Dorsal Root Ganglion Stimulation to Treat Focal Postsurgical and Diffuse Chronic Pain: A Case Report

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Dorsal root ganglion stimulation (DRG-S) is widely accepted for treating focal pain syndromes. We present the case of a 46-year-old woman with severe lumbar radiculopathy with an implanted spinal cord stimulator (SCS) that had lost efficacy. She developed an incisional hernia after undergoing a minimally invasive, extreme lateral interbody fusion and SCS explant. After herniorrhaphy, she presented with severe pain at the T10-T11 dermatomes, which we treated with DRG-S. One-year after lumbar fusion, her refractory lumbar and radicular pain returned, which we ultimately treated with bilateral T12+S1 DRG-S. DRG-S was thus used to successfully treat focal postsurgical and diffuse chronic pain. (A&A Practice. 2022;16:e01589.)

GLOSSARY

CRPS = complex regional pain syndrome; **CT** = computed tomography; **DRG** = dorsal root ganglion; **DRG-S** = dorsal root ganglion stimulation; **FBSS** = failed back surgery syndrome; **LBP** = low back pain; **MME** = morphine milligram equivalent; **SCS** = spinal cord stimulation; **VAS** = visual analog scale; **XLIF** = extreme lateral interbody fusion

Dorsal root ganglion stimulation (DRG-S) is a relatively novel technique in which an electrical field is placed over the somata of afferent neurons to modulate signaling. Neuromodulation of the dorsal root ganglion (DRG) allows access to all nerve fiber types along a specific dermatome to block pain in a paresthesia-free manner. This contrasts with spinal cord stimulation (SCS), in which an electrical field is placed over the dorsal columns, thus limiting nerve fiber access.

Extreme lateral interbody fusion (XLIF) is a minimally invasive surgical technique that has several benefits relative to more invasive lumbar fusion techniques, including reductions in incision size, blood loss, infection rates, postoperative pain, and reoperation rates.[1] However, as with any surgery, there are risks for potential long-term complications. Failed back surgery syndrome (FBSS) has an incidence of 10% to 40% after lumbar fusion,[2] and it is the most common indication for SCS. Nerve injuries are reported in 30% to 40% of XLIF cases and may contribute, along with direct muscle injury, to incisional hernias.[1] Pain from flank hernias occurs in 17% of surgeries, necessitating a lateral abdominal wall incision.[3] The definitive treatment, surgical hernia repair, causes pain in 8% to 16% of patients.[3]

Multisite pain occurs in up to 20% of patients with chronic pain,[4] and patients who experience a surgical complication are more likely to experience a second complication.[5] Here, we describe a successful case utilizing DRG-S to treat severe focal neuropathic pain after a flank herniorrhaphy, and for intractable low back and leg pain 1 year after XLIF surgery in the same patient.

A written Health Insurance Portability and Accountability Act authorization was obtained from the patient.

CASE DESCRIPTION

The patient is a 46-year-old woman with a medical history of hypothyroidism. After a motor vehicle accident, she experienced chronic low back pain (LBP), which was treated with a lumbar SCS implant that provided effective relief for 6 years. At presentation, she reported worsening of her original LBP radiating into her bilateral lower extremities. She had not used the SCS for 8 months because she was discouraged by lack of effectiveness and the need for frequent charging. On physical examination, the patient had tenderness over her bilateral sacroiliac joints and lumbar paraspinal muscles, a positive bilateral straight leg raise test, and a positive bilateral lumbar facet loading test. Computed tomography (CT) in 2016 demonstrated moderate central stenosis at L4-5 and moderate to severe bilateral neural foraminal stenosis at L4-5 and L5-S1.

The patient's symptoms were resistant to 90 oral morphine milligram equivalents (MMEs) per day, interventional procedures, and SCS reprogramming. She was referred for neurosurgical evaluation. Ultimately, the lumbar SCS was explanted, and a staged XLIF of L2-L3 and L3-L4 followed by left transforaminal lumbar interbody fusion of L4-L5 with L2-L5 pedicle screw fixation was performed (Figure 1C). Her LBP and radicular pain improved postoperatively, but over a 6-month period, she developed worsening left flank swelling and pain at the incision site. Seven months after the XLIF, she presented to the emergency department with an acute episode of left flank pain, nausea, and emesis. CT confirmed the presence of a left flank hernia containing nonobstructed bowel. Due to symptomatic bowel involvement,

