

Comparison between transcutaneous electrical nerve stimulation and metoclopramide in preventing postoperative nausea and vomiting after gastrointestinal laparoscopic surgery-A prospective and randomized study



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ABSTRACT

Background: Postoperative nausea and vomiting is a common complication after laparoscopic surgery and general anesthesia. It increases the patient's discomfort and compromises the surgical outcome. **Aims and Objectives:** The study aimed to compare the effectiveness of Transcutaneous Electrical Nerve Stimulator (TENS) and Injection of Metoclopramide for the prevention of post-operative nausea and vomiting in patients undergoing gastrointestinal laparoscopic surgery. The secondary objective of the study was to find out the percentage of cases needed rescue antiemetic drug (Inj. Ondansetron) when prophylaxis failed. **Materials and Methods:** The study was a prospective, double-blind, randomized trial conducted at M.G.M. Medical College and M.Y. Hospital, Indore. 90 patients of 18–60 years of age, ASA physical status I-II, undergoing elective laparoscopic gastrointestinal surgery were included. Patients were allocated randomly into two equal groups. Group T received TENS (the stimulation group) at P6 acupressure point, whereas group M received an injection of Metoclopramide before induction of anesthesia. Patients in both groups were observed for 24 h postoperatively for the incidence of nausea and vomiting and the requirement for rescue antiemetic. **Results:** The percentage of Postoperative Nausea Vomiting (PONV) and requirement of rescue antiemetics in both the groups were comparable in the first 6 h following laparoscopic gastrointestinal surgeries ($P=1.000$). There was no significant difference in PONV and rescue antiemetic requirement at 24 h in both the groups. **Conclusion:** TENS stimulation at P6 acupressure point is comparable to injection of Metoclopramide in preventing postoperative nausea and vomiting after laparoscopic gastrointestinal surgeries.

Key words: Laparoscopic surgery; Metoclopramide; Postoperative nausea vomiting; Transcutaneous electrical nerve stimulation

INTRODUCTION

Postoperative nausea vomiting (PONV) is one of the most prevalent and troublesome issues in the field of anesthesia. It has been characterized as the occurrence of nausea and/or vomiting by the patient within 24 h after surgery.¹ The prevalence of PONV is estimated to be 30% in the general surgical population and up to 80%

in high-risk individuals.² It is affected by a number of variables including the patient, type of surgery, anesthesia techniques, drugs, and postoperative variables such as pain, dizziness, ambulation, and use of opioids.³ PONV is a frequent complaint following laparoscopic surgery and general anesthesia that can cause serious complications such as dehydration, electrolyte imbalance, aspiration, increased hospitalization duration and readmission as well as affect the

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surgical outcomes through tension on suture line, bleeding and disruption of the skin flap.⁴ The commonly utilized pharmacological prophylaxis for PONV is only moderately effective in preventing PONV. Many non-pharmacological strategies such as acupuncture, acupressure, transcutaneous electrical nerve stimulator (TENS), electro-acupuncture, and others, have been used in clinical practice because of the limited efficacy and side effects of pharmacological therapy.⁵ Most non-pharmacological studies have focused on stimulating P6 acupressure point (Neiguan Point) to prevent and reduce nausea and vomiting. It is located on the palmar side of the wrist two inches proximal to the transverse crease of the wrist, between the tendons of Palmaris longus and Flexor carpi radialis (Figure 1). An easy way to find the point is to place three fingers across the wrist starting at the wrist crease; then, look at the point where this line crosses between the two tendons.⁶ The rationale of the study is to evaluate the efficacy of transcutaneous electrical nerve stimulation at P6 acupressure point and compare it with Metoclopramide in preventing PONV after gastrointestinal laparoscopic surgery. The secondary objective aimed at finding out the percentage of cases that needed rescue antiemetic drug (Inj. Ondansetron) when prophylaxis failed.

Inclusion criteria

Inclusion criteria were as follows: Patients between 18 and 60 years of age with ASA physical status I-II, undergoing elective laparoscopic gastrointestinal surgery were included in this study.

Exclusion criteria

Patients who refused to participate, having a history of chemotherapy in the previous 7 days, motion sickness, medication with antiemetic drugs in 24 h before surgery, drugs or alcohol abusers, patients with any major systemic illness, and those with cardiac pacemakers were excluded from the study.

Aims and objectives

The study aimed to compare the effectiveness of Transcutaneous Electrical Nerve Stimulator (TENS) and Injection of Metoclopramide for the prevention of postoperative nausea and vomiting in patients undergoing gastrointestinal laparoscopic surgery. The secondary objective of the study was to find out the percentage of cases needed rescue antiemetic drug (Inj. Ondansetron) when prophylaxis failed.

