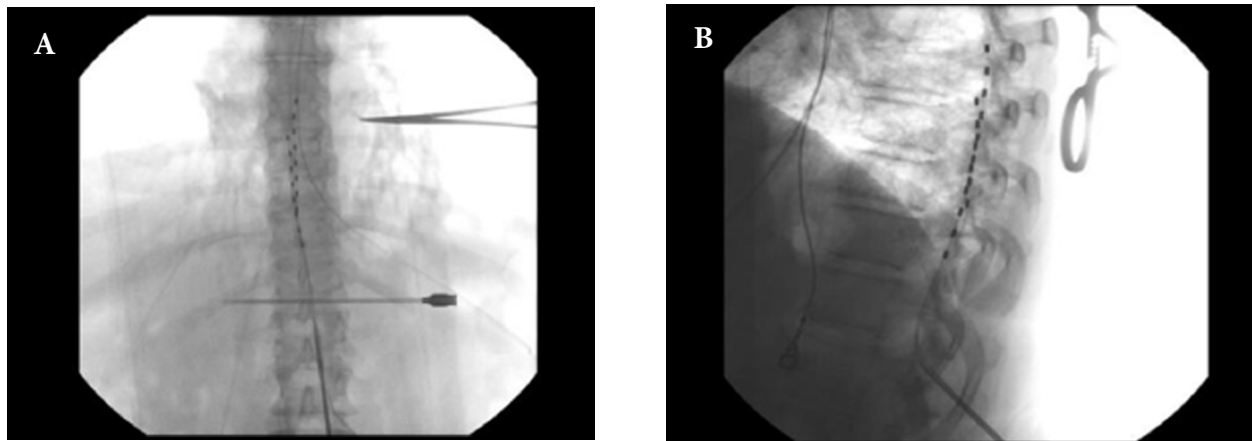
Initial imaging included lumbosacral radiographs, which showed bilateral facet arthropathy from L3 to S1. Lumbar spine magnetic resonance imaging showed severe lumbar facet arthrosis without significant central canal stenosis or foraminal narrowing. The physical examination was notable for bilateral positive Kemp's test. The patient had been previously treated by a pain specialist with physical therapy, nonsteroidal anti-inflammatory drugs, muscle relaxants, neuropathic pain agents, and interventional techniques, including lumbar medial branch radiofrequency ablation and epidural steroid injections, without sustained relief and with significant side effects. Given her chronic refrac-

tory axial low back pain despite extensive conservative and interventional treatment, SCS was considered as a treatment option for nonsurgical refractory back pain rather than for lumbar facet arthropathy alone (5). Following multidisciplinary evaluation, psychological clearance, and discussion of the risks and benefits, the patient underwent an SCS trial, which produced marked improvement in pain and function. The patient had declined further pharmacologic escalation and had been told there were no additional treatment options due to the presence of the VP shunt.

Given the refractory nature of her symptoms and strong interest in pursuing neuromodulation, our team conducted a comprehensive review of potential risks associated with SCS implantation in the setting of a VP shunt. A multidisciplinary team including neurosurgery was assembled, and after thorough discussion, the patient was deemed an appropriate candidate for a percutaneous SCS trial. She subsequently underwent psychological evaluation and was cleared for the procedure. Two days prior to implantation, the patient was evaluated by neurosurgery and had no clinical signs or symptoms of shunt malfunction; the shunt valve refilled briskly on examination. No dedicated imaging or other assessment of the VP shunt catheter route was performed specifically for the SCS procedure.

The procedure was performed under monitored anesthesia care using the Nevro Senza® HFX iQ System (IPG3000; Nevro Corp., Redwood City, CA), programmed with 10-kHz therapy. Bilateral octopolar SCS leads were placed percutaneously into the posterior epidural space under fluoroscopic guidance. The left lead was positioned at the midpoint of T7 and the right lead at the superior endplate of T8. The leads were connected to an external pulse generator, and the trial was conducted over 7 days. The patient reported marked reduction in pain, with intensity decreasing from 8/10 to 1/10, along with significant improvements in ambulation and daily function. Throughout the trial, no complications were observed. There were no signs of increased intracranial pressure, shunt malfunction, or infection. The trial leads were removed without complications.

