

## Prolonged Severe Abdominal Pain Following Spinal Cord Stimulator Implantation: A Case Report of Post-Operative Spinal Cord Stimulator Thoracic Radiculopathy

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### Abstract

The use of neuromodulation, specifically spinal cord stimulator, has gained popularity in the management of chronic pain syndromes. Some indications for spinal cord stimulator placement include chronic pain arising from complex regional pain syndrome (CRPS), neuropathy, and post-laminectomy syndrome. With placement of spinal cord stimulator, there have been poorly described cases of post-operative thoracic radiculopathy as a potential complication. This case report describes a patient with prolonged severe thoracic radiculopathy after undergoing spinal cord stimulator paddle lead placement.

The patient is a 52 years old female with a history of worsening low back and leg pain not relieved by conservative measures and back surgeries. She underwent successful percutaneous SCS trial with greater than 80% relief of her symptoms; with subsequent implantation of SCS, paddle lead. In the immediate post-operative period, the patient reported good relief of leg pain with spinal cord stimulator turned on. However, she complained of severe, achy band-like thoracic and abdominal pain. Of note, there were no intraoperative events. Her pain was minimally relieved with medication management. All laboratory work, abdominal and chest radiographs as well endoscopy was negative. With good relief of leg pain with SCS, she declined removal of the paddle lead.

There are a few case studies that have described thoracic radiculopathy after spinal cord stimulator placement. In those cases, pain gradually improved within a short duration; and or after removal of the device. This particular patient had prolonged steady 9-10/10 abdominal pain that was not amenable to conservative treatment. Although a rare phenomenon, it is important to know that persistent abdominal pain can be a result of thoracic neurological injury during SCS lead placement.

**Keywords:** Interventional pain medicine; Spinal cord stimulation; Thoracic radiculopathy; Neurosurgery; Abdominal pain; Paddle lead; Post-operative pain

### Introduction

For many decades, spinal cord stimulator (SCS) paddle lead implantation has been the mainstay for the treatment of refractory chronic pain syndromes, with complex regional pain and post-laminectomy syndromes being the most indicated reasons for placement [1]. There has been a steady increase in the incidence of chronic lower back and leg pain in recent years. Statistics demonstrate that 1 in 4 adults have reported low back pain in the past three months [2]. Additionally, there has been a gradual rise in the number of back surgeries performed in the United States [2]. A subsequent challenge in pain management in the contexts of post-laminectomy and complex regional pain syndromes (CRPS) has become an ongoing concern for spinal surgeons and pain medicine physicians. Interventions such as spinal cord stimulator implantation have proven to be useful in ameliorating and possibly eliminating the occurrence of pain [2]. Spinal cord stimulator devices have also been used internationally to treat peripheral vascular disease (PVD), neuropathic pain, [3] refractory angina, [4] and visceral pain [5]. In addition to its potential cost-effectiveness [6-11], SCS implantation has also been documented to both improve quality of life and increase activities of daily living [1,2]. It is important to understand both the more common SCS complications such as infections, lead migration, and lead and generator malfunction as well as rarer complications such as persistent abdominal pain possibly as a result of thoracic neurological injury.

### Literature Review

In a large systematic literature review looking at complications associated with SCS implantation for management of chronic pain, Turner et al. reported an average complication rate of 42% across all studies [12,13]. A vast majority of complications were electromechanical in nature. Causes have included lead migration or malfunction, failure of pulse generator, and breakage of lead wires. Turner et al. in a second systematic review of 538 articles reported that 34% of patients had stimulator-related complication, and 5.4% of the patients developed pain in the region where the stimulator components were placed [13]. According to Holsheimer, perception threshold and motor discomfort is due to dorsal root stimulation. Because these thresholds have a very small ratio (1:1.4), any stimulation of the dorsal column and paresthesia coverage is limited by the small range of stimulation [1].

