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CASE REPORT

Spinal Cord Stimulation – Device Revision After Weight Loss in a Patient on Chronic Semaglutide – A Case Report

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Background: Spinal cord stimulation (SCS) is an effective treatment option for patients suffering from chronic intractable pain of the trunk and/or limbs. One of the potential adverse effects of SCS is discomfort or pain at the site of the implantable pulse generator (IPG). It is a known phenomenon that patient weight loss may exacerbate or increase discomfort or pain at the IPG implantation site.
Objective: This case report aims to educate neuromodulation clinicians on the potential impact of glucagon-like peptide-1 receptor agonists (GLP-1RA) medications on patient weight loss and decreased subcutaneous adipose tissue stores post-SCS system implant, necessitating lead anchor or IPG pocket revision.
Study Design: Case Report.
Conclusion: The usage of GLP-1RA medications for diabetes or weight loss therapy continues to increase as does the use of implantable SCS systems for the management of chronically painful conditions. Interventional pain management or neuromodulation clinicians should be well-educated on the indications for use of GLP-1RA medications and their associated mechanisms of action, which may lead to weight loss, decreased subcutaneous adipose tissue stores, and muscle wasting, potentially impacting the comfortability of SCS devices. Pre-screening for the use of GLP-1RA medications should occur prior to SCS implant, and clinicians should plan accordingly to minimize the potential for SCS lead anchor or IPG pocket site discomfort. Further, patient's body habitus and adipose tissue stores should be taken into consideration when planning for IPG pocket site location.
Keywords: weight loss, spinal cord stimulation, diabetes, obesity, glucagon-like peptide-1 receptor agonists

Introduction

The use of spinal cord stimulation (SCS) has dramatically increased as an interventional pain management therapy within the past few decades. Traditional dorsal column SCS typically involves the placement of either percutaneous cylindrical stimulating leads or a surgically implanted paddle lead within the posterior epidural space of the spine. The leads are tunneled subcutaneously and connected to an implantable pulse generator (IPG) which is implanted into a subcutaneous pocket, most often in the posterolateral flank. However, the IPG can be placed in other locations, such as the gluteal region, depending upon the patient's body habitus or preference. Currently, SCS is approved by the United States Food and Drug Administration for management of non-surgical refractory back pain, failed back surgery syndrome, diabetic peripheral neuropathy, complex regional pain syndrome, or conditions associated with chronic intractable pain of the trunk and/or limbs.[1–3]

One of the potential complications associated with SCS implant is IPG pocket site pain or IPG-related discomfort. This can occur for a variety of reasons such as suboptimal IPG site placement, where the IPG may be causing friction against a pant line or beltline. While most studies report the incidence of IPG site pain somewhere between 1% and 19%, one survey study of 278 patients showed that up to 64% of patients undergoing SCS implant reported IPG site discomfort or pain.[4–6] IPG site pain may be alleviated with the use of over-the-counter medications, topical agents, or even localized

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injections.[7] Unfortunately, efforts to minimize IPG pocket site pain are not always successful and ultimately, the IPG and/or SCS system may need to be surgically revised to a new location or explanted. Observations of the IPG explanation have been reported between 1.38% and 3.49%.[5]

With regard to IPG site location, one study showed that of 175 patients with buttock IPG placement 29.14% (n = 51) underwent at least one revision surgery, whereas of 75 patients with flank IPG placement 16% (n = 12) underwent at least one revision surgery.[6] In addition to pocket-site discomfort, patients may develop discomfort at the placement of SCS lead anchors. While these anchors may be less perceptible by patients with adequate subcutaneous tissue stores, patients with normal or lower BMIs may develop discomfort over the anchor sites.[8] Therefore, it has been recommended that clinicians should consider the texture or firmness of lead anchors in patients with lower BMIs.[8]

