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Bilateral S2 Dorsal Root Ganglion Stimulation Improves Urine Retention in a Patient With Pelvic Pain: A Case Report

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Background: Chronic pelvic pain is a debilitating condition that is often refractory to conventional therapies, including pharmacologic management, physical therapy, and interventional procedures. Dorsal root ganglion stimulation has emerged as a targeted neuromodulation strategy, offering precise analgesia by modulating sensory neurons at affected dermatomes. Its potential effects on urinary distention, however, remain underexplored.

Case Report: This is the report of a 24-year-old woman with chronic pelvic pain refractory to conservative treatments who underwent bilateral S2 dorsal root ganglion lead placement. She experienced significant pain relief, accompanied by a reproducible improvement in long-standing urinary retention. When stimulation was on, urinary retention improved markedly; when off, symptoms returned within hours. No changes in medications or urologic management occurred, suggesting a direct neuromodulatory effect on her urinary function.

Conclusion: Sacral dorsal root ganglion stimulation may provide dual benefits for patients with chronic pelvic pain, because it addresses both neuropathic pain and urinary distention. This case highlights the broader therapeutic potential of dorsal root ganglion stimulation for pelvic floor dysfunction and underscores the need for further studies to evaluate its efficacy, mechanisms, and long-term outcomes.

Key words: Dorsal root ganglion stimulation, urine retention, chronic pelvic pain, neuromodulation

BACKGROUND

Chronic pelvic pain (CPP) is a debilitating condition that affects thousands of individuals worldwide, profoundly impacting daily functioning, emotional well-being, and overall quality of life (1).Patients often experience persistent discomfort that interferes with work, social activities, sexual health, and sleep; however, effective treatment options are limited. The complex anatomy and innervation of the pelvis often render conventional therapies, such as pharmacological management, physical therapy, and dorsal column spinal cord stimulation, insufficient for providing meaningful pain relief.

Emerging evidence suggests that dorsal root ganglion stimulation (DRGS), which targets the sensory neurons at the dorsal root ganglia that corresponds to the affected pelvic dermatomes, may offer more precise and effective neuromodulation than traditional spinal cord stimulation. By modulating aberrant pain signaling at the level of the DRG, DRGS has the potential to reduce pain intensity, improve physical function, and decrease reliance on analgesic medications in patients with refractory CPP (1).

Neuromodulation therapy encompasses a range of electrical stimulation techniques that target specific nerves to alleviate lower urinary tract symptoms. These

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include pelvic floor electrical stimulation via vaginal, anal, or surface electrodes; interferential therapy; magnetic stimulation; percutaneous tibial nerve stimulation; and sacral nerve stimulation. These first 4 techniques are typically used for short-term external stimulation, while sacral nerve stimulation provides long-term internal modulation. These interventions have demonstrated efficacy for overactive bladder, urgency urinary incontinence, and, in some cases, stress urinary incontinence. The mechanism involves reflex inhibition of detrusor contractions through the activation of afferent fibers that affect the hypogastric nerve, the pelvic nerve within the sacral cord, and supraspinal detrusor reflex pathways. For stress incontinence, pelvic floor contraction is enhanced both via direct muscle stimulation and pudendal nerve activation (2).

Neuromodulation has been increasingly recognized as an effective therapy for both stress and urgency urinary incontinence, particularly in patients who do not respond adequately to conservative measures or pharmacologic treatment. Reported cure rates for pelvic floor neuromodulation range from 30% to 50%, with improvement rates of 60% to 90%, underscoring its potential to enhance the quality of life for individuals significantly affected (2,3). In clinical practice, external stimulation is typically delivered via vaginal, anal, or surface electrodes for short-term therapy. In comparison, sacral nerve stimulation provides long-term modulation of the sacral nerve roots. The efficacy of these interventions has been validated in randomized, placebo-controlled trials. These trials showed that neuromodulation can reliably reduce symptoms of urinary incontinence over both the short- and long-term (3).

Despite these promising results, the superiority of neuromodulation compared with other conservative approaches, such as structured pelvic floor muscle training, has not been definitively established. Consequently, current clinical guidelines advocate for pelvic floor exercises as the foundational therapy, often supplemented with adjunctive neuromodulation to enhance outcomes. For patients with urgency incontinence or mixed stress–urgency incontinence, neuromodulation may serve as a valuable alternative to pharmacologic therapy, especially when medications are contraindicated, poorly tolerated, or ineffective. Overall, neuromodulation represents a versatile and durable treatment that can address both storage and voiding dysfunction, providing individualized therapy for patients with complex lower urinary tract symptoms.

CASE PRESENTATION

A 24-year-old woman presented with chronic pelvic pain that had not responded to conservative treatments, medications, or prior interventional procedures, such as steroid injections and nerve blocks. The patient also reported urine retention, which she managed with self-catheterization. After a thorough evaluation, we deemed her an appropriate candidate for a bilateral S2 DRG stimulator trial to evaluate its efficacy for treating her resistant chronic pelvic pain.

She had 70% pain relief during the trial and underwent permanent implantation. In addition to her pain improvement, she also reported a marked improvement in her long-standing severe urinary retention that also was resistant to conservative therapy. This effect was consistent and reproducible: when the stimulator was on, bladder emptying was smooth with minimal postvoid residual sensation; when it was off, urinary retention returned within hours. Restoring stimulation reliably resolved her symptoms. Prior to the permanent implantation her urinary retention was severe and required constant self-catheterization. She reported that she no longer needs self-catheterization after the bilateral S2 DRG implant.

