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Posterior Tibial Nerve Stimulation as a Treatment for Constipation

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Abstract:
There are various functional disorders present in the digestive system, among them we find constipation affecting 30% of the western population characterized by alterations in defecation presenting a decrease in number and difficulty when performing evacuations generally caused by anatomical, physiological and characteristics of the stool such as consistency, volume and presence of irritants, classified depending on the clinical or anatomical characteristics present where improvements are generally found when changes in eating habits, pharmacological treatment or strengthening of the pelvic floor and second line are applied Treatment involves neuromodulation, which uses low-frequency currents to directly or indirectly stimulate the spinal nerves. It includes regulation of the sacral root nerve and stimulation of the posterior tibial nerve. This technology has two modes of application: percutaneous needle electrode and percutaneous surface electrode acting on neurons that act as facilitators or inhibitors of colonic contractions.

Key words: Constipation, fecal incontinence, tibial nerve stimulation

I. Introduction

Constipation is the most common functional digestive disorder, affecting about 30% of people in Western countries. It is a very heterogeneous condition that encompasses several clinical subtypes, including constipation due to slow transit, difficulty in defecating, and combinations of these forms, all of them characterized by

difficult and / or infrequent defecations. In most cases, dietary or lifestyle changes and medications (often self-medication) can provide benefits, and a small group of patients with difficult defecation may benefit from surgery (1).

In Latin America it is reported that chronic constipation has an estimated prevalence of 5% -21% in the region, with a female: male ratio of 3: 1, with a high impact on the quality of life of patients and their families. Due to the large number of interpretations given to constipation and bowel movements, attempts have been made to classify the symptoms and characteristics of constipation, bowel movements, and stool using the Rome III criteria.

There are different spectra of the disease, which can be classified from the clinical or anatomical point of view, taking into account if the involvement is diffuse in the colon or if there is an evacuation disorder. In some cases, diagnostic tests are normal but the patient has significant symptoms. In general terms, then, chronic constipation is classified as slow-transit constipation, which is divided into colonic inertia and colonic hyperresponsiveness, evacuation disorder, and irritable bowel syndrome, with a predominance of constipation (functional constipation) (2).

The etiology of FI is often multifactorial. The pathophysiological mechanisms can be structured into four categories: structural abnormalities (muscular, neurological and / or visceral), physiological abnormalities (changes in anorectal sensation; fecal impaction), stool characteristics (changes in consistency, volume or frequency; presence or absence of irritants) or others (3).

The treatment of IF includes a wide spectrum of techniques. Once conservative measures have initially failed (diet modifications, pelvic floor reeducation, biofeedback, drug treatment), the next line of treatment includes neuromodulation, which uses low-frequency electrical current for direct or indirect stimulation of the muscles. spinal nerves. It includes sacral root neuromodulation and posterior tibial nerve stimulation (PTNS), which are less expensive and without the need to implant any permanent device surgically. There are two modes of application of this technique: percutaneous with needle electrode and transcutaneous with surface electrodes (3).

II. Materials and methods

To carry out this article, a bibliographic search was carried out in various databases such as Elsevier, Scielo, Medline, pubmed, ScienceDirect and Ovid, thus selecting original articles, case reports and bibliographic reviews from 2011 to 2019 in Spanish and English using MeSH terms: constipation, incontinence of the and tibial nerve stimulation, including all the documents that will deal with neurostimulation for the treatment of constipation and information related to it, the data found were between 8-15 records, thus using 9 articles for the completion of this document.

III. Results

In a study carried out in 12 patients with fecal incontinence (FI) undergoing treatment with P-PTNS in the Pelvic Floor Rehabilitation Unit of the Virgen del Rocío University Hospital in Spain, between June 2015 and June 2017. After treatment a statistically significant improvement was obtained in the clinical parameters: defecation frequency and incontinence; Regarding the amount of loss, a reduction in the number of absorbents was observed in 33.3% of the patients with a mean reduction of 0.5 ± 0.8. The treatment also caused a reduction in severity measured with the Wexner test, and an improvement in the quality of life represented by the FIQL in its 4 dimensions --- lifestyle, behavior, depression and shame (Table 1). Regarding patient satisfaction, 100% reported subjective improvement, and no adverse effects were found with the application of P-PTNS (4).

