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Utility of Bilateral Posterior Tibial Nerve Electrostimulation in the Treatment of Idiopathic Constipation in the Mexican Population

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ABSTRACT

Background: Constipation has a prevalence in the Mexican population of up to 14.4% (Remes-Troche 2018). Posterior tibial electrostimulation from L4 to S3 modulates sacral roots through multiple afferent pathways in the spinal cord via a spinal and supraspinal somatovisceral reflex that activates sympathetic nerve flow, increasing rectal distensibility, improving rectal sensory thresholds and favoring anterograde and retrograde colonic propagation sequences through stimulation of S2 and S3 thus improving the defecation mechanism.

Objective: To describe the usefulness of bilateral posterior tibial nerve electrostimulation in the treatment of idiopathic constipation in the Mexican population.

Materials and Methods: Prospective, longitudinal analytical study including 49 patients with idiopathic constipation from the coloproctology and gastroenterology outpatient department of Hospital General Regional no. 1, Orizaba, Veracruz. Two non-randomized groups were formed: group 1 received bilateral posterior tibial stimulation via transcutaneous electrodes 3 times a week for 6 weeks; group 2 was treated with fecal bolus modifiers and dietary habit changes. Constipation status was evaluated at the beginning and end of treatment using a custom survey where higher scores indicated greater symptoms and scores closer to zero indicated fewer symptoms. Descriptive statistics, frequencies, percentages, and central tendency measures were applied. The study took place from September 2023 to February 2024.

Results: A total of 49 patients were selected; group 1 consisted of 15 patients (31%) who underwent bilateral posterior tibial nerve electrostimulation and were compared with 34 participants (69%) in group 2 who were treated with fecal bolus modifiers and changes in dietary habits. The mean age of the bilateral posterior tibial nerve electrostimulation group was 45 ± 18 and 55 ± 14 for the fecal bolus modifiers. The female sex predominated in both groups; group 1 with 12 participants (80%) and the second group with 28 (82%) female participants. Of all the patients in group 1, the mean improvement of symptoms was 16% at 6 weeks with bilateral posterior tibial electrostimulation as a treatment for idiopathic constipation, compared to the mean of 33% reported with the use of fecal bolus modifiers and changes in dietary habits; the use of laxatives was also evidenced, in group 1 only 2 participants (13%) continued with their use and in group 2, 22 participants (65%) continued with their use at the end of 6 weeks.

Conclusion: Bilateral posterior tibial electrostimulation treatment for idiopathic constipation reduced symptom perception and laxative use compared to fecal bolus modifiers and dietary habit changes.

KEYWORDS: Electrostimulation, chronic idiopathic constipation, posterior tibial nerve.

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I. INTRODUCTION

Chronic idiopathic constipation (CIC) is among the most common gastrointestinal disorders worldwide, classified into three subtypes: dyssynergic defecation, slow-transit constipation, and normal-transit constipation, the latter being the most prevalent. Physiologically, colonic motility involves mass movements and high-amplitude propagating contractions, mediated by serotonin (5-HT) and interstitial cells of Cajal, which regulate intestinal smooth muscle contractions. CIC prevalence ranges from 2.4% to 22.3%, with a meta-analysis estimating 14.4% in Mexico. Incidence data are limited but suggest a 17% cumulative incidence over 12 years. Globally, prevalence aligns with U.S. data at 14%-16%, with nearly half of patients reporting symptoms lasting over five years, significantly impacting quality of life.[1-5]

Diagnostic approaches often include the Wexner constipation score, assessing severity on a scale from 0 (normal) to 30 (severe). Radiopaque marker studies are sometimes used to evaluate slow-transit constipation, but findings show limited correlation with symptom severity ($R = 0.09$, $P = 0.25$). Initial evaluation focuses on detailed history-taking, including stool frequency, consistency (using the Bristol Stool Scale), use of laxatives, and associated symptoms. Diagnosis is generally based on clinical history, physical exams (including abdominal and rectal assessments), and identification of alarm signs to rule out secondary causes. This comprehensive approach helps differentiate idiopathic constipation from other underlying conditions.[6-9]

