

Urgent Cesarean Section in a Patient with a Spinal Cord Stimulator: Implications for Surgery and Anesthesia

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ABSTRACT

Background: Spinal cord stimulation used in the treatment of chronic pain is offered to women of child-bearing age. This practice warrants special consideration on the part of the obstetricians and anesthesiologists charged with their care.

Case Report: We report the instance of a parturient with a spinal cord stimulator who presented for urgent cesarean section. In spite of the patient's daunting back examination, the suitability of neuraxial anesthesia for cesarean delivery was rapidly determined by accessing images in our centerwide electronic medical record system.

Conclusion: Accepted approaches to managing labor and delivery—such as neuraxial anesthesia and analgesia—need not be denied patients with spinal cord stimulators. Whenever possible, however, the pain specialist should communicate the specific characteristics of the implanted device to the team who will manage the patient in the periparturient period.

INTRODUCTION

In recent years, spinal cord stimulation has been accepted as a therapeutic modality for an increasing number of conditions and a wide array of patients. Spinal cord stimulation is used in the management of chronic pain experienced by patients with angina pectoris, peripheral vascular disease, and syndromes

such as complex regional pain syndrome that have proven refractory to conventional management.¹

Neuromodulation via stimulating electrodes may diminish chronic pain and is accomplished using percutaneous or implanted electrodes coursing within the epidural space from as high as C3 to T11. These electrodes may be tethered to adjacent supraspinous ligaments. Extension tubing is tunneled subcutaneously to a pulse generator implanted in the buttock or abdomen. Physiologically, spinal cord stimulation is thought to improve microcirculatory blood flow and to activate dorsal column afferent neurons while concomitantly inhibiting sympathetic efferent neurons resulting in modification of neurotransmitter activity at both segmental and supraspinal levels.²

Spinal cord stimulators (SCSs) may now be implanted in women of child-bearing age. This practice carries special considerations for both the obstetricians and anesthesiologists involved in such patients' care. Practitioners who care for obstetric patients must familiarize themselves with considerations for SCS in this population.

CASE REPORT

A 29-year-old gravida 3 para 2 female with an intrauterine pregnancy at 38 weeks and 3 days' gestation presented to the labor and delivery unit in active labor. She had a history of 2 cesarean deliveries. A cesarean section without trial of labor was planned for this delivery. Her medical history was significant for well-controlled asthma, diet-controlled diabetes, and chronic pain for which she had had a thoracic SCS implanted.

A motor vehicle accident that had occurred several years earlier left the patient with low back pain and bilateral neuralgias for which she underwent placement of the SCS. Two percutaneous leads were inserted at T12-L1 and located at T7. She obtained good pain relief initially, but several months later her pain returned, likely because of the migration of the percutaneous leads. She was referred to a spine surgeon at our institution for placement of surgical leads. She underwent removal of her percutaneous leads and implantation of paddle leads at the same

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Figure 1. Visual inspection of the patient's back revealed 1 horizontal scar and 2 midline vertical scars, corresponding to previous lead implantations for her spinal cord stimulator.

thoracic level. She experienced improvement in her symptoms following implantation of the surgical leads. She obtained follow-up care from a pain specialist outside our health system.

Two years later, upon learning about her pregnancy, the patient was instructed by her pain specialist to turn off her SCS. During her pregnancy, she managed to control her pain with nonnarcotic analgesics. At the time of her presentation to the labor and delivery unit, she was having frequent contractions and complained of severe pain. She was given intramuscular meperidine by the obstetric team while she was evaluated for a repeat cesarean section.

On physical examination, the patient's vital signs were within normal limits. Her airway examination revealed a normal mouth opening, Mallampati score of 3, thyromental distance >6 cm, intact dentition, and full range of motion of her neck. Visual inspection of her back revealed 1 horizontal scar on the right flank and 2 midline vertical scars, 1 at the mid-thoracic level and the other at the upper lumbar spine (Figure 1). Upon palpation, the inferior margin of the lower vertical incision appeared to correspond to the L2-L3 interspinous space.

For reasons unknown to our anesthesia team, the patient did not have a preanesthetic evaluation before she presented in active labor 11 days before her due date. No advance communication regarding her SCS had been provided to the anesthesia team. However,



Figure 2. The patient's thoracic x-ray.

because surgical implantation of the device was performed at our institution, we were able to quickly review imaging of the patient's thoracic and lumbar spine (Figures 2 and 3) contained in our electronic



Figure 3. The patient's lumbar x-ray.

medical record (EMR) system. The stimulator leads were located in the mid-thoracic region. The lumbar region appeared to be free of any foreign objects. Laboratory studies were reviewed and the results were noted to be within normal limits. After discussion with the patient and the obstetric team, we decided to proceed with cesarean delivery under spinal anesthesia because the benefits to the patient of neuraxial anesthesia appeared to outweigh risks to the SCS.

The patient was brought to the operating room and helped into a seated position. Her back was prepped and draped. The L3-L4 interspace was identified below the lumbar scar and the skin was anesthetized with 1% lidocaine. In 1 attempt, a 25-gauge Whitacre spinal needle was inserted with ease into the L3-L4 interspace. Upon return of clear cerebrospinal fluid, 12.5 mg of 0.75% hyperbaric bupivacaine, 10 mcg of fentanyl, and 150 mcg of preservative-free morphine were injected through the spinal needle into the subarachnoid space. This injection produced excellent anesthesia up to the T5 dermatomes bilaterally. Two grams of cefazolin were given intravenously prior to incision for infection prophylaxis. Minutes later, a healthy term neonate was born without any complications. Apgar scores were 9 and 10 at 1 and 5 minutes postpartum.