Thoughtful pre-procedure planning of anchor type and placement, as well as IPG pocket site location may help minimize the risk of discomfort leading to subsequent lead anchor or IPG pocket revisions. However, another reason for IPG pocket site discomfort may be that of post-SCS implant weight loss, which may also lead to revision or repositioning of the IPG to a more comfortable location.[9] Weight loss not only increases the prominence of the IPG within the pocket site due to loss of subcutaneous adipose tissue stores, but it may also be associated with loose tissue, which can result in IPG tilting or difficulties connecting to a charger for rechargeable IPGs. Post-SCS implant weight decline may be due to improved pain control and increased physical activity, resulting in increased caloric expenditure. Additionally, there has been a rapid increase in the usage of glucagon-like peptide-1 receptor agonists (GLP-1RA), such as Semaglutide (Ozempic) or Liraglutide (Victoza), for treatment of type 2 diabetes and obesity.[10] The GLP-1RA medications stimulate insulin secretion from the pancreatic islets cells and are more resistant to degradation, which allows for a longer half-life.[11] GLP-1RA medications slow gastric emptying, suppress appetite, and improve satiety, among other actions.[11] Due to the patient's decreased caloric intake associated with treatment of GLP-1RA medications, muscle wasting has been associated with their usage.[10] Semaglutide has been associated with lean mass loss of up to 40% of total weight loss; liraglutide with up to 60%.[12,13]

In addition to weight loss and improvement in glycemic control, Liraglutide has shown a lower risk of death from cardiovascular causes, and Semaglutide has shown a 26% risk reduction in death from cardiovascular cause.[14] Further, studies with Semaglutide have found improvements in heart failure symptoms, a reduction in major adverse cardiovascular events, and improvements in inflammatory markers such as C-reactive protein and tumor necrosis factor-alpha.[14] Beyond the cardiovascular benefits of GLP-1RA medications, newly published research has also shown patients with type 2 diabetes and chronic kidney disease may benefit from added therapy with Semaglutide in an effort to reduce kidney failure.[15] This case report aims to educate neuromodulation clinicians on the potential impact of GLP-1RA medications on patient weight loss post-SCS system implant, necessitating lead anchor or IPG pocket revision. The patient provided both verbal and written informed consent to publish the presented case in medical journals. No additional institutional approval was required to proceed with case publication.

Case

A 58-year-old male with a past medical history of type 2 diabetes, obesity, and prior L5-S1 fusion, had a dorsal column spinal cord stimulator (dual 8-contact lead system) implanted at an outside medical facility with leads over the T8-10 level in 2008 for the indication of post-laminectomy syndrome. The system was revised over time for lead migration in 2016 (Figure 1) and for battery replacements as needed at battery end of life.

In March 2024, he was initiated on Semaglutide (Ozempic) injected subcutaneously once weekly for management of his diabetes. His BMI reduced from >35 kg/m^2 (March 2024) to 32.1 kg/m^2 (November 2024) and his Hemoglobin A1c (HbA1c) decreased from 7.6% to 6.9% within that timeframe. Between March and November of 2024, the patient self-reported weight loss of approximately 15 kg with use of the Semaglutide.

In November 2024, the patient presented with complaints of lead anchor and IPG site discomfort after weight-loss secondary to Semaglutide. Interestingly, he reported his abdominal girth had not reduced, but he had instead noticed reduction of adipose tissue and muscle mass of the posterior trunk. However, he was overall pleased with the weight loss and improvement in his HbA1c lab values. Vital signs at the time of office visit included height: 175.26 cm, weight: 98.43 kg, BMI: 32.1 kg/m^2. Medications included: Semaglutide 1 mg injected weekly, pregabalin 300 mg twice daily,

