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TARGETING THE GUT VIA THE SPINE: SPINAL CORD STIMULATION FOR CHRONIC IDIOPATHIC GASTROPARESIS—A CASE REPORT

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Background: Gastroparesis is characterized by delayed gastric emptying and can cause abdominal pain, nausea, impaired oral intake, and reduced quality of life (QoL).

Case Report: We describe spinal cord stimulation (SCS) in a patient with chronic idiopathic gastroparesis, intractable nausea, epigastric pain, severe food intolerance, and poor nutrition. She presented after multiple treatments, including gastric electrical stimulation, had failed to provide lasting relief. A celiac plexus block briefly improved her symptoms. High thoracic SCS was subsequently trialed and implanted, with reported improvement in pain, nausea, and oral intake at 1 month, and continued food tolerance without early satiety at 1 year post-implantation.

Conclusions: SCS was associated with improvement in symptoms and quality of life in this patient. Longer follow-up and further study are needed to evaluate its role in refractory gastroparesis.

Key words: Case report; gastroparesis; spinal cord stimulation; neuromodulation; epigastric pain.

BACKGROUND

Gastroparesis is a chronic gastrointestinal motility disorder characterized by delayed gastric emptying, sometimes associated with dysautonomia (1). Symptoms include abdominal pain, early satiety, bloating, nausea, food intolerance, and poor nutrition, which can substantially reduce quality of life (QoL) (2).

Causes of gastroparesis include diabetes mellitus, postinfectious and postsurgical conditions, medications, and autoimmune disorders; with at least 50% of cases classified as idiopathic (3). The incidence is reported to be almost 4 times higher in women than in men (4). Gastric emptying scintigraphy is the standard test for confirming delayed gastric emptying, with retention measured 4 hours after a meal (3).

Treatment may combine dietary modification, including a low-fat, low-fiber diet, with antiemetics such as ondansetron and prokinetic agents such as metoclopramide (5). Other interventions include gastric electrical stimulation and surgery, including pyloroplasty or partial gastrectomy (6).

Spinal cord stimulation (SCS) may modulate neural pathways involved in visceral pain (2). It has shown benefit in some patients with chronic visceral pain and has been proposed to affect gastric motility through autonomic modulation (2,7-10). We describe SCS in a patient with idiopathic gastroparesis, intractable nausea, epigastric pain, and food intolerance.

CASE PRESENTATION

The patient was a 21-year-old woman with almost 10 years of gastroparesis, lower gastrointestinal (GI) dysmotility status post colostomy, postural orthostatic tachycardia

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syndrome (POTS), and a demyelinating disease. She developed intractable nausea, epigastric pain, severe food intolerance, and poor nutrition after multiple viral illnesses and was diagnosed with idiopathic gastroparesis. Rapid weight loss led to a prolonged hospitalization for superior mesenteric artery syndrome. She required long-term total parenteral nutrition, after which liver failure developed. Nutritional support was subsequently delivered through a jejunostomy tube and then a gastrostomy tube.

A gastroenterologist implanted a gastric stimulator 2 years after the initial diagnosis. The patient initially experienced substantial symptom relief and weight gain but later required 3 device replacements because of battery depletion or lead migration. After COVID-19 infection, 6 years after the initial placement, the gastric stimulator provided only partial relief of nausea, even at its highest setting. Oral intake remained intolerable, and a gastrojejunostomy tube was placed. She also had a colostomy for lower GI dysmotility.

The patient presented to our pain clinic with chronic epigastric pain associated with gastroparesis. We discussed an SCS trial contingent on a favorable response to celiac plexus block, and she agreed. A celiac plexus block was performed with 20 mL of 0.25% bupivacaine at T12 under fluoroscopic guidance. After the block, she reported one-day pain relief and tolerated oral intake without nausea or vomiting for the first time in more than a year. This response led to the consideration of high thoracic SCS.

