Efficacy of transcutaneous electrical nerve stimulation in the treatment of chronic pelvic pain

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ABSTRACT

Background: Chronic pelvic pain is prevalent in 2% of women population globally. The etiology is multifactorial. Even in the absence of pelvic pathology, there is a subgroup of women who do not respond to analgesic and anti-inflammatory therapy. Chronic pelvic pain can be inhibited by direct inhibition of impulses in the preganglionic afferent neuron by closing the hypothetical gate in the dorsal horn of the spinal cord. Transcutaneous electrical nerve stimulation (TENS) is based on the gate control theory of abolishing the painful stimuli by providing simultaneous inputs in larger myelinated nerve fibers.

Aims and Objectives: This study was designed to assess the effectiveness and safety of TENS in idiopathic chronic pelvic pain.

Methods: It is a prospective, experimental study to evaluate the effectiveness of TENS versus placebo in reducing pain severity in chronic pelvic pain (G1 = 30, G2 = 32, G3 = 30, and G0 = 30). Patients with chronic pelvic pain due to benign lesions of genital tract, gastrointestinal, and renal disorders were excluded from the study after performing an ultrasound study of abdomen and pelvis. Ten treatment sessions (5 sessions/week) of 30 min were conducted.

Observations and Results: There was a significant improvement in pain scores in TENS group as compared with control group, and two patients were completely pain free following TENS therapy.

Conclusion: In women patients with idiopathic chronic pelvic pain, TENS can be a useful intervention. TENS units are safe, economical, and easily commercially available.

Key Words: Chronic pelvic pain, idiopathic, transcutaneous electrical nerve stimulation

INTRODUCTION

Chronic pelvic pain may involve organ system diagnosis including gynecological pain, interstitial cystitis or painful bladder syndrome, irritable bowel syndrome, vulvodynia, pelvic floor tension myalgia, and abdominal and pelvic myofascial pain.¹ In our study, patients with chronic pelvic pain due to benign lesions of genital tract, gastrointestinal, and renal disorders were excluded from the study after performing an ultrasound study of abdomen and pelvis. The pathophysiology of idiopathic chronic pelvic pain in the absence of organic lesions is usually obscured. It affects 2% of women at the peak of their career, affecting their social life and confidence levels.² This causes a considerable personal, financial, and social burden.

The first-line therapy according to the international guidelines is analgesics and anti-inflammatory medicines. Unfortunately, most patients are middle to old age and do not tolerate gastric

Access this article online

Quick Response Code:

Website: www.jmidlifehealth.org

DOI: 10.4103/jmh.JMH_60_16

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How to cite this article: Sharma N, Rekha K, Srinivasan JK. Efficacy of transcutaneous electrical nerve stimulation in the treatment of chronic pelvic pain. J Mid-life Health 2017;8:36-9.
side effects such as gastritis, nausea, and vomiting. The care of elderly and middle age should be our prime concern in this era of rising life expectancy. Hence, this study was designed to assess the effectiveness and safety of transcutaneous electrical nerve stimulation (TENS) in chronic pelvic pain.

The use of electricity in medicine is 4000 years old. Ancient Egyptians (1200 BC) and Romans (46 AD) have used fishes to deliver electric current therapy for various ailments.[4,5] TENS is based on the gate control theory of abolishing the local pain reflex arc.[6] TENS triggers the hypothetical gate located in the lamina V of dorsal horn ganglia of the spinal cord to close. This is achieved by providing simultaneous inputs from the T10 dermatome located in the suprapubic area. It is a nonpharmacological and physiological method of inhibiting the presynaptic afferent neurons carrying impulses from pelvis by stimulating the nerves of peripheral segmental dermatome (gate control theory of electromodulation by stimulating the peripheral nerves corresponding to the visceral organ).

