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Transient Neuropathic Pain after the Insertion of Spinal Cord Stimulation Leads

Linqiu Zhou[1]* and Tom G Shahwan[2]

[1]*Department of Rehabilitation Medicine, Jefferson Medical College, Thomas Jefferson Medical University, USA*
[2]*Three Rivers Health Hospital, Three Rivers Health 701 S. Health Parkway Three Rivers, MI 49093, USA*

Abstract

Objectives: Spinal Cord Stimulation (SCS) therapy has been adopted as a standard treatment modality for various chronic pain conditions. Transient neuropathic pain is an unreported complication after lead insertion. Our objective was to determine the incidence of transient neuropathic pain in 221 consecutive patients after SCS placement.

Design and setting: This was a retrospective chart review conducted at Thomas Jefferson University Hospitals, from May 2005 to November 2011.

Patients: 221 patients were included: total 369 SCS procedures (trial: 213; implantation: 156); male: 135, female: 86; ages: 18 to 83 years (mean 46); cervical and upper thoracic spinal stimulation: 21, lumbar: 200 cases.

Methods: Incidence calculation of new onset pain after SCS leads insertion. Transient neuropathic pain is diagnosed with new onset pain in the lower limbs after SCS lead insertion.

Results: 5 (6 cases) of the 221 patients (369-procedures) experienced new pain in their lower extremity immediately after lead insertion. Each of these patients underwent lumbar SCS lead insertion; two after trial, two after implantation, and the fifth after both trial and implantation. Their symptoms involved pain at a localized area of one lower extremity. Thorough clinical examination was notable for heightened sensitivity to light touch and pinprick (allodynia) at the painful area, but no sensory or motor deficits. Four of 5 patients were treated with oral steroids for 7 days and followed closely until symptom resolution. Within 5 to 10 days, their pain resolved entirely without residual neurological deficits. One patient refused to take oral steroids. Her symptoms resolved after her SCS leads were removed.

Conclusion: Transient neuropathic pain after SCS lead insertion is an uncommon complication. Based on our data, the incidence is 1.62% (6/369). The clinical presentation is focal pain and allodynia without other neurological deficits. The cause of these symptoms is unclear. The management includes oral steroids, patient reassurance, and close follow-up.

Keywords: Spinal Cord Stimulation (SCS); Complications; Neuropathic pain; Neurologic deficit; Percutaneous

Introduction

Spinal Cord Stimulation (SCS) therapy has been adopted as a standard treatment modality for various chronic pain conditions. While the exact mechanism of action of this therapy is unknown, many theories have been postulated including: activation of gate control mechanisms, conductance blockade of the spinothalamic tracts, activation of supraspinal mechanisms, blockade of supraspinal sympathetic mechanisms, and activation or release of putative neuromodulators [1]. The complication of SCS therapy includes lead migration, infection, pain at the battery site and device mechanical failure [2]. There is no literature report of new onset pain after SCS lead insertion. Here we report five patients (six cases) of transient neuropathic pain, a previously unreported complication after SCS lead insertion.

Material and Methods

This was a retrospective chart review conducted at Thomas Jefferson University Hospitals. The study was approved by the Institutional Review Board. The chart review consisted of patients seen between May 2005 and November 2011.

All patients had failed conservative management for low back pain including physical therapy and pain management with or without surgical intervention, and were referred for SCS therapy. They passed psychological evaluation prior to the SCS trial. If the patients received more than 50% of pain relief during the trial and were satisfied with the SCS therapy, the patients underwent permanent SCS implantation with a percutaneous lead insertion technique. In all cases, the procedure was performed by one physician (LZ) under monitored anesthesia care with mild sedation. The procedure was conducted with patients in a prone position on a radiolucent exam table with pillows under the chest and pelvis to decrease abdominal pressure. An appropriate prep and drape were conducted for each patient. Under fluoroscopic guidance, the spine was examined in order to find the appropriate laminar space for spinal needle insertion. The laminar levels usually entered were at C7-T1 or T1-2 for cervical and T12-L1, L1-2 or L2-3 for thoracic and lumbar SCS lead insertion (Figures 1 and 2). The entrance level of the spinal needle is usually at one to one and half vertebral levels from the laminar space with a 15 degree angle from the midline. After local anesthesia, a 15 gauge spinal needle was inserted with a loss of resistance technique. After loss of resistance, an eight-contact SCS lead was inserted until the lead reached an appropriate position (Figure 3). A second lead was then inserted with the same technique on the contralateral side or the same side at a different level. After setting the