Systematic reviews suggest limited evidence supporting routine general laboratory testing for chronic constipation, as cost-effectiveness is likely low. Testing is recommended only for patients with alarm signs or suspected underlying causes. Diagnostic tools include Rome IV criteria, anal and rectal exams, colonoscopy (for patients over 50 or with alarm symptoms), and physiological tests such as anorectal manometry and colonic transit studies. The evidence for these diagnostic approaches holds a B1 recommendation. Non-adherence to treatment is a common issue, with adherence rates dropping to 30% after six months in pediatric populations. Initial treatments typically involve non-pharmacological measures (fiber) and escalate to pharmacological agents like polyethylene glycol, which shows greater efficacy than placebo in increasing stool frequency. Despite this, many patients report dissatisfaction due to limited efficacy or safety concerns.[10-13]

Advanced therapies include prucalopride (a 5HT-4 agonist) and secretagogues like linaclotide and lubiprostone, which reduce colonic transit time but are effective in only 3–5% of patients. Transanal irrigation is emerging as a minimally invasive alternative for refractory functional constipation, with evidence of efficacy in pediatric and adult cohorts. Surgical interventions, such as colonic resection and rectopexy, are reserved for severe or refractory cases, particularly for rectal redundancy or dyssynergic constipation. Additionally, gut microbiota modulation via probiotics shows promise in alleviating symptoms by improving intestinal motility and stool quality. Further research is needed to confirm these findings and establish long-term efficacy.[14-19]

Surgical Treatment in Pediatric Patients

Laxatives are effective in most pediatric cases, but some patients require surgical evaluation. Surgical interventions are guided by rectal biopsy results, colonic transit studies, contrast enemas, anorectal manometry, and colonic motility assessments. Procedures such as intestinal diversions, antegrade enemas, sacral nerve stimulation, colonic resection, or botulinum toxin injections may be considered. However, the evidence is limited, and less invasive options should be prioritized before surgery, such as colonic resection. [20]

Neurostimulation in Constipation Treatment

In recent decades, neurostimulation has been used to address conditions like nausea, vomiting, and intestinal disorders. These techniques involve electrical currents to elicit physiological responses. Sacral nerve stimulation with implantable devices can alleviate severe constipation but is invasive, costly, and requires anesthesia. Transcutaneous electrical nerve stimulation is a less invasive and more affordable alternative, activating neural networks safely. [21]

Posterior Tibial Nerve Stimulation

The posterior tibial nerve, derived from L4-S3, plays a role in the innervation of pelvic organs. Peripheral neuromodulation alters nerve signaling between sympathetic and parasympathetic systems, improving intestinal motility. Additionally, dermatomes or skin stimulation can be used as an alternative.

Posterior Tibial Nerve Stimulation Technique

Supine position with the medial malleolus pointing upward. A 34-gauge needle is inserted 2-4 cm deep at a 60°-90° angle near the posterior tibial nerve without direct contact. A rod electrode is placed near the foot arch, connected to a low-voltage stimulator (9 V). Parameters: 200 µs pulse width, 20 Hz frequency, and adjustable intensity (0-10 mA). Stimulation affects efferent (toe flexion) and afferent fibers, with intensity adjusted during treatment. [22]

Treatment Protocol

Twelve 30-minute outpatient sessions administered 1-3 times per week. Initially developed for overactive bladder, posterior tibial nerve stimulation is now a third-line option for idiopathic constipation. Transcutaneous stimulation is as effective as percutaneous, but current evidence is low-quality, and larger, well-designed studies are needed. [23–24]

The posterior tibial nerve, derived from the L4-S3 roots, modulates sacral roots through afferent pathways in the spinal cord, likely activating a somatovisceral reflex that enhances rectal compliance and sensory thresholds. This

electrostimulation may also improve colonic motility and defecation mechanisms. [24]

A study in Egypt (2014-2015) on bilateral posterior tibial nerve electrostimulation for evacuation disorders found that 47% of patients responded positively after six weeks of treatment. Further research with larger sample sizes is needed. [25]