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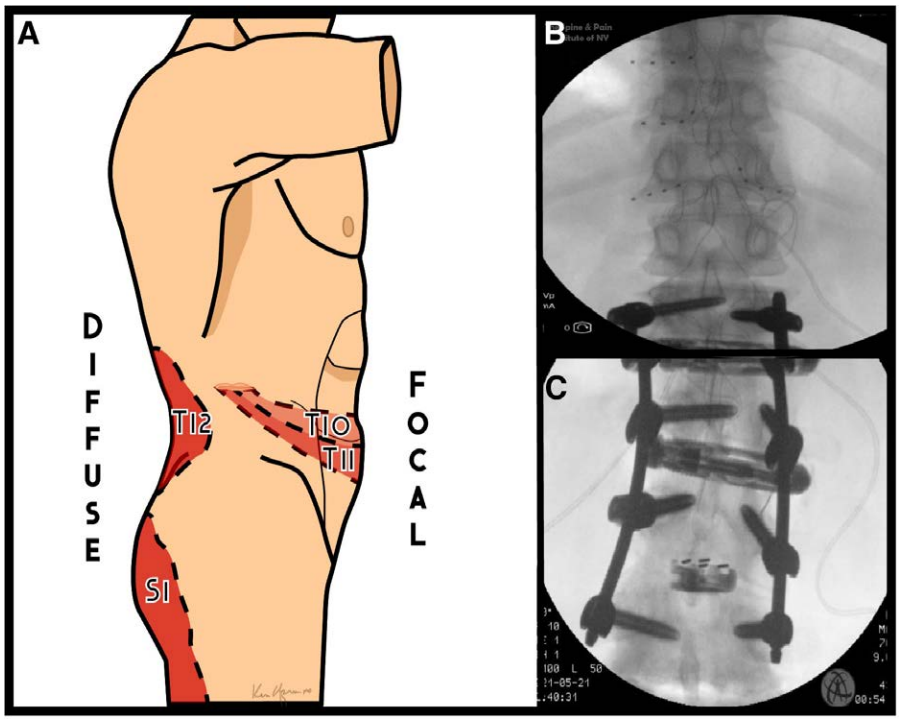

Figure 1. Dorsal root ganglion stimulation in a postsurgical patient. A, Pain coverage of dorsal root ganglion stimulation at T10-T11 and T12-S1. B, Fluoroscopy showing the T10-T11 and T12 leads. C, Fluoroscopy showing the lumbar fusion hardware.

the general surgical team admitted the patient and performed an incisional hernia repair with mesh.

The patient reported severe neuropathic left flank pain immediately after the surgery, which was initially controlled with opioid medications. She described the pain in the periumbilical area along the T10 and T11 dermatomes as constant, aching, burning, and radiating. The left flank scar and affected dermatomes demonstrated hypersensitivity to light touch, and deep palpation caused severe sharp pain. Deep inspiration, cough, and movement exacerbated the pain. She reported that her only relief was lying still in a left lateral recumbent position. Examination confirmed that she did not have a recurrent hernia.

Over the next 9 months, the patient failed conservative medical pain management, including escalating opioids and anticonvulsants, antidepressants, nonsteroidal anti-inflammatory drugs, muscle relaxants, and topical lidocaine. She reconsulted with general surgery, neurosurgery, and neurology, and her condition was deemed a nonsurgical issue. She underwent 2 ultrasound-guided left transversus abdominis plane blocks, 2 left T10 and T11 intercostal nerve blocks, and a left T10 and T11 selective nerve root block followed by pulsed radiofrequency of the left T10 and T11 DRG. The pulsed radiofrequency provided the longest duration of relief at 60% for 6 weeks and was repeated with diminished results. Each intervention provided moderate pain relief for relatively short periods followed by a return to preintervention pain intensity. Despite conservative therapy, the patient remained in significant pain that severely impaired her activities of daily living and quality of life.

After failing injections and opioid dose escalation to 165 MMEs, we decided to proceed with a DRG-S trial at the left T10 and T11 levels. These levels were chosen based on local anesthetic response to previous interventional procedures. After the trial, the patient had dramatic improvements in her visual analog scale (VAS) pain scores from 10 of 10 to 2 of 10 for the intermittent sharp, stabbing pain and to 0 of 10 for the constant burning pain. Interestingly, her pain relief lasted for >5 hours after both leads were removed. We subsequently implanted the DRG-S (Figure 1A, B). At her 1-, 3-, 6-, 12-, and 18-month postimplant follow-ups, she has maintained a flank pain VAS of 0 to 2 of 10, including 0 of 10 at her most recent follow-up (Table).

The patient reported intermittent mild to moderate chronic lumbar radiculopathy after the XLIF, which responded to conservative therapy. Three months after T10-T11 DRG-S implantation and 20 months after the XLIF, she complained of severe constant lumbar radiculopathy. Over the next 7 months, the patient failed conservative medical pain management, physical therapy, and multiple transforaminal and caudal epidural steroid injections. Given our clinical experience treating similar cases of chronic refractory LBP, we opted to proceed with a DRG-S trial at the left T12 and S1 levels. During her 5-day trial, she reported >70% pain reduction with improved functioning (Figure 1A). The second DRG-S system was subsequently implanted at the bilateral T12 and S1 levels (Figure 1B). At 6 months postimplant, her LBP and leg pain intensity improved from a VAS of 9 of 10 at baseline to 3.5 of 10. Her Oswestry Disability Index improved from 78 (crippled) to 39 (moderate disability), and her quality of life, measured by the EQ-5D questionnaire, increased from a baseline of −0.11 to 0.659 (Table). The patient was able to wean to 45 MME daily. For a complete summary of the timeline, see Figure 2.

