

Rescue Nerve Root Stimulation for Recurrent Complex Regional Pain Syndrome After Failed Dorsal Column Spinal Cord Stimulation: A Case Report

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ABSTRACT

Background: Loss of efficacy in dorsal column spinal cord stimulation (SCS) for complex regional pain syndrome (CRPS) remains a therapeutic challenge. This case report demonstrates the successful use of nerve root-targeted SCS revision after failed conventional SCS in a patient with CRPS following total knee arthroplasty (TKA).

Case Presentation: A 52-year-old female with CRPS type I after right TKA initially achieved pain relief (NRS 10/10 to 6/10) and functional improvement (ODI 50 to 36) with dorsal column SCS implanted in 2020. By 2023, stimulation efficacy diminished (NRS 9/10, ODI 50). Revision to right L3-4 nerve root stimulation restored analgesia (NRS 2-5/10, ODI 36) with sustained benefit at six months.

Conclusion: Nerve root stimulation may serve as an effective salvage therapy for failed dorsal column SCS in CRPS, emphasizing the role of anatomical specificity in neuromodulation.

Keywords: Complex Regional Pain Syndrome, Spinal Cord Stimulation, Nerve Root Stimulation, Total Knee Arthroplasty, Oswestry Disability Index

Introduction

Complex regional pain syndrome (CRPS) is a debilitating condition characterized by chronic neuropathic pain, autonomic dysfunction, and functional impairment. Spinal cord stimulation (SCS) is a well-established intervention for refractory CRPS, though long-term efficacy is often limited by device failure or disease progression [1]. This report highlights nerve root-targeted SCS as a salvage strategy after dorsal column SCS failure in a post-TKA CRPS patient, contextualized within current literature.

Case Presentation

Patient History

A 52-year-old female developed CRPS type I after right TKA in 2018. Conservative therapies, including NSAIDs, gabapentin, oxycodone, physical therapy, and multiple lumbar sympathetic nerve blocks, provided minimal relief. Permanent dorsal column SCS (T8-10) was implanted in 2020 after a successful trial using a high-frequency system (Figure 1, Figure 2), achieving significant pain reduction (NRS 10/10 to 6/10) and functional improvement (ODI 50 to 36).

Loss of Efficacy

By 2023, pain recurred (NRS 9/10), and functional impairment worsened (ODI 50) despite optimized programming. Imaging confirmed stable lead position without migration.

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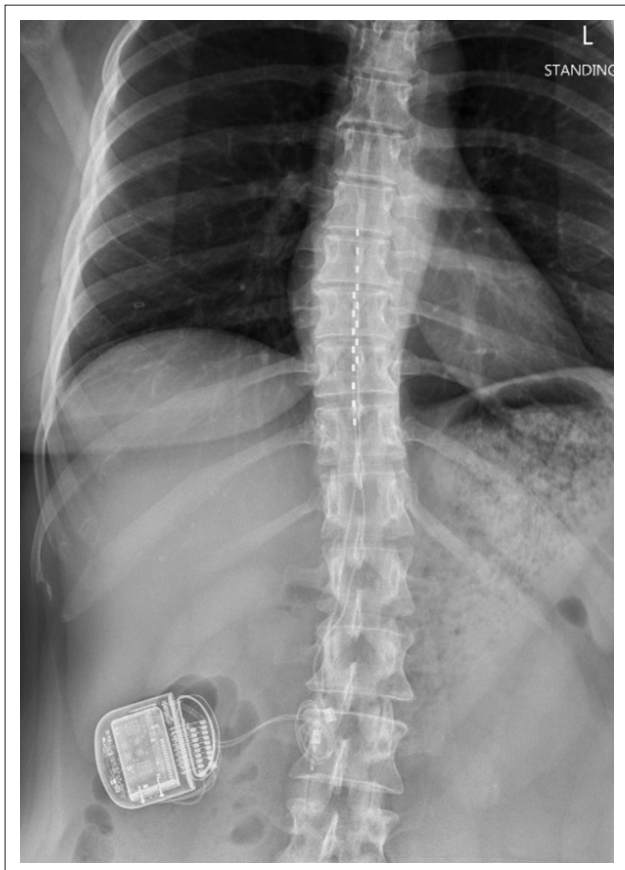