It has also been hypothesized that the TENS works by improving the local vascularity and a possible inhibition of sympathetic impulses by the release of brain endorphins.[7-9]

METHODS

Study design
This prospective study was conducted in the Department of Obstetrics and Gynecology and Department of Physiotherapy at Saveetha Medical College, Chennai, from January 2015 to January 2016. Inclusion criteria were women with chronic pelvic pain not responding to analgesic and anti-inflammatory therapy in the age group of 18–60 years. Patients with known abdominal or pelvic pathology, pregnancy, or any medication for chronic renal diseases were excluded from the study. Clinical history of pelvic inflammatory disease (PID) and prolapse was taken in all cases. Pap smear and clinical pelvic bimanual examinations were done for all cases to rule out PID. Pessary test was done to rule out pelvic pain due to prolapse. Ninety two patients with a clinical diagnosis of chronic pelvic pain not responding to analgesic and anti-inflammatory therapy were treated with square wave biphasic pulse of frequency <25 Hz (G1), 25–75 Hz (G2), and 75–100 Hz (G3) with a current density on two electrodes, each 4 cm². The number of patients is G0 = 30, G1 = 30, G2 = 32, and G3 = 30. The controls taken were matched with cases with regards to age, duration of pain, and severity of pain. The sampling method followed was consecutive enumerating sampling.

The three parameters of current were adjusted. A = Amplitude, F = Frequency, and D = Duration [Figure 1]. These parameters can be adjusted on any standard TENS equipment. Further, there are options such as burst current, continuous current, and amplitude modulated current. We used continuous current. Cases and controls were comparable in terms of pre-TENS pain scores and maximum intensity tolerated by the patient was used. Three different frequencies were used in the three groups. The principle is the balance between receptor downregulation with increasing frequency and minimal effective frequency.

The electrodes were applied on suprapubic dermatome corresponding to T10 after explaining the procedure. The current amplitude was gradually increased and set at the maximum tolerated by the patient (0–80 mA).

The electrode-skin impedance was minimized by applying a generous layer of electrode gel to promote good contact under entire electrode. The participants were given five settings per week for 2 weeks. Ten treatment sessions (five sessions/week) of 30 min were conducted for each patient. Thirty cases of chronic pelvic pain were taken as controls on placebo (G0). For ensuring the blinding of participants, TENS electrodes were attached to the control group as in the study group but no current was delivered. Pre- and post-questionnaires (visual analog scale 1–10) were used. Patients were instructed to circle the score that best applied. The long-term advantage of TENS is peripheral nerve myelination. This effect is cumulative. To assess the long-term myelination, the patients were reassessed for pain relief after 4 weeks.

Statistical analysis was done using Student’s paired t-test and Analysis of variance test using SPSS (SPSS for WINDOWS V16, WA, USA) package.

Observations
The mean age of the 122 patients was 48 years (range: 18–60). Cases were comparable to controls in age, duration, and intensity of pain scores. TENS showed an improvement in the low-frequency group (G1 = 30). In the low-frequency group, there was a reduction in the pain score from pretest scores (6.77 ± 2.21) to (2.07 ± 1.05) in the post-TENS group. This was statistically significant reduction (P = 0.0001, t = 10.05, Standard error of Deviation (SED) =1.73) [Table 1].

In the TENS treatment group with medium frequency (G2 = 32), there was a reduction in the pain scores from pretest scores (6.66 ± 2.34) to (2.38 ± 1.10) in the post-TENS group. This was a statistically significant reduction (P = 0.0001, t = 9.38, SED = 1.83) [Table 1].

In the TENS treatment group with high frequency (G3 = 30), the reduction in the pain from pretest scores (7.03 ± 2.20)
RESULTS

There were no cases of electrode injury in our patients. Box plots were plotted for placebo group and TENS group. There was a significant improvement in pain scores in TENS group, and two patients were completely pain free following TENS therapy. Our study had the maximum pain relief in the high-frequency TENS group, thereby showing a dose-response relationship of TENS in the treatment of chronic pelvic pain. High-intensity TENS (75–100 Hz) with maximum tolerability is shown to have maximum effect. The ideal stimulation protocol and exact position of electrodes need to be worked out. Our study shows high frequency to have maximum pain relief.