A 2016 London study showed that posterior tibial electrostimulation significantly improved patients with dyssynergic defecation but had limited impact on slow-transit constipation. The overall success rate was lower than previous studies. [26]

A 2017 London study on transcutaneous tibial electrostimulation for chronic constipation showed improvements in quality of life, stool frequency, and symptoms, but results weren't statistically significant. About 25% of patients benefited from the treatment. [27]

While posterior tibial nerve electrostimulation is proven effective for treating urinary dysfunction and fecal incontinence, there's no research on its use in children for constipation. [28]

A systematic review confirmed electroacupuncture's effectiveness in treating idiopathic constipation. A study of 1,075 participants showed that electroacupuncture was safe and effective. Transcutaneous electrostimulation accelerates colonic transit and may offer therapeutic benefits, though electroacupuncture might be more effective despite being more painful. [29]

Electrostimulation is used for fecal incontinence and constipation as an alternative to conservative and invasive treatments. It involves low-voltage stimulation of a sacral root with an implanted pulse generator, showing long-term efficacy and low mortality. While sacral nerve electrostimulation requires two surgeries, posterior tibial electrostimulation is safer, cheaper, and has no adverse effects, though no comparative studies exist. [30]

II. MATERIAL AND METHODS

Participants diagnosed with idiopathic constipation who attended the coloproctology and gastroenterology outpatient clinic at Regional General Hospital Number 1, Orizaba, and agreed to participate were included after signing informed consent. An initial custom survey was conducted for the study. Participants were divided into two groups: group 1 received dietary habit change information and bilateral posterior tibial transcutaneous stimulation therapy, while group 2 received pharmacological treatment with fecal bolus formers and dietary habit changes, supported by a TENS device. Sessions were held 3 times per week for 6 weeks, with electrodes placed near and posterior to the medial malleolus. The negative electrode was positioned closer to the malleolus and the positive electrode 2 cm above, with a frequency of 10 Hz and 200 milliamperes for 20 minutes. After 6 weeks, a final survey using the same format was conducted to assess symptom improvement.

A. Study Design:

This is an analytical, prospective, longitudinal study conducted at the General Regional Hospital of Orizaba, specifically within the General Surgery and Coloproctology departments, during the period from September 1, 2023, to February 28, 2024.

B. Sample Size:

All patients diagnosed with idiopathic constipation who attended the coloproctology and gastroenterology outpatient clinic at Regional General Hospital Number 1, Orizaba, Veracruz, during the period from September 2023 to February 2024, including a total of 49 patients

C. Selection criteria

Inclusion: Patients with idiopathic constipation meeting Rome IV criteria, aged between 18 and 99 years, willing to participate in the study. Exclusion: History of pacemaker placement, Pregnant women, Diagnosis of diabetes mellitus, hypothyroidism, degenerative diseases, spinal surgery, or paraplegia. Non-Inclusion: Patients lost to follow up, those who choose to leave the study or those unwilling to participate

D. Population:

Patients who attended the coloproctology and gastroenterology outpatient clinic at Regional General Hospital Number 1, Orizaba, Veracruz, with a diagnosis of idiopathic constipation during the period from September 2023 to February 2024.

E. Data Analysis and Statistical Aspects:

The collected data were processed in a database specifically designed in Microsoft Excel. Statistical analysis was performed using SPSS software version 24. Descriptive and analytical results were obtained using Chi-square (X^2) tests to associate stoma closure techniques with the complications observed in each group.

F. Ethical Aspects

The participants declared no conflicts of interest, and all procedures in this study will be conducted in accordance with the General Health Law on Health Research, as well as the principles of the Declaration of Helsinki and the World Medical Association. In accordance with the procedure for evaluation, registration, monitoring, amendment, and cancellation of health research protocols submitted to the Local Health Research Committees and Ethics Committees for Research (R-2022-3101- 038.)