The patient received a 10 kHz SCS trial with leads placed at the mid-T5 level along the spinal process, resulting in an 85% overall improvement in abdominal pain, nausea, and food intolerance during a one-week trial period. After obtaining medical clearances, the patient eventually received a permanent implantation of the 10 kHz SCS system with both permanent leads positioned along the midline over the posterior spinous processes (anatomical midline), with one lead at the mid-T5 level and the other lead placed at mid-T6 to cover more levels (Fig. 1). The T5-T6 vertebral levels were chosen to correspond with the origin of the greater splanchnic nerve (T5-T9), which provides primary sympathetic innervation to the stomach via the celiac ganglion (11). This lead placement is consistent with the approach used by Kapural et al. (12), who placed epidural leads spanning T4-T8 in their prospective study of SCS for chronic abdominal pain. Prior studies by Song et al. (13) demonstrated that SCS at the dorsal columns at the thoracic levels accelerated gastric emptying and reduced sympathetic activity in rodent models, supporting this rationale. Additionally, the patient's positive response to the trial lead at T5 dictated the final position of permanent leads.

One month after her implantation, she described being able to "finally eat" with her friends when they hang out, bringing her much joy. One year since implantation, she has had significant, sustained improvements in food tolerance and oral intake.

DISCUSSION

This case report highlights the potential for spinal cord stimulation as an interventional therapy for gastroparesis. Gastrointestinal motility is promoted by vagal efferent activity and inhibited by sympathetic efferent activity; thus, sympathectomy may improve motility and gastroparesis symptoms (8). SCS at a high thoracic level modulates sympathetic outflow similar to sympathectomy from a celiac plexus block (7,9). Thus, our patient's positive response to diagnostic celiac plexus block supported her candidacy for SCS. The patient experienced significant improvement in quality of life after SCS and sustained food tolerance for at least one year after implantation.

To date, scattered literature has suggested that the use of high-frequency 10kHz SCS at high thoracic levels for gastroparesis can improve gastric emptying post-implantation (7, 8). Rejeski et al. (7) demonstrated that 2 patients with idiopathic gastroparesis who underwent SCS showed improved or normalized gastric emptying tests, and 3 patients had increased water load volumes, indicating improved gastric accommodation before feeling early satiety (conference abstract). Hernandez et al. (8) described a retrospective chart review that studied 10 patients in Spain with gastroparesis who had SCS with lead placement at T4 or T5, of which 9 continued with permanent implants and had significant improvement in abdominal pain (conference abstract). Kapural et al. (9) demonstrated through retrospective chart review significant decreases in daily nausea, abdominal pain, and overall opioid use after 6 months with 10 kHz SCS in patients with refractory, chronic abdominal pain Other narrative reviews have also suggested significant improvement of chronic abdominal pain with the use of SCS (2,10). Although multiple studies support the use of SCS for treating abdominal pain, whether related to gastroparesis or other etiologies, a case study by Manjunath et al. (14) describes gastroparesis induced by SCS with leads placed at T8-T9 for the treatment of chronic axial and radicular back pain. Thus, further studies are needed to better understand the exact effects of SCS on the gastrointestinal tract.

Although prior studies have documented the successful treatment of abdominal pain associated with gastroparesis utilizing SCS, this case report makes several new contributions to the existing literature. To our knowledge, this is among the first reported cases of high frequency 10 kHz SCS as a rescue therapy after declining gastric stimulator efficacy in a patient with refractory gastroparesis. While Kapural et al. (12) reported reductions in chronic abdominal pain and in nausea and vomiting with 10 kHz SCS, this case report documents improvements in patient-reported functional GI outcomes, such as food tolerance, increased oral intake, and improved quality of life.

Furthermore, in this case a diagnostic celiac plexus block served as a clinical observation that informed the decision to pursue SCS for gastroparesis. Rizk et al. (15) demonstrated the utility of differential epidural blockade to confirm visceral pain origin prior to SCS. In our patient, a celiac plexus block at T12 produced short term pain relief and ability to tolerate oral intake, supporting the consideration of SCS at high thoracic level as the next step.