MATERIALS AND METHODS

This was a comparative, randomized, prospective, double blinded interventional study carried out at the Department of Anesthesiology, M.G.M. Medical College and M.Y.

Hospital, Indore which was conducted after approval from Institutional Ethics Committee. 90 patients were included. The selected patients were randomized into two groups of 45 each using chit method.

Group T-Transcutaneous Electrical Nerve Stimulation
Group M - Injection Metoclopramide.

After taking written informed consent, patients were shifted inside the operation theatre. Standard multipara monitors (electrocardiography, non-invasive blood pressure and pulse oximeter) were attached. In the TENS group (group T), patient's forearms were cleaned with surgical spirit. The P6 acupressure point was located on the anterior aspect of the forearm approximately 3 fingers proximal to the distal crease of the wrist joint between the two tendons of Flexor Carpi Radialis and Palmaris Longus and electrodes were placed bilaterally over the points with the help of adjustable straps for 30 min before induction of anesthesia. The stimulation frequency was set at 6 Hertz (between 2 and 10 Hz) with 25 mA current. Physio Life Care (ISO 9001:2015 certified Co.) TENS + Muscle stimulator (manufactured in India) was used for the study

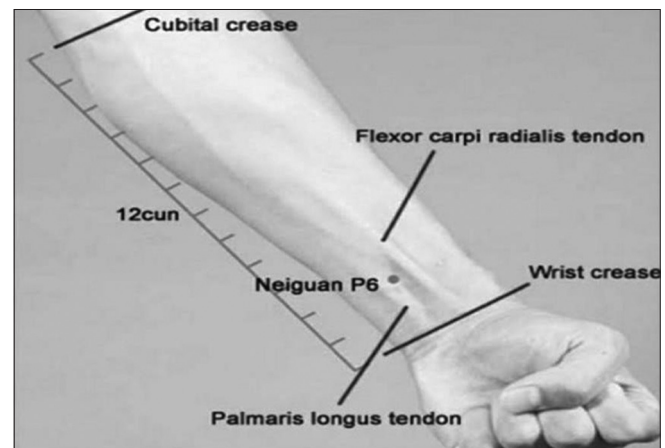


Figure 1: Location of P6 acupressure point (Neiguan Point)

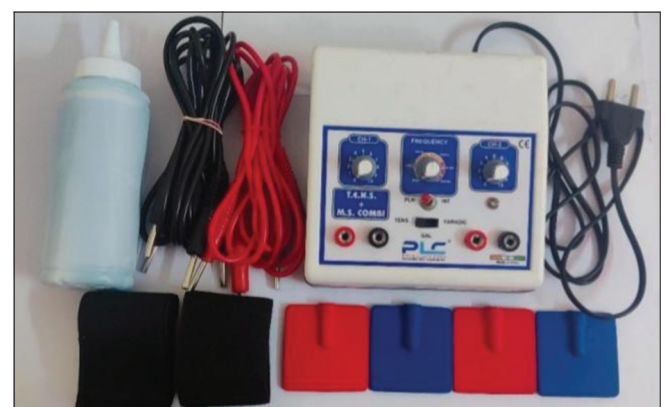


Figure 2: The physio life care TENS + muscle stimulator with adjustable straps

(Figure 2). For the Metoclopramide group (Group M), Inj Metoclopramide was given to the patients at the dose of 0.2 mg/kg intravenously just before induction of anesthesia. Group T patients received normal saline 2 mL i.v. just before induction of anesthesia and in Group M, inactivated TENS electrodes were placed on the anterior aspect of the forearms bilaterally for 30 min before induction of anesthesia to maintain blinding. No antiemetic medication was given before or during the operation in the TENS group. Patients were induced under standardized general anesthesia protocol with Injection Fentanyl 2 mcg/kg i.v., Inj. Propofol 2 mg/kg i.v. and Injection Succinylcholine 1.5 mg/kg i.v. Intubation was done with an appropriate size endotracheal tube through oral route and loading dose of Injection Atracurium at the dose of 0.5 mg/kg i.v. was given. Intra-operatively patients were maintained with O₂, Isoflurane and maintenance dose of Injection Atracurium 0.1 mg/kg. At the end of the surgical procedure, patients were extubated after reversal of neuromuscular blockade with Injection Neostigmine 0.05 mg/kg i.v. and Inj. Glycopyrrolate 0.01 mg/kg i.v. The percentage of PONV cases was evaluated within 6 h of surgery and then in 24 h. The results were scored as event of nausea and vomiting. Patients experiencing both nausea and vomiting were included in the vomiting group. Injection Ondansetron 0.1 mg/kg i.v. was given as a rescue antiemetic when the patients experienced vomiting. Adverse effects due to Injection Metoclopramide and TENS at P6 acupressure point were observed and managed.