This study complies with the requirements outlined in Title V of the Federal Health Law dedicated to health research, specifically Articles 96, 97, 98, 99, 100, 101, and 102

III.RESULTS

A total of 49 participants were included in the study and divided into two groups. The first group consisted of 15 participants (31%) who received bilateral posterior tibial nerve stimulation (PTNS), while the second group included 34 participants (69%) who were treated with oral stool modifiers and dietary habit changes. The average age of the participants in the PTNS group was 45 ± 18 years, compared to 55 ± 14 years in the stool modifiers group. Regarding sex distribution, the majority were female in both groups, with 12 women (80%) and 3 men (20%) in the PTNS group and 28 women (82%) and 6 men (18%) in the stool modifiers group. In terms of clinical outcomes, straining during defecation was reported in 36% of participants in the PTNS group and 41% in the stool modifiers group at the beginning of the study. By the end of treatment, this decreased to 19% in the PTNS group and 25% in the stool modifiers group. Hard stools were observed in 40% of participants in the PTNS group and 25% in the stool modifiers group at baseline, with a reduction to 17% and 24%, respectively, after treatment. Incomplete evacuation was initially reported by 25% of participants in the PTNS group and 23% in the stool modifiers group, which decreased to 9% and 14%, respectively, following treatment. The sensation of anorectal obstruction was reported in 7% of participants in the PTNS group and 16% in the stool modifiers group at the start of the study. By the end of treatment, these rates were reduced to 3% in the PTNS group and 10% in the stool modifiers group, as summarized in Table 1

At the end of the treatment, the use of laxatives was observed in 2 participants (13%) from the bilateral posterior tibial nerve stimulation (PTNS) group, while 13 participants (87%) in this group discontinued their use. In contrast, in the stool modifiers and dietary habit changes group, 22 participants (65%) continued using laxatives, and only 12 participants (35%) discontinued their use, as illustrated in Figure 1.

The use of laxatives at the end of treatment showed a significant reduction in the bilateral posterior tibial nerve stimulation group, with only 2 participants (13%) continuing their use, compared to the fecal bolus modifiers group, where 22 participants (65%) continued using them (n=49).

Regarding symptom improvement after six weeks, the group treated with bilateral posterior tibial nerve stimulation for idiopathic constipation showed a 16% improvement in symptoms, while the group using fecal bolus modifiers and dietary habit changes demonstrated a 33% improvement. Detailed results are shown in Table 2.

IV.TABLE

TABLE 1. REPORT OF THE MEAN PERCENTAGES OF BOWEL MOVEMENT CHARACTERISTICS IN THE COMPARISON GROUPS AT THE BEGINNING AND END OF THE STUDY TO ASSESS THE EFFICACY OF TREATMENT FOR IDIOPATHIC CONSTIPATION.

Characteristic	Group 1 (n=15)	Group 2 (n=34)
Excessive Straining during Evacuation	Initial: 36%	Initial: 41%
	Final: 19%	Final: 25%
Hard Stools in Evacuations	Initial: 40%	Initial: 58%
	Final: 17%	Final: 24%
Incomplete Evacuation	Initial: 25%	Initial: 23%
	Final: 9%	Final: 14%
Anorectal Obstruction Sensation	Initial: 7%	Initial: 16%
	Final: 3%	Final: 10%

At the end of the study, Group 1 showed a lower mean in evacuation characteristics compared to Group 2. n = 49

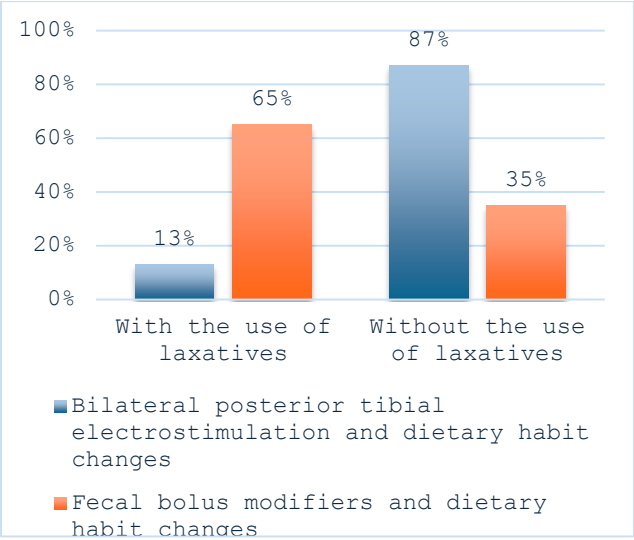
TABLE 2. REPORTED MEAN OF IDIOPATHIC CONSTIPATION IN THE STUDY GROUPS.