The clinical complexity of this patient, including refractory gastroparesis, multiple gastric stimulator replacements, and concurrent POTS and demyelinating disease, further underscores the potential of 10 kHz SCS in medically complex pain patients.

CONCLUSIONS

Gastroparesis can have a significant negative impact on the quality of life of patients. Although pharmacological treatments are available, there is a considerable unmet need for sustained treatments for refractory cases. In this patient with refractory gastroparesis and profound food intolerance, 10 kHz SCS was used as rescue therapy after declining gastric stimulator efficacy and was associated with patient-reported improvement in quality of life, and food tolerance without early satiety that persisted for at least 12 months after implantation. This single case does not establish SCS as a treatment for gastroparesis, but it adds to the limited literature on neuromodulation for this condition. Larger cohorts and randomized controlled trials are needed to provide more robust evidence.

Author Contributions

NS: writing and data curation.
VS: writing and editing.
HZ: writing, editing, supervision, and conceptualization.
AK: writing, editing, supervision, and conceptualization.

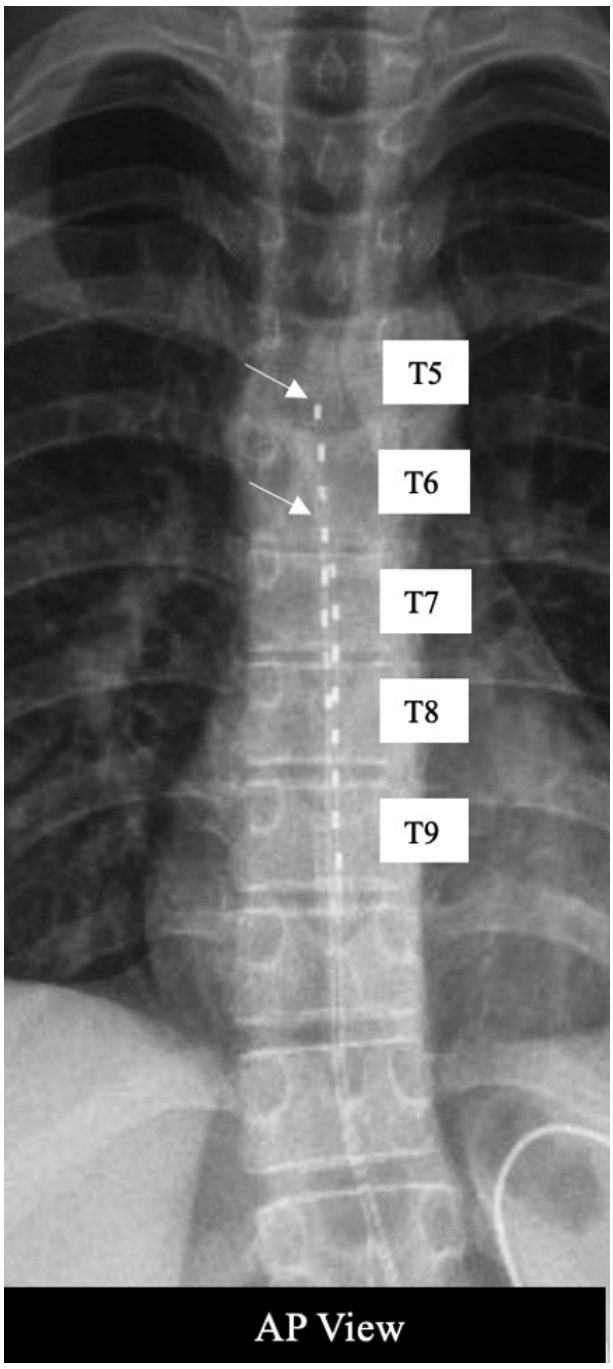


Fig. 1. Post-operative x-ray showing permanent leads from the spinal cord stimulator implant spanning T5-T9 levels.

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