Nine weeks following the trial, the patient had successful placement of permanent percutaneous SCS under general anesthesia. The left medial lead was placed at the superior endplate of T8 and the right medial lead at the superior endplate of T9 (Fig. 1A,B). A subcutaneous pocket was created for placement of the implantable pulse generator in the left lower



Figs. 1A and 1B display final AP and lateral fluoroscopic views of permanent lead placement.

A. Anteroposterior view of final permanent stimulator lead placement.

Bilateral octopolar SCS leads placed percutaneously into the posterior epidural space under fluoroscopic guidance.

The left medial lead tip was placed to the superior endplate of T8 and the right medial lead tip to the superior endplate of T9.

B. Lateral view of final permanent stimulator lead placement.

Bilateral octopolar SCS leads placed percutaneously into the posterior epidural space under fluoroscopic guidance.

The left medial lead tip was placed to the superior endplate of T8 and the right medial lead tip to the superior endplate of T9.

back. Intraoperative neurophysiological monitoring with electromyography and somatosensory evoked potentials was used throughout the procedure. There were no clinical signs or symptoms of shunt dysfunction intraoperatively, postoperatively, or at the 3-week and 3-month follow-up visits.

Three weeks after the procedure, the patient reported excellent pain relief and satisfaction, with appropriate wound healing and no signs of neurological or infectious complications. At the 3-month follow-up appointment, a numeric pain score was not documented; however, the patient reported excellent overall pain relief with occasional episodes of back pain that resolved with stimulator activation. She also demonstrated substantial functional improvement, including the ability to walk approximately one mile, and expressed satisfaction with her clinical progress.

DISCUSSION

Patients with chronic pain refractory to conservative management may pursue neuromodulation as a therapeutic option. SCS has demonstrated efficacy in select populations; however, identifying appropriate candidates for SCS remains a clinical challenge. Current consensus guidelines emphasize appropriate patient selection, including psychosocial screening and consideration of individual patient characteristics prior to

SCS therapy (2). In patients with a VP shunt, neuraxial procedures warrant additional consideration because of the presence of indwelling CSF diversion hardware and theoretical concerns regarding infection and shunt function. However, the available literature regarding neuraxial procedures in patients with CSF shunts consists primarily of case reports and case series and does not establish a significantly increased complication rate (6).

Adherence to established bleeding-risk mitigation and postprocedural neurologic monitoring is still important.

Despite these concerns, our patient successfully tolerated the percutaneous SCS trial without complications. This favorable outcome reinforces the importance of careful multidisciplinary planning. Current guidelines recommend appropriate perioperative antimicrobial prophylaxis for SCS procedures (7). Perioperative prophylaxis consisted of cefazolin (Ancef). No postoperative antibiotics were administered in this patient. The patient was positioned prone without additional shunt-specific positioning modifications. This case contributes to the limited literature suggesting that, with appropriate precautions and multidisciplinary care, SCS may be performed successfully in patients with VP shunts.

CONCLUSIONS

This case report describes a 58-year-old woman

with HIV on HAART, communicating hydrocephalus status post VP shunt revision, and chronic lumbar facet arthropathy who underwent a percutaneous SCS trial for refractory lower back pain. Given her history of intracranial shunting, the procedure carried increased risks related to altered CSF dynamics, shunt malfunction, and infection. Through careful multidisciplinary planning, including preoperative neurosurgical consultation, imaging review, optimized positioning, and adherence to infection control protocols, the patient was able to

tolerate the trial and permanent implantation without any complications. The patient achieved significant pain relief and meaningful functional improvement.

This case highlights the potential risks of performing SCS in a patient with a VP shunt, and it also demonstrates that with careful preoperative planning and interdisciplinary coordination, the presence of a shunt should not be regarded as a contraindication to SCS therapy.

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