SCSs are frequently placed in the thoracic region and less so in the

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cervical or lumbar areas. In a mid-thoracic SCS lead implantation, the distance between the epidural electrode and the spinal cord is large. In this setting, the threshold for dorsal column stimulation exceeds discomfort threshold, thus possibly resulting in a segmental paresthesia [1]. There have been a few case studies of patients presenting with thoracic radiculopathy following spinal cord stimulator placement. Mammis et al. performed a retrospective analysis of a prospectively acquired database of patients undergoing placement of an epidural paddle lead for SCS. Case series analysis recorded over a 10 year period generated a total of 176 patients who underwent thoracic SCS implantation with paddle leads [1]. Of this cohort, 15 (9%) patients developed thoracic radicular symptoms, with some complaints of abdominal pain postoperatively [1]. A comprehensive evaluation of the incidence and frequency of neurologic injury as a result of SCS paddle electrode implantation suggests that neurologic injury is a rare, but serious, complication of SCS [14].

### Case Presentation

The patient is a 52 year old female who presented with a history of postlaminectomy syndrome due to underlying lumbar spinal stenosis. She was status post an L4-5 fusion complicated by an epidural hematoma. Despite surgical intervention for lumbar spinal stenosis, she developed ongoing severe low back and leg pain. She subsequently underwent a successful percutaneous SCS trial with greater than 80% relief of her symptoms. Two weeks after the successful SCS trial, it was decided to proceed on to a permanent implantation of spinal cord stimulator. The patient then had placement of St. Jude paddle lead (3228 Penta) at levels T9-10 under deep sedation at an outpatient surgical center.

There were no intraoperative complications. She remained stable during anchoring of the leads within the epidural space. However, in the immediate post-operative period, she complained of severe periumbilical and bilateral sharp flank pain. She had no incisional pain. The patient stated that the SCS had significantly relieved her leg pains, numbness, and weakness. Despite the administration of steroids, IV opioids, and midazolam, her abdominal pain persisted. She was offered the option of explantation which she declined given that the instant benefit of improvement in her leg symptoms with the stimulator strongly outweighed her current abdominal pain. The decision was made to admit her to an inpatient facility for close monitoring, further work-up, and management.

On arrival to the inpatient unit, the patient continued to have unrelenting abdominal pain. She was then started on protonix, an IV hydromorphone patient-controlled analgesic (PCA), Gabapentin at 600 mg twice a day, and Duloxetine dose at 60 mg in the morning and 30 mg at bedtime for symptomatic relief. Duloxetine dose was continued as it was her regimen at home.

On post-operative day (POD)#1, her abdominal pain was measured at a 10/10 on a numerical analog scale. She described the pain as band-like, radiating from her back to the epigastrium. At this time, it was decided to perform imaging studies to both rule out any underlying abdominal pathology that may have been missed and also to confirm paddle lead position. Computed tomography (CT) of her thoracic spine and abdomen with and without contrast was negative for any intra-abdominal processes. CT scan confirmed a spinal stimulator present at the dorsal aspect of the spinal canal located at the mid T9 to mid T10 levels, with its lead extending to the T10-11 inter-laminar space. In addition, a right upper quadrant ultrasound of the abdomen was also unremarkable. All laboratory findings including CBC, comprehensive

metabolic profile, amylase, and lipase were within normal limits.

On POD #3, patient continued to have periumbilical pain relieved with medical management. Of note, she had a previous gastric bypass 10 years ago and an endoscopy two years ago which showed mild marginal ulceration. At this time, she denied any nausea, vomiting or constipation. She continued to ambulate without difficulty and void and move her bowels despite having severe abdominal pain. There was no melena or hematochezia with bowel movements. Nevertheless, the nature of her abdomen remained the same with the pain being described as stabbing with waxing and waning occurrences. She was transitioned from the hydromorphone IV PCA to oxycodone for breakthrough pain. General surgery and gastroenterology services were consulted for evaluations and recommendations. There was reluctance to proceed with any reoperation in the absence of deterioration or worsening of her symptoms. Again, the option of explanation of the paddle lead and generator before scarring ensued was discussed. However, patient declined given her successful trial and also the current relief she was experiencing. Note that the abdominal pain occurred whether or not the generator battery was turned on or off.

On POD #4, her abdominal pain persisted, occurring every 10-15 minutes. It was described as a lancinating pain that lasted about 15 to 25 seconds. She underwent an upper endoscopy study which was negative for any intra-abdominal pathology. Serial abdominal exams remained unremarkable. She reported marginally improved pain with oral opioids.