DISCUSSION

Chronic pelvic pain is a disease of spontaneous remissions and exacerbations.\[10,11]\) Patients often present late after several years of symptoms. Lifestyle modifications and analgesics have been practiced earlier. In our study, we found a significant improvement in symptoms after TENS as the first-line treatment. This is in accord with other studies where TENS has been compared with anti-inflammatory therapy and sacral neuromodulation therapy. Several prospective studies have implicated TENS as an effective and safe treatment warranting randomized, placebo, controlled trials.\[12-16]\)

In elderly patients where other comediations have their own gastrointestinal side effects and impairment of cognition is a concern, TENS can be a useful intervention. Genetic differences result in dissimilar metabolic degradation of nonsteroidal anti-inflammatory drugs by cytochrome P 450, so dose adjustment is a challenge. TENS dose on the contrary is easy to adjust while balancing efficacy against tolerability.

Limitation of our study is that patients who are involved in the clinical trial received more intensive monitoring of their treatment. Motivation increases lifestyle modifications. This might explain the improvement in pain scores in our set of patients who were taken as controls.

### Table 1: Placebo group (G0 = 30) and transcutaneous electrical nerve stimulation (G1 = 30, G2 = 32, and G3 = 30) group: Pretest and posttest scores

| Group   | TENS frequency       | Mean±SD  | P   | t    | SED |
|---------|----------------------|----------|-----|------|-----|
|         |                      | Pretest  | Posttest |     |     |     |
| G0 (30) | Placebo              | 5.53±1.53| 4.83±1.42| 0.071 | 1.84 | 1.47|
| G1 (30) | Low (<25 Hz) frequency| 6.77±2.21| 2.07±1.05| 0.0001 | 10.5 | 1.73|
| G2 (32) | Medium (25-75 Hz) frequency| 6.66±2.34| 2.38±1.10| 0.0001 | 9.38 | 1.83|
| G3 (30) | High (75-100 Hz) frequency| 7.03±2.20| 1.67±0.802| 0.0001 | 12.5 | 1.66|

TENS: Transcutaneous electrical nerve stimulation, SD: Standard deviation
Efficacy of TENS depends on the accepted principle that an optimal effect requires an adequate dose. Steps taken to prevent tolerance to TENS therapy include the use of alternate high and low frequencies and using burst currents. The initial accumulation and then gradual reduction of endogenous opioids vary widely among individuals. On an average, the effect of TENS lasts for 18–24 h.

TENS units are commercially available without prescription as over counter or rom Internet. Standard TENS device with accessories cost between Rs. 1800 and Rs. 2500 with more advanced TENS device between Rs. 22,000 and Rs. 25,800. Indian physiotherapists use TENS predominantly for musculoskeletal pain and neuropathic pain and rarely for dysmenorrhea, labor pain, and postoperative pain. TENS devises may be loaned to the patients for their duration of stay during hospital. Similar to the model of patient controlled analgesia, patient can be trained on how to self-administer TENS. Costs to the clinic will be initial outlay for TENS devise and then the running costs of replacing batteries and self-adhering electrodes or carbon rubber electrodes.

In rural India, there may be a sociocultural barrier to accept TENS due to reluctance to try new treatments. Carbon electrodes will be a better choice in rural India as self-adhering electrodes deteriorate rapidly if not kept in cool and dust-free area.

CONCLUSION

Many chronic pelvic pain patients have been successfully treated with TENS. TENS is a portable, nonaddictive, and noninvasive means of pain relief with flexible patient directed dosing. Small electrical pulses delivered through electrodes directly placed on skin reduce pain scores through both central and peripheral mechanisms. High stimulus just below strong but comfortable intensity with alternating high- and low-frequency current produces maximal effect. There is increasing evidence that the therapy is also effective in labor pain, overactive bladder, vulvodynia, fecal incontinence and neurogenic dysfunctional elimination syndrome, and poststroke incontinence. Future advancements will likely emphasis on the exact placement site of electrodes with less collateral stimulation.

Acknowledgment

We thank our physiotherapy staff and obstetrics and gynecology outpatient staff for helping in the care given to the patients.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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