Table 1. P-PTNS results in relation to defecation frequency, incontinence episodes, WEXNER, and FIQL. (lifestyle, behavior, depression, and shame)

	Before P-PTNS Media± SD	After P-PTNS Media± SD	P
Depositions / day	3,75 ± 2,6	1,92 ±0,9	0,027
Incontinence / day	3,02 ± 2	0,81 ± 0,93	0,012
WEXNER	11,42 ± 3,5	8,42 ± 4,46	0,007
FIQL Lifestyle	1,96 ± 0,7	3 ± 0,59	0,005
FIQL Conduct	1,66 ±0,64	2,56 ± 0,83	0,005
FIQL Depression	2,6 ± 0,87	3,26 ± 0,74	0,008
FIQL Shame	2 ± 0,83	3,08 ±0,71	0,005

FIQL: Fecal Incontinence Quality of Life; P: level of statistical significance; P-PTNS: Percutaneous electrostimulation of the posterior tibial nerve; SD: standard deviation

In a study conducted by the Gastroenterology Division of Yinzhou People's Hospital in October 2014 to October 2015, for stimulation on each leg, 2 electrodes, connected to a stimulator, were placed in the following locations: an electrode at the point of PTN (3 fingers above the tip of the malleolus and posterior to the tibia) or acupoint ST36 (Zusanli, located on the proximal one-fifth of the craniolateral surface of the leg distal to the head of the tibia in a depression between the muscles of the cranial tibia and the long digital extensor, Fig. 1) and the other electrode 4 cm above or below the first electrode.

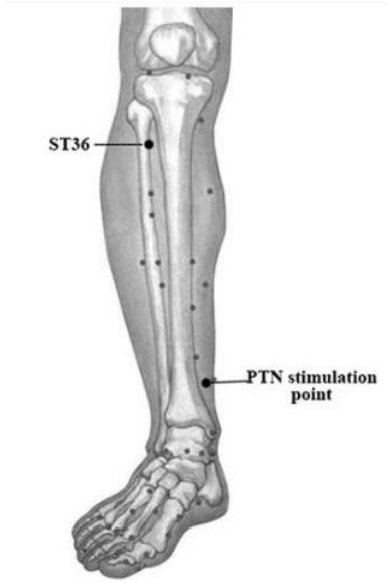

FIGURE 1. Location of the ST36 acupoint (Zusanli) and the PTN stimulation point. The gray spots in this figure refer to the other water spots (except ST36) on the leg and foot. PTN indicates the posterior tibial nerve.

2-week TN in ST36 but not in PTN improved rectal sensation. TN in ST36 resulted in a 36.1% decrease in the impulse threshold to rectal distension (134.1 ± 14.3 mL pre-TN vs. 85.6 ± 6.5 mL post-TN, P = 0.008) and a reduction of 22.5 % at the maximum tolerance threshold (178.1 ± 14.9 mL pre-TN vs. 138.1 ± 8.0 mL post-TN,

P <0.05, Fig. 2). However, no improvement was seen with TN in ST36 or TN in PTN in other measurements of anorectal motility or sensory functions (5).

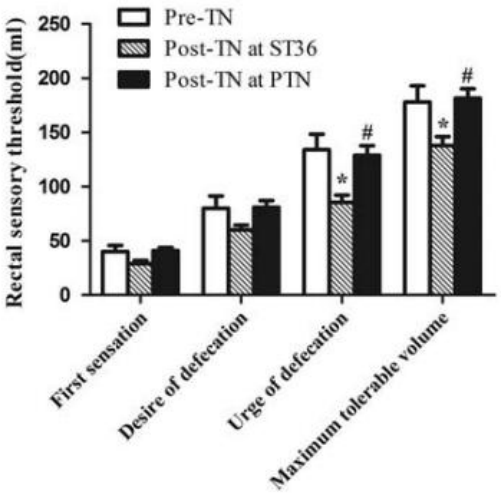

FIGURE 2. Comparison of rectal sensory threshold before and after TN (n = 16). PTN indicates posterior tibial nerve; TN, transcutaneous neuromodulation. * P <0.05 for post-TN versus pre-TN. #P <0.05 for post-TN in PTN versus post-TN in ST36.