In the immediate postoperative period, the patient controlled her pain via patient-controlled analgesia with morphine. She was subsequently transitioned to oral analgesics on postoperative day (POD) 1. On POD 3, she was discharged from the hospital with instructions to follow up with her pain specialist for advice on when to reprogram her SCS. At her postpartum follow-up visit 6 weeks later, she was doing well and was without complaint.

DISCUSSION

The safety of SCSs for the embryo/fetus is unclear. Currently, SCS manufacturers recommend inactivating the device at gestation. Clinicians have postulated that SCS via electromagnetic field force could potentially compromise the placenta and developing fetus.² However, various studies have demonstrated that SCS improves microcirculation and produces peripheral vasodilatation without compromising uteroplacental blood flow.^{3,4} Furthermore, SCS systems produce minimal electrical currents, and the electromagnetic field is confined to the posterior spinal column via insulation from vertebral bones and ligaments.^{5,6}

For the subset of patients with chronic pain who are considering a future pregnancy, an SCS enables significant pain control and prevents the possible teratogenic effects from harmful medications such as anticonvulsants and opioids used in chronic pain management. The implantation of an SCS system in a woman of child-bearing age necessitates consider-

ation of future obstetric and anesthetic needs, with a good outcome dependent upon a multidisciplinary team including anesthesia, obstetrics, pain management, and pediatrics.

During initial placement, an SCS system should be established via the high lumbar intervertebral space to facilitate subsequent safe neuraxial anesthesia without compromise of the SCS.⁵ The pulse generator should be implanted in the gluteal region to avoid damage to leads caused by the increasing abdominal girth of pregnancy and damage to the extension wire, leads, or electromagnetic field from surgical trauma or electrocautery. Sommerfield et al⁷ note that energy from electrocautery can be conducted through the SCS system and can alter, reprogram, or suppress neurostimulator output if the simulator components are within the pathway of electrocautery components. Logé et al note that SCS leads create fibrous deposits forming an encapsulating sheath that, compounded with the use of supraspinous sutures, decreases the possibility of migrating leads as might occur with neuraxial analgesia or anesthesia.⁸ From a mechanical perspective, neuraxial anesthesia is unlikely to harm the electrical leads of the SCS device. However, the anesthesiologist administering the neuraxial technique in patients with SCS implantation is advised to obtain a thorough report from the pain management, orthopedic, and/or neurosurgery team to ascertain the anatomy of lead placement, power source location, and path of the extension wire.⁹

Our ability to rapidly access and view images in the EMR allowed us to assess the suitability of various anesthetic techniques for our patient. If a vaginal birth after cesarean section had been contemplated, we would have agreed to place an epidural catheter because we were confident that the SCS extension wires and leads were out of range of the low lumbar approach. If the extension leads had been near the L3-L4 intervertebral space, we would have suggested general anesthesia rather than spinal anesthesia for cesarean section. The Table summarizes reported cases of SCS implantation in pregnant patients and the anesthetic technique selected in each case.

Earlier case reports^{5,9} champion the role of interdisciplinary communication in the management of SCSs during pregnancy and delivery. Our case illustrates how close communication may not occur in reality, and the anesthesiologists who usually administer neuraxial techniques can be entirely left out of the loop. Although 2 pain physicians and 2 obstetricians were involved in managing this patient during pregnancy, the anesthesia team was not consulted. Fortunately, the EMR provided significant details about the SCS location, so we were comfortable proceeding with a spinal anesthesia technique.

Table. Reports of Spinal Cord Stimulator (SCS) Implantation and Selection of Anesthetic Technique in Pregnant Patients

Study	SCS Location	Anesthetic Technique	Early Anesthesia Referral
Hanson and Goodman ⁹ (2006)	Lead insertion: C7-T1 Tip location: C3	Labor epidural at L2-L3	Yes
Sommerfield et al ⁷ (2010)	Lead insertion: L2-L3 Tip location: T8	Spinal at L4-L5 for cesarean section	Not mentioned
Bernardini et al ⁵ (2010) Case 1	Lead insertion: T12-L1 Tip location: T9-T10	Labor epidural	Yes
Bernardini et al ⁵ (2010) Case 2	Lead insertion: T12-L1 Tip location: C4 Additional SCS with lead insertion: T12-L1 Tip location: T9-T10	1 st pregnancy: General anesthesia for cesarean section 2 nd pregnancy: Epidural for repeat cesarean section	Yes
Fedoroff et al ¹⁰ (2012)	For both pregnancies Lead insertion: L1-L2 Tip location: T10	1 st pregnancy: Failed epidural; spinal for emergency cesarean section 2 nd pregnancy: Spinal for elective cesarean section	Not mentioned
Ito et al ² (2013)	Lead insertion: L2-L3 Tip location: T10-T11	Spinal at L3-L4 for elective cesarean section	Not mentioned
Present Case (2013)	Lead insertion: T12-L1 Tip location: T7	Spinal at L3-L4 for urgent cesarean section	No

CONCLUSION

SCS is a favorable option for patients with chronic pain who have failed conventional therapy and a viable choice for women of child-bearing age. However, a number of unique challenges face the obstetrician and anesthesiologist in managing a pregnant woman with an SCS. Nevertheless, accepted approaches to managing labor and delivery—such as neuraxial anesthesia and analgesia—need not be denied the patient. Whenever possible, the desirable scenario is for the pain specialist to communicate the specific characteristics of the implanted device to the team who will manage the patient in the periparturient period. Until EMRs are shared widely across medical systems, we advocate that pregnant patients appearing near term should have their records in their possession.

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