DISCUSSION

CPP is a multifactorial and often debilitating condition that may arise from postsurgical nerve injury, pelvic floor dysfunction, chronic pelvic pain syndrome, or other neuropathic etiologies (1). Patients with chronic pelvic pain frequently experience persistent symptoms despite conventional multimodal therapies, including pharmacologic management, physical therapy, and interventional procedures such as nerve blocks. The refractory nature of chronic pelvic pain highlights the need for targeted, advanced interventions that can address both somatic and visceral pain pathways.

DRGS has emerged as a promising neuromodulatory therapy for patients with chronic pelvic neuropathic pain. By precisely targeting the DRG corresponding to the affected dermatomes, DRGS provides focal analgesia while minimizing unintended stimulation of nontarget regions. Observational studies, including multicenter retrospective and prospective analyses, have demonstrated that DRGS can significantly reduce pain intensity, improve physical function, enhance quality of life, and reduce reliance on analgesic medications (4). In chronic pelvic and groin pain, leads are commonly placed at sacral levels (typically S2–S3), with evidence

suggesting substantial pain relief even in patients with refractory postsurgical neuropathic pain (4).

Clinical evidence, primarily from multicenter retrospective and prospective studies, indicates that most patients experience significant pain reduction following DRGS, with leads typically placed between T12 and L2 (5). For patients who had a herniorrhaphy, optimal lead configurations often include T12–L2 in combination with L2 or L3. Collectively, these findings suggest that DRGS is a viable and effective option for patients with intractable neuropathic groin pain, particularly when conservative medical management has failed (5).

Across 28 studies involving 354 patients, DRGS consistently produced meaningful reductions in pain, improved physical function, enhanced quality of life, and decreased reliance on analgesic medications (6). DRGS may be considered on a case-by-case basis for patients with refractory, focal pain who are not ideal candidates for other neuromodulation therapies because it offers a targeted and precise intervention for chronic pain management (6).

DRGs can be understood in the context of their unique neurophysiology and their roles in sensory and autonomic regulation. DRGS exerts its analgesic effects through several converging mechanisms. At the neuronal level, stimulation stabilizes the excitability of primary sensory neurons. It enhances the filtering capacity of the T-junction, thereby reducing the transmission of high-frequency nociceptive signals into the spinal cord. This modulation of afferent traffic is particularly relevant in chronic pelvic pain, where both somatic and visceral pathways frequently exhibit hyperexcitability.

DRGS also affects the surrounding neuroimmune environment by reducing satellite glial cell activation and dampening inflammatory signaling, both of which are increasingly recognized contributors to persistent pelvic pain syndromes. Furthermore, DRGS can modify both orthodromic and antidromic conduction, thereby affecting segmental dorsal horn processing and peripheral afferent excitability.

These mechanisms are especially relevant at the sacral levels, where the DRG contains not only somatic afferents but also visceral sensory fibers involved in bladder sensation, pelvic floor feedback, and lower urinary tract reflex pathways. Modulation of these afferents may have downstream effects on spinal and supraspinal circuits involved in pelvic organ function. While DRGS is traditionally used for somatic pain, its influence on mixed sensory populations provides a plausible framework for understanding additional clinical effects beyond analgesia (7).

Although the mechanism remains incompletely understood, prevailing theories suggest that stimulation alters bladder sensation and motor output by influencing both unmyelinated C-fibers and myelinated A-fibers of the pelvic and pudendal nerves. This modulation is believed to inhibit aberrant spinal cord sensory processing, suppress detrusor overactivity, and reduce pelvic floor hypertonicity by attenuating the guarding reflex. These effects collectively improve urgency, urge incontinence, incomplete bladder emptying, and nonobstructive urinary retention (1-3).

Overall, the current understanding of DRGS shows it can influence both nociceptive and nonnociceptive nerve pathways. This wide-ranging neurophysiological effect provides a plausible biological basis for the sensory or autonomic changes observed during sacral DRGS. It also highlights the importance of conducting further research into its potential applications for pelvic and lower urinary tract disorders (8).

While the primary indication was analgesia, she experienced a marked improvement in her long-standing urinary retention. Posttreatment, her bladder emptying became smooth, her postvoid residual volumes decreased; her urinary retention predictably returned within hours when stimulation was turned off, showing a direct link between sacral DRGS and bladder function. No changes in medications or urologic management occurred. This reinforces the role neuromodulation has in restoring normal voiding dynamics. This aligns with prior studies on sacral neuromodulation systems, which have demonstrated improved voiding efficiency, increased average voiding volume, and reduced urgency and leakage, providing further evidence for the role of neuromodulation in mitigating urinary distension (8-10).

Real-world data from the InterStim™ Micro system (Medtronic) further support the clinical effectiveness of sacral neuromodulation for overactive bladder. In a multicenter, postmarket study of 68 patients, significant improvements were reported in overactive bladder-specific quality-of-life scores, as well as in the frequency and severity of urgency and urinary incontinence episodes, at both 3 and 6 months postimplantation (9). The majority of patients reported meaningful improvements in bladder function, with low rates of device- or procedure-related adverse events (9).

Complementary studies, such as the SOUNDS registry, which had 291 patients, confirmed durable improvements in urinary symptoms, disease-specific quality of life, and symptom bother for up to 3 years (10). Importantly, these interventions were well-tolerated, with mostly minor complications and a relatively low rate of permanent device removals (10).

Taken together, these findings suggest that sacral DRGS may provide dual benefits for patients with chronic pelvic pain, addressing both their refractory neuropathic pain and urinary retention.

Limitations

This is a case report; larger cohorts and studies can help identify DRGS's mechanism of action and confirm our finding on a larger scale.

CONCLUSION

Sacral DRGS represents a promising intervention for patients with chronic pelvic pain refractory to conventional therapies. Beyond providing substantial analgesia, DRGS may also improve urinary retention, likely by modulating mixed somatic and visceral afferents at the sacral level.

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