Statistical analysis

Statistical Software IBM SPSS Version 20.0.0.0 was used for calculating the P values. Descriptive statistics was presented in the form of numbers and percentages. Mean comparison between the two groups was done using Unpaired “t” test. Pearson Chi-square and Fisher’s Exact Test were used for non-parametric comparison between the two groups. A P<0.05 was taken as statistically significant (Figure 3).

RESULTS

Patients were comparable in both the groups with regards to the demographic data and duration of surgery (Table 1). The incidence of PONV and the requirement of rescue antiemetic in Group-T was 2 (4.4%) and in Group-M was 3 (6.7%) which was comparable between the two groups

at 0–6 h after surgery (P=1.000). There was no significant difference in incidence of nausea at 6–24 h between the two groups where Group-T had 2 (4.4%) and Group-M had 2 (4.4%) cases (P=1.000) (Table 2). There were no incidence of postoperative vomiting and no requirement of rescue antiemetic in 6–24 h after surgery (Figures 4 and 5). The subjects receiving P6 acupressure point stimulation using TENS experienced no adverse effects.

DISCUSSION

Laparoscopic gastrointestinal procedures are popular among both surgeons and patients because of their numerous advantages, such as a quicker return to regular activities and a shorter stay in hospital. Nonetheless, PONV remains a prevalent symptom following surgery, which undermines benefits of the minimally invasive surgery and results in unanticipated readmission or extended hospital stay. PONV is triggered by the nerve projected to the vomiting center, which is influenced by the cerebral cortex, vestibular and cerebellar nuclei, and chemoreceptor trigger band. The surface of the chemoreceptor trigger band covers various receptors, such as 5-HT₃, 5-HT₄, opioid, cholinergic, cannabis, and dopamine receptor.^{7,8} Factors including, prolonged CO₂ insufflation,⁹ intraoperative usage of nitrous oxide,¹ female gender¹ and patient-controlled analgesia with opioids following surgery increases the likelihood of PONV following laparoscopic surgery. Emetogenic chemicals like serotonin are released during CO₂ insufflation, which raises intraperitoneal pressure, decreases intestinal blood flow and induces intestinal ischemia.¹⁰ Afferents from the gastrointestinal tract, which are altered during surgery, also stimulate the Emetic Centre.¹¹

Pharmacological prophylaxis widely used in clinical practice is only partially effective in preventing or treating PONV. Previous studies have demonstrated that Metoclopramide decreases the incidence of nausea and vomiting. The drug, however, is not without possible side effects, including anxiety, agitation, sedation and dystonic reactions.¹² In a study, Eisenach and Dewan reported that metoclopramide may exaggerate tachycardia after stress.¹³

Stimulating the P6 acupressure point is thought to provide antiemetic effects, however the mechanism is not fully understood. It is hypothesized that the production of

Table 1: Demographic data and duration of surgery

Patient's characteristics	TENS stimulation (n=45)	Metoclopramide (n=45)	P-value
Age (years)	37.22±10.98	37.98±10.49	0.739
Sex (M/F)	21/24	20/25	0.832
Weight (kg)	60.80±9.03	63.44±6.45	0.114
Duration of surgery (minutes)	105.09±31.87	110.00±25.27	0.420

Table 2: Incidence of postoperative nausea and vomiting and requirement of rescue antiemetic within 6 h and 6–24 h following gastrointestinal laparoscopic surgery

Event	TENS stimulation (n=45)	Metoclopramide (n=45)	P-value
Nausea			
0–6 h	2 (4.4%)	3 (6.7%)	1.000
6–24 h	2(4.4%)	2(4.4%)	1.000
Vomiting			
0–6 h	2 (4.4%)	3 (6.7%)	1.000
6–24 h	0 (0.00%)	0 (0.00%)	-
Rescue antiemetic			
0–6 h	2 (4.4%)	3 (6.7%)	1.000
6–24 h	0 (0.00%)	0 (0.00%)	-