Survey	Group 1 (n=15)	Group 2 (n=34)
Initial Total Survey	53%	59%
Final Total Survey	16%	33%

Regarding symptomatology at the end of the treatment, Group 1 showed greater improvement, with a final survey mean of 16%, equivalent to a 17% higher response compared to the mean in Group 1 at 6 weeks. n = 49.

V. FIGURE

Graph 1. Laxative use at the end of treatment.



VI. DISCUSION

Bilateral posterior tibial nerve stimulation (PTNS) is an innovative technique for treating idiopathic constipation, involving 20-minute sessions, three times per week for 6 to 12 weeks, showing positive responses in patients. In a study conducted from 2023 to 2024 with 49 participants in Mexico, Group 1 received bilateral PTNS, while Group 2 was treated with stool modifiers. Results showed that 87% of Group 1 stopped using defecation aids, compared to 13% who continued needing assistance. (24)

A 2014–2015 study by Khaled M. Madbouly in Egypt evaluated the efficacy of bilateral PTNS in 36 participants with evacuation disorders. Sessions lasted 30 minutes, three times weekly for six weeks. At the study's end, 75% no longer required defecation aids, compared to 25% who did. Structural disorders were ruled out via manometry. In comparison, the Mexican study achieved a similar success rate (87%) without pre-treatment manometry, highlighting regional differences. (25)

In a 2016 London study by Kumar and Liwanag, 34 participants underwent 12 weeks of PTNS, with no statistically significant improvement in Wexner constipation scores for patients with slow transit constipation or combined pathologies, showing an 11.8% success rate. The Mexican study, however, reported a 16% mean improvement in symptoms, aligning more closely with the global success rate of 32% for PTNS in constipation treatment. (26)

Another London study, published in 2017 by Iqbal and Collins, assessed the efficacy of transcutaneous PTNS in chronic constipation. Eighteen patients (mean age: 46 years) self-administered 30-minute sessions daily for six weeks. Significant improvements were noted in quality-of-life scores, but symptom evaluation and defecation frequency changes were not statistically significant. Similarly, the Mexican study (with 15 participants) reported a 16% mean improvement in symptoms, consistent with international findings. (27)

In a 2020 Turkish study by Hande and Feridun Suat Gokce, 44 patients over 65 years old with fewer than three weekly bowel movements underwent bilateral transcutaneous PTNS for 30 minutes, three times per week for six weeks. Stool softener use decreased from 63.3% to 15.9% after six weeks and 11.4% after 12 weeks. Parameters such as obstructive defecation, straining, and pain showed significant improvement ($p < 0.001$). These findings align with the Mexican study, which reported a 13% continued laxative use after six weeks and improvements in evacuation characteristics, confirming similar outcomes across different populations. (31)

VII. CONCLUSIONS

The study shows that bilateral posterior tibial nerve stimulation is more effective in improving symptoms of idiopathic constipation compared to fecal bolus modifiers and hygienic-dietary measures. Using a custom survey based on Rome IV and Wexner severity criteria, significant improvement was observed in Group 1 across all studied variables, with an average symptom improvement of 33%, compared to 16% in Group 2. This highlights the potential benefits of innovative electrostimulation therapy for reducing symptoms and decreasing medication use.

The study's strengths include the availability of facilities for electrostimulation therapy at HGRO1 or UMF 1 and its promising outcomes. However, limitations such as a small sample size, lack of manometry studies before treatment, absence of a validated symptom assessment scale, and short follow-up (6 weeks) restrict the generalizability of results. Future research should include larger sample sizes, pre-treatment manometry to rule out structural disorders, validated symptom scales, and extended follow-up periods (12 weeks). Despite these limitations, the study supports the safe implementation of bilateral posterior tibial nerve stimulation in treating idiopathic constipation, aligning with international literature.

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