***Corresponding author:** Linqiu Zhou, Professional Pain Associates, 730 North Broad Street, Suite 205, Woodbury, New Jersey 08096, USA, Tel: 856-202-5331; Fax: 856-202-5638; E-mail: linzhoumd@yahoo.com

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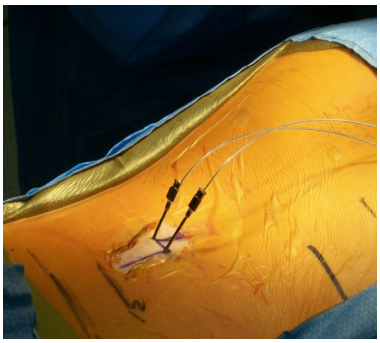

Figure 1: Percutaneous SCS Procedure.

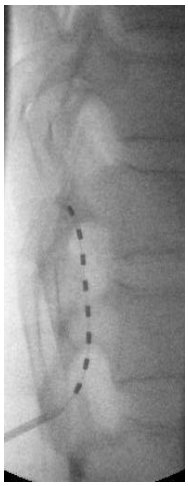

Figure 2: SCS lead insertion.

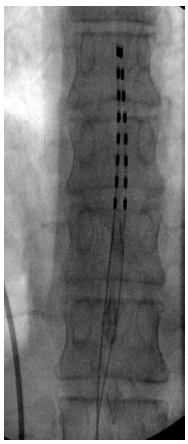

Figure 3: Lumbar SCS therapy.

pulse stimulation to the patient's desired level, the leads were anchored to the skin in trial cases. For permanent implantation, the leads were anchored to the deep fascia and tunneled to the battery site (normally at the level of the buttocks) where they were connected to the pulse generator. The patients were discharged home the same day after the stimulator was activated. Patients were contacted by phone the next day and followed up in the office 5 to 10 days afterward based on the patient's clinical situation. For the patients undergoing a trial, the leads were removed within 5 to 7 days after the trial. For patients undergoing implantation, the dressing was removed in 10 days. The patients were followed for 2 weeks, then monthly for three months and then every 3 months.

Result

From May 2005 to November 2011, 221 patients underwent a SCS procedure and were included in this study. There were a total of 369 SCS procedures (213 underwent trials: 156 underwent implantations); male: 135, female: 86; ages: 18 to 83 years (mean 46); cervical and upper thoracic spinal stimulation: 21; lumbar: 200 cases. Five of the 221 patients (369 procedures) experienced new pain in their lower extremity immediately after lead insertion (Table 1). All of these patients had undergone lumbar SCS lead insertion: two after the trial, two after implantation, and one after both the trial and implantation. Their symptom was pain at a localized area in the lower extremity. Thorough clinical examination was notable for heightened sensitivity to light touch and pinprick (allodynia) at the painful area, but no sensory or motor deficits. There was no progressive neurological deficit or other complications such as a hematoma or infection. Four of these 5 patients were treated with oral steroids (Medrol Dosepack taper) for 7 days and followed closely until their symptoms resolved. These patients experienced complete resolution of their pain symptomology without residual neurologic complications within 5 to 10 days of oral steroid treatment. Four of the patients did not require removal of their SCS leads. In case 4, his SCS leads were removed during the procedure because of poor lead position, which did not cover his usual painful area. His symptoms completely resolved after oral steroid therapy. Case one refused to take oral steroids and chose removal of the SCS lead. Her symptoms resolved after the leads were removed. All of the patients were followed for 6 months to 7 years. There were no residual symptoms or new symptomatology associated with the procedure.

Discussion

Transient neuropathic pain after SCS lead insertion is an uncommon complication. We have reported our cases in national and international conferences [3-7]. During these presentations, physicians have remarked that they too have seen patients with similar clinical presentations after SCS lead insertion. However, a review of the literature demonstrates no description of this entity. Based on our data, the incidence is from 1.40% (4/285) to 1.62% (6/369) [3-7]. Patients immediately develop pain in their lower extremity after the procedure. The clinical presentation is allodynia without other neurological deficits. The cause of these symptoms is unclear; however, the irritation to a single fiber or small group of nerve fibers caused by the spinal needle or SCS lead insertion may provide an explanation. After carefully reviewing their MRI films, we found no correlation between spinal stenosis and incidence of this complication. The angle of needle insertion may contribute to the mild irritation of the nerve. Review of our data, however, has not demonstrated a difference in needle angle insertion among patients with and without this complication. Further research is required to substantiate this as a possible etiology.