DISCUSSION

Incisional hernia after XLIF is a rare complication. There are reports describing DRG-S to treat abdominal pain syndromes,[6,7] but not specifically for pain after incisional flank hernia repair. In this patient, we initiated a stepwise treatment

Table. Pain Intensity, Disability, and Quality of Life Questionnaire Results

Time Course	Visual analog scale	Oswestry Disability Index	EQ-5D
Before DRG-S: T10-11	10/10		
Last follow-up (18 mo)	1.5/10		
Before DRG-S: bilateral T12-S1	9/10	78	–0.11
Last follow-up (6 mo)	3.5/10	39	0.659

Abbreviations: DRG-S, dorsal root ganglion stimulation.

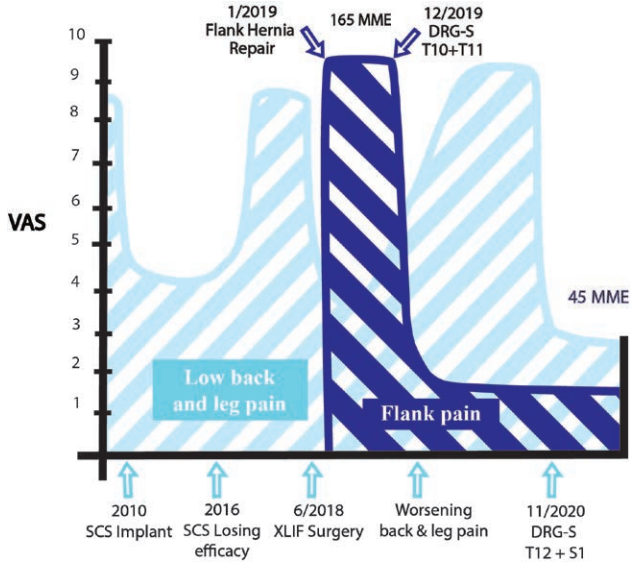

Figure 2. Longitudinal pain intensity and pain management strategies. DRG-S indicates dorsal root ganglion stimulation; MME, morphine milligram equivalent; SCS, spinal cord stimulation; VAS, visual analog scale; XLIF, extreme lateral interbody fusion.

approach, adapted from algorithms used in the treatment of chronic neuropathic groin pain. Behavioral therapy was not exhausted in this patient and should be considered in complex pain cases. The patient's history of possible nerve injury during hernia repair, severe continuing pain, and hyperalgesia on examination led to our working diagnosis of complex regional pain syndrome (CRPS) type II. DRG-S provides more specific dermatomal coverage than SCS and demonstrates superiority in the treatment of CRPS.[8-10] Placement of a DRG-S at T10 and T11 treated this patient's postherniorrhaphy flank pain and resulted in a dramatic improvement in her quality of life. This is a Federal Drug Administration-approved use of DRG-S for CRPS type II below the T10 level. This patient's successful outcome of sustained improvement in pain and function 18 months postimplantation mirrors the results of other patients with treatment-resistant postherniorrhaphy pain treated with DRG-S.[8]

The patient had the unfortunate sequelae of flank hernia and FBSS after an XLIF. Her treatment plan was guided by our clinical experience with SCS that has lost efficacy, the positive outcomes of DRG-S at T12 for LBP,[11–13] and the patient's preference after a positive experience with DRG-S. DRG-S at the T12 and S1 levels bilaterally provided paresthesia-free pain relief for her LBP and leg pain. Control of diffuse multidermatomal pain serves as potential evidence that the mechanism of action of DRG-S may include orthodromic propagation within the dorsal horn, not just filtering of incoming signals at the DRG.[14] Although further research is needed, we believe that the mechanism likely involves convergence in the dorsal horn. These defining qualities of DRG-S allow for treatment of both focal and broad-range dermatomal pain.

This case highlights the versatility and efficacy of DRG-S as a treatment modality for both focal neuropathic pain and diffuse pain originating from multiple dermatomes. Most patients undergo extensive treatment before SCS implantation, so failure of this therapy leaves patients with few remaining options. Loss of efficacy is the most common reason for device explantation, and DRG-S has demonstrated efficacy as a salvage therapy in the literature and in our patient.[15] Given the inherent risks of surgical intervention demonstrated in this case, it bears considering whether DRG-S should have been trialed as a salvage therapy before surgical intervention.

DISCLOSURES

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