On POD #5, patient was discharged home on oxycodone 5 mg every six hours as needed for pain. Throughout her stay in the hospital, she was followed closely by both the neurosurgery and pain medicine teams. The patient was seen in the outpatient chronic pain clinic 9 days after discharge. She reported no leg pain and continually resolving abdominal pain. She stated that the intensity of her abdominal pain had essentially been waning since discharge from the hospital, decreasing daily in a slow, gradual fashion (Table 1).

POD	Numerical Analog Pain Score	Treatments	Testing Performed
0	10/10	IV Protonix IV Hydromorphone PCA Gabapentin 600 mg PO BID Duloxetine 60 mg PO Q AM Duloxetine 30 mg PO Q PM	CBC-wnl BMP-wnl Amylase-wnl Lipase-wnl
1	10/10	IV Protonix IV Hydromorphone PCA Gabapentin 600 mg PO BID Duloxetine 60 mg PO Q AM Duloxetine 30 mg PO Q PM	CT thoracic spine-wnl CT abdomen-wnl
2-3	8/10	IV Protonix IV Hydromorphone PCA Gabapentin 600 mg PO BID Duloxetine 60 mg PO Q AM Duloxetine 30 mg PO Q PM	None performed
4	8/10	IV Protonix IV Hydromorphone PCA Gabapentin 600 mg PO BID Duloxetine 60 mg PO Q AM Duloxetine 30 mg PO Q PM	Upper endoscopy-wnl
5	6/10	Oxycodone 5 mg PO QID prn Gabapentin 600 mg PO BID Duloxetine 60 mg PO Q AM Duloxetine 30 mg PO Q PM	None performed Patient discharged

Table 1: Summary of the patient's pain and medical evaluation.

## Discussion

SCS implantation is a widely used intervention for the management of chronic pain syndromes. Specifically, the utility of SCS in the management of post-laminectomy syndrome has been proven by multiple research studies [2]. The most commonly observed complications of SCS implantation include infections, lead migration, and lead and generator malfunction. A syndrome of postoperative radiculopathy complicating SCS paddle lead placement was recently described by Mammis et al. Previously there has been nothing published regarding radiculopathy after SCS paddle lead placement. In their retrospective analysis and review of patients who exhibited this syndrome, there is a characteristic band-like (dermatomal) abdominal and thoracic pain that is refractory to pain medication [1]. Abdominal pain without sensory or motor deficits occurred in the immediate post-operative period [1]. These findings are similar to the symptoms the patient had in the above case. Of note, the patients described in the case series had removal of SCS system with complete resolution of pain [1]. Although the presenting patient refused explantation, her symptoms gradually improved over time.

Thoracic radiculopathy is a spinal disorder most commonly due to thoracic disc herniation, trauma, or diabetes [1]. In the case described above, radiculopathy after SCS implantation is a rare poorly described phenomenon and is possibly due to traction on the dorsal roots. According to Mammis et al., in their case series, lateral placement of paddle leads can predispose patients to post-operative spinal cord stimulator thoracic radiculopathy [1]. It is therefore suggested that this should be avoided. Furthermore, other potential risk factors include a pre-existing scoliotic spine deformity, disc herniation and stenosis [1]. The above patient has a history of diabetes and spinal stenosis/lumbosacral disc herniation. In general, patients demonstrating any of these pathologies have an increased risk of post-operative spinal cord stimulator thoracic radiculopathy [1].

It is necessary that physicians be aware of this rare complication of SCS implantation as it will eliminate unnecessary work-up and the possibility of an abdominal surgery, allay patient fears and concerns, provide the healthcare team with closure, and reduce overall health care costs. In addition, close postoperative management of patient who undergo SCS implantation is necessary as an infection may occur, the paddle leads may migrate, and the generator may fail. More so, Mammis and his team recommend routine preoperative MRI screening of all SCS candidates. The goal are as follows: to identify any underlying thoracic spine pathology and tailor therapy for those at high risk to include more extensive laminectomy and decompression. However, there is no data in the role of preoperative MRI in preventing or minimizing post-operative spinal cord stimulator thoracic radiculopathy. As case studies such as this accrue over time, a more formal recommendation for preoperative thoracic MRI screening can be possibly made.

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