A diagnosis of transient neuropathic pain should be considered if a patient develops new symptoms immediately after the insertion of SCS. A thorough physical examination should be conducted in order to rule out other complications such as spinal cord or nerve root injury or an epidural hematoma [8]. If the spinal cord or nerve roots are injured, a neurological deficit should be present [8]. Our initial management of

Case serial	Gender	Age	Clinical Diagnosis for SCS therapy	Detail of Procedure (type, entrance level, number of leads and level of leads)	Clinical course of TNP (onset, clinical presentation, duration of symptoms)
1	Female	69	History of L5 and S1 laminectomy and fusion. Lower back pain and right L5 and S1 radiculopathy secondary to spinal and foraminal stenosis. She received a successful SCS trial.	Permanent implantation, bilateral L1-2, two leads, at T9.	Immediately after procedure developed pain at the right great toe, with positive allodynia. No sensory and motor deficits. Negative lab tests for infection and gout. She refused steroid therapy. Her symptoms resolved after removal of the SCS.
2	Female	62	Thoracic back pain and radiculopathy, status post T6-T8 corpectomy and fusion of T5 to T11 with posterior pedicle screws for a T7 compression fracture. History of thoraco-lumbar scoliosis.	The initial trial entrance was left of T11-12; however, the procedure was complicated by an epidural leak, which was treated with a blood patch intraoperatively. The entrant levels were then changed to the left of T12-L1, where the lead tip reached T5. The patient also received peripheral nerve stimulation on the right paraspinal regions of T8 to T11.	Immediately after the procedure, the patient experienced pain at the medial left foot. Findings included allodynia but no motor or sensory findings. Her symptoms resolved completely in 5 days after oral steroid therapy. She received a successful trial and underwent percutaneous placement of a permanent SCS with two leads.
3	Male	48	Failed back syndrome, previous unsuccessful SCS therapy (the leads had been removed). Lumbar radiculopathy.	Permanent implantation. The entrances of both leads were at T12-L1 bilaterally. The procedure was successful and the lead tips were at T7.	The patient experienced pain and allodynia at both dorsal feet immediately after the procedure. No new neurological deficit. These symptoms resolved within 1 week after the oral steroid therapy. He has had successful pain relief after the SCS implantation.
4	Male	57	Failed back syndrome, lumbar radiculopathy, T11 T2 mild compression fractures, and spinal stenosis.	Trial, Narrowing at the interlaminal space of T12-L1, L1-2, L2-3. The needle entrances were attempted at different levels; however, the SCS leads could not be secured in an appropriate position. The leads were removed in the OR.	Immediately following the procedure, the patient experienced dorsal foot pain without neurological deficit. His symptoms completely resolved in 1 week after oral steroid therapy.
5	Male	33	Status post discectomy and intervertebral fusion at the L4-5 level. Chronic low back pain and lumbar radiculopathy.	Trial Needle entrance at the T11-12 interlaminal space. The SCS lead tips were at T7.	The patient experienced pain at the left, medial aspect of his knee. This symptom completely resolved in two days after taking oral steroids. He completed 7 days of the SCS trial.
6	Male	33	The same patient from case 5.	Permanent implantation. The SCS needle entrance was at the L1-2 interlaminal space bilaterally. The SCS lead tips were at T7.	Immediately after surgery he complained of pain at bilateral anterior tibia. There was no new neurologic deficit. His symptoms completely resolved within 1 week after oral steroid therapy. His SCS therapy was otherwise successful.

Table 1: Clinical data of five patients who experienced transient neuropathic pain (TNP) after insertion of SCS leads.

transient neuropathic pain is with oral steroid therapy (Medrol dose pack). In severe cases, intravenous steroids should be considered in the operating suite or in the recovery room, and followed by oral steroids for one week. The physician should closely follow and document the patient's neurological status. Patient and family reassurance are important. For trial patients, the physician should encourage them to use the SCS. The pain relief from SCS should be focused on the usual pain such as lower back pain or radicular pain, and not on the new symptoms. Early removal of trial leads is not necessary. Both SCS trial patients in our report had completed their normal trial duration. The trial was successful and they pursued permanent implantation. In patients with permanent implantation where stimulation aggravates their pain, stimulation can be withheld, in addition to reassurance and steroid therapy, until the transient symptoms resolve. If a patient should present with a progressive neurologic deficit or progressive pain, further evaluation should be conducted using a lumbar CT scan in order to rule out an epidural hematoma [8].

Conclusion

Transient neuropathic pain is new onset pain at the lower extremity after SCS lead insertion. The diagnosis can be made after thorough clinical examination without an imaging study. Treatment mainstays are oral steroid therapy and patient reassurance. The outcome is normally favorable if early diagnosis and treatment are conducted.

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