In a study conducted at London University Hospital they included all tertiary referrals for the treatment of refractory constipation over a period of 18 months and included patients who had no longer achieved any symptom relief through other available conservative therapy. Eligible patients were older than 18 years. All of them were willing to participate in the study and had met the Rome III criteria for constipation having failed treatment by two different classes of laxatives for six months (for the STC group) or biofeedback (for the RED group) or a combination (for the BOTH group). Patients with slow transit constipation (CTS) and combined pathology (BOTH) did not show statistically significant improvement in the Wexner constipation score before and after PTNS (21.3 3.0 vs 20.2 4.9 [p = 0.34] and 20.9 3.1 vs 21.4 3.3 [p = 0.63]. There was a significant improvement in patients with rectal evacuation dysfunction (21.2 3.7 vs 18.4 5.1 [p = 0.004]), but the analysis of all groups of patients taken together (STC + RED + Both) showed no significant differences between Wexner scores before and after treatment (21.0 ± 3.2 vs 19.3 ± 3.4 [p = 0.10]. And in patients with CTS, the number of remaining radiopaque markers seen at five days in the study of colonic transit was 47.8 (SD 9.3) before and 44.1 (SD 9.2) after PTNS (p = 0.25). When all patients were analyzed together again, there was no significant difference (31.3 10.3 vs 30.4 10.0 [p = 0.47] (6).

IV. Discussion

Electro-stimulation can be applied in various ways, including in the anterior roots of the pelvic nerve, by surgery (in patients with spinal cord injuries) or percutaneously, through the sacral foramen; stimulation of the posterior tibial nerve with needle; the application of an external electromagnetic field; or stimulation of the smooth muscle layer of the colon (7).

Most studies use IF current and therefore, medium frequency mode, using the low frequency mode with asymmetric and rectangular bipolar wave microcurrents in one study. A trend towards a higher frequency and duration of sessions has been observed in adults, compared to children (30 min sessions, 5/7 times a week vs 20 min, 2-3 times a week). This may have been due to issues of adherence to treatment or because in adults a higher cumulative dose of stimulation may be necessary. The AMF in the studies in the child population was variable, oscillating between 5- 150 Hz being 80-150 Hz, 5-25 Hz or 80-120 (8). In the adult population, on the other hand, the MFA has been 80-120. Generally, there is a predilection for high AMFs (75-150 Hz) that are

usually better tolerated by patients and are advisable in acute problems, with severe pain and hypersensitivity. However, several trials in a population with secondary-type constipation due to post-operative Hirschsprung or MMC and in one case of functional constipation have used low AMF (5-25 Hz) .This range is normally used for peripheral venous circulation problems and constipation and at the same time, complement the reeducation in case of atrophy due to immobilization and degeneration of the neuromuscular system, which is why it seems a fairly successful choice in the case of the study in patients with secondary constipation due to post-operative Hirschsprung and MMC

The application of the IF current, in addition to reducing pain due to the stimulation of the thick nerve fibers, produces the normalization of the autonomic balance. Likewise, knowing that the control of colonic motor function resides in the extrinsic nerves (cortical and spinal neurons that act as facilitators or inhibitors of colonic contractions), the intrinsic nerves of the colon, the interstitial cells of Cajal and in the properties of the smooth muscle cells of the colon (3) (6). It is hypothesized that the mechanism of action of IF therapy is through the stimulation of electrically excitable Cajal cells or pacemaker cells of the gastrointestinal tract, responsible for peristalsis. Alternatively, because the electrode placement is very close to the spinal cord, it is also suggested that their effects may be exerted directly on the spinal cord, influencing the autonomic nervous system through the afferent or efferent pathways. However, given that the effects of stimulation are not immediate and last a few months, it is likely that they are due to an alteration in neuronal function due to an influence on the neuroplasticity of enteric nerves, inducing structural, intrinsic or synaptic changes (9).

V. Conclusion:

Constipation as a functional disorder of the digestive system present in an important way in the population and mainly presented in women, characterized by the aforementioned alterations present at the time of bowel movements caused by anatomical, physiological and stool-specific alterations with pain symptoms present and other characteristics that affect the quality of life of the patient, generally treating therapy based on diet changes, pharmacotherapy and improvements in the pelvic floor, reporting improvement in most patients, however, according to the findings, there is evidence that relates the stimulation of nerves of sacral root and posterior tibial nerve with constipation improvement, however further basic and clinical research on colon motility is necessary to identify a type or subtype of constipation that does not respond to medical treatment that can be successfully responded to and controlled by middle of the neuroe stimulation.

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