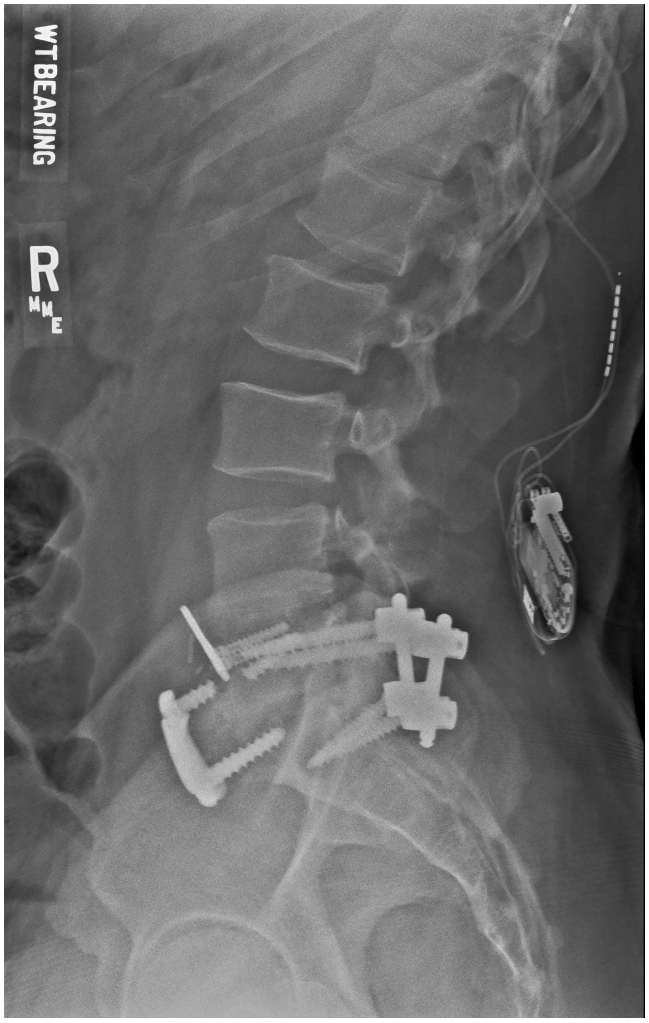

Figure 1 Lateral plain radiograph of the case report patient's migrated spinal cord stimulator (SCS) lead and subcutaneously placed implantable pulse generator (IPG). One of the leads can be seen remaining within the epidural space whereas one of the eight-contact leads has migrated out of the epidural canal into the subcutaneous tissue superior to the IPG in the right lower lumbar region. The patient subsequently went under lead revision to place the migrated lead back into the epidural space.

topical diclofenac gel, and acetaminophen as needed. Physical examination revealed a 58-year-old gentleman in no acute distress with anterior/central adiposity. Examination of the posterior trunk revealed a prominent palpable SCS anchor in the mid-thoracic region associated with pain upon palpation. Patient was also tender over the right lower flank IPG pocket site. Lateral plain films of the lumbar spine (Figure 2) revealed proper SCS lead placement in the dorsal column of the mid-thoracic spine. However, the IPG site was visibly shallow on the x-ray imaging.

The patient subsequently underwent successful SCS lead anchor revision, resulting in improvement in his lead anchor site discomfort. The patient's managing SCS implanter was tentatively planning for a second stage of revision, moving the existing IPG from the right posterolateral flank to the gluteal region, should his IPG site discomfort not improve.

Discussion

Interventional pain and neuromodulation clinicians are now treating chronically painful conditions in a growing population of patients who are taking GLP-1RA medications for management of diabetes and/or weight. These medications have been associated with weight loss, decreased subcutaneous adipose tissue stores, and muscle wasting. As such, it is imperative that clinicians begin to pre-screen potential neuromodulation patients for the usage of GLP-1RA medications as the associated weight loss or muscle wasting may lead to device complications such as lead anchor or IPG pocket site