Figure 1



Figure 2

Intervention

After shared decision-making, a successful trial of nerve root stimulation at L3-4 was conducted. The SCS system was revised to target the right L3-4 nerve root via percutaneous epidural lead placement (Figure 3,4), utilizing the same internal pulse generator and incision from the previous implant.

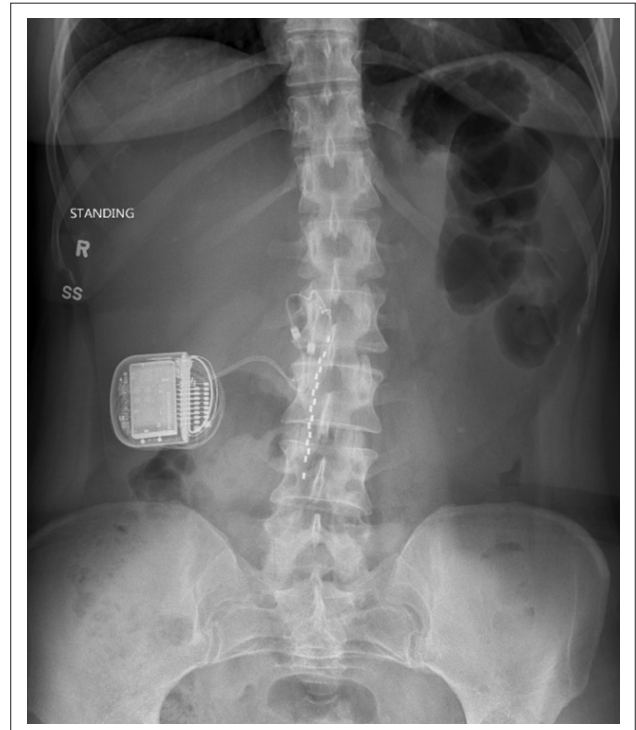


Figure 3



Figure 4

Outcomes

post-revision, pain scores decreased to NRS 2-5/10, and ODI improved to 36, with sustained efficacy at six-month follow-up. Functional mobility improved, and opioid use was completely discontinued.

Discussion

Dorsal column SCS failure in CRPS is multifactorial, involving fibrotic encapsulation, neural plasticity, or disease progression [1]. As Deer et al. noted, “Adaptive changes in spinal cord circuitry often necessitate alternative neuromodulatory targets in refractory cases” [1]. Nerve root stimulation directly modulates segmental afferents, bypassing central sensitization pathways. The L3-4 roots provide somatotopic coverage of the anterior knee, enabling focused pain control in this patient [2].

Russo recently demonstrated similar success with lumbar nerve root stimulation in lower-limb CRPS, reporting “60% sustained pain relief at 12 months post-revision” [3]. This aligns with our findings, underscoring the potential of anatomical specificity in salvage therapy. Technical precision in lead placement is critical to avoid dorsal root ganglion irritation. Careful surgical planning allowed us to use the same incision and internal pulse generator, reducing postoperative pain, improving cosmetic outcomes, and minimizing financial burden for both the patient and the healthcare system. Hybrid programming (combining dorsal column and nerve root parameters) was not required in this case.

Limitations

Single-case design and short follow-up limit generalizability. Long-term studies comparing dorsal column SCS, nerve root stimulation, and hybrid approaches are needed.

Conclusion

Nerve root-targeted SCS revision restored analgesia and functional improvement in a patient with CRPS after dorsal column SCS failure, highlighting the importance of individualized neuromodulation strategies. Prospective trials are warranted to validate these findings.

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