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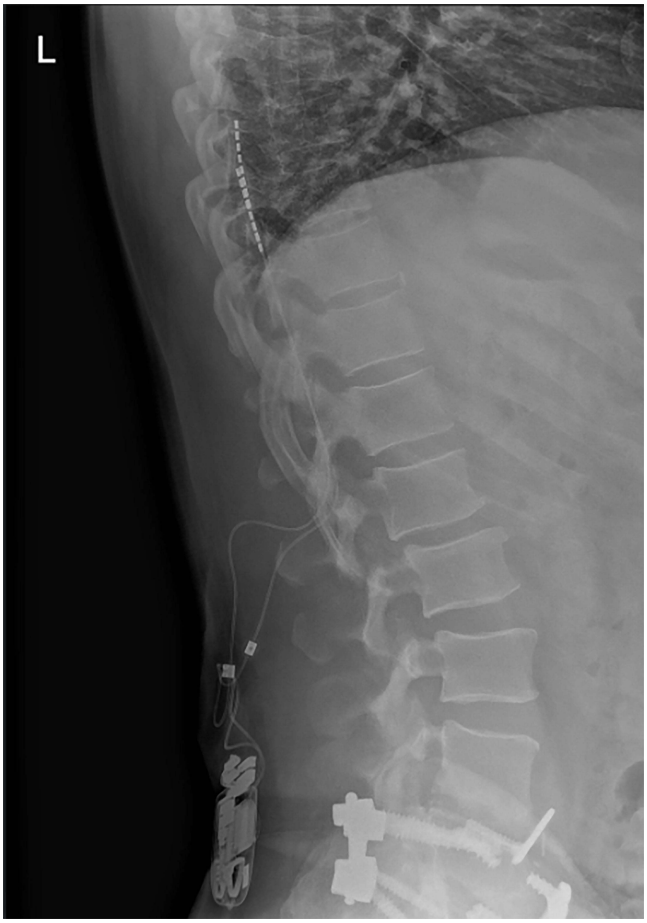

Figure 2 A subsequent lateral plain radiograph of the case report patient's spinal cord stimulator (SCS) leads and subcutaneously placed implantable pulse generator (IPG) following initiation of Semaglutide therapy and patient weight loss. This image depicts the IPG in the right lower lumbar region with dual eight-contact SCS leads placed into the dorsal column of the thoracic spine with leads overlying the T8-9 interspace. The x-ray shows the shallow depth of the IPG and loss of subcutaneous adipose tissue at the IPG pocket site.

discomfort necessitating subsequent revision. Risks of bleeding, infection, or other complications exist for revision of any SCS device components.

If a GLP-1RA medication is identified during the neuromodulation candidate prescreening and preoperative planning process, clinicians should communicate with the GLP-1RA prescriber to determine whether the patient will be escalating the dosage of this medication. Standard treatment, with both Semaglutide and Liraglutide, involves incremental dosage escalations over the course of treatment, which is based off the STEP clinical trials.[11] The STEP trials performed with Semaglutide showed most of the weight loss occurring between weeks 0–52 of treatment, whereas weeks 52–104 showed more of a plateau of sustained weight loss.[12] Therefore, knowing where a patient is at in their course of GLP-1RA therapy and properly timing neuromodulation device implant may be beneficial. Additionally, whether patients are on GLP-1RA therapy or not, assessment of a patient's body habitus and thoughtful placement of the subcutaneous IPG pocket site may mitigate the risk of patient discomfort.

Limitations and Future Directions

This case report cannot claim to establish cause and effect between the patient's use of Semaglutide and subsequent need for SCS device revision. The timeline of the initiation of Semaglutide therapy, the associated weight loss, and the visible decrease in the subcutaneous tissue storage near the IPG pocket site at the time of follow-up imaging raise questions as to whether this phenomenon will be observed in other patients with implanted medical devices (pacemakers, sacral nerve stimulators, or other) who are on GLP1-RA medications. As such, future case series or cohort studies should be conducted tracking patient outcomes in these patient populations. Further, no research exists on the topic of GLP-1RA medications and the potential influence on post-SCS implant infection or pocket infections. This is another opportunity for future research.

Conclusion

A growing number of patients with diabetes and/or obesity are being treated with GLP-1RA medications. Many of these patients also suffer from chronically painful conditions, which may be amenable to SCS implant. Interventional pain management or neuromodulation clinicians should be well-educated on the indications for use of GLP-1RA medications and their associated mechanism of action, which lead to weight loss, decreased subcutaneous adipose tissue stores, and/or muscle wasting, potentially impacting the comfortability of SCS devices. Pre-screening for the use of GLP-1RA medications should occur prior to SCS implant and clinicians should consider optimizing device implant timing, IPG pocket site location, and anchoring materials to minimize the potential for SCS implant-related discomfort.

Disclosure

C.H. provides general consulting services for Nalu Medical Inc. The authors report no other conflicts of interest in this work.

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