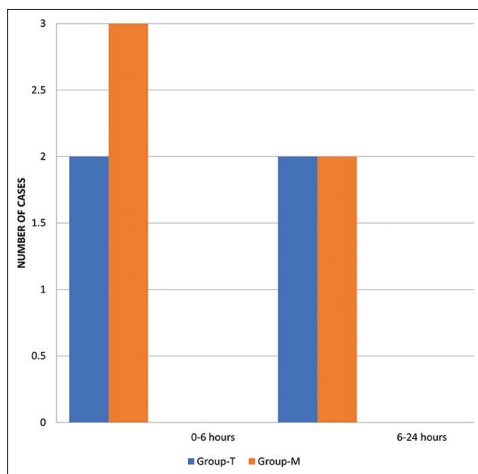


Figure 3: Comparison of incidence of nausea between the two groups

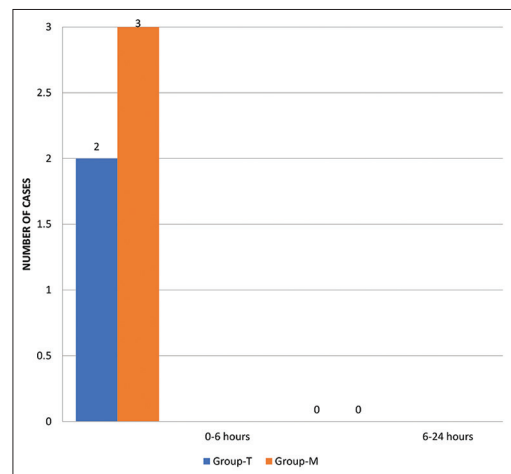


Figure 5: Comparison of rescue antiemetic requirement between the two groups

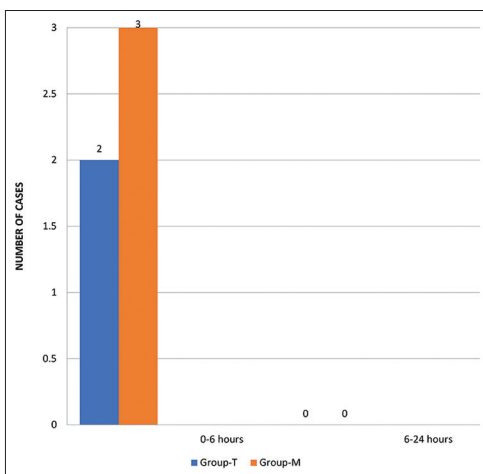


Figure 4: Comparison of incidence of vomiting between the two groups

enkephalin, endorphin, and endomorphins was prompted by low frequency stimulation of the skin, which stimulated A-β and A-δ fibers and may impact neurotransmission in the dorsal horn and the hypothalamus. Antiemetic actions of β-endorphins may be mediated through their interaction with μ receptors.⁵ It prevents the production of stomach acid and increases gastric motility.¹⁴ The effectiveness of stimulating the P6 acupressure point as a non-pharmacological prophylactic for PONV has been the subject of a number

of research. In 1989, Dundee et al.,¹⁵ evaluated the antiemetic effectiveness of the P6 acupressure point stimulation in women undergoing gynecological procedures under general anesthesia and found that it effectively reduces the incidence of nausea and vomiting in the early postoperative period. Correspondingly, TENS can modulate comprehensive PONV triggering receptors and reflex pathways to prevent PONV. It stimulates neuronal pathways from the somatic splanchnic neurons to the paraventricular nucleus of the hypothalamus.¹⁶ TENS also reduces secretion of 5-HT₃ in the duodenum and suppresses the activation of the nucleus tractus solitarius in the brain-stem.¹⁷ TENS also stimulates receptors such as NO, CCK-A, cannabinoid, opioid receptor, and others and regulates neurotransmitters such as serotonin, GABA, and catecholamines.¹⁶ All these result in a decreased incidence of PONV. Furthermore, the PONV prophylaxis outcome of TENS might be due to stimulating acupoints of P6 and ST3. P6 is currently recognized as the standard acupoint for the prevention of PONV, and its effect was comparable to that of antiemetic drugs. In a study done by Lee et al., in 2015 showed that stimulation of P6 in laparoscopic radical gastrectomy for gastric cancer significantly reduced the incidence of PONV, decreased early postoperative pain intensity and analgesic dosage, shortened

the time of exhaust and excretion, promoted the recovery of gastrointestinal function, and improved patient satisfaction.¹⁸

In the summary, we compared TENS with Metoclopramide for the prevention of PONV in adult patients undergoing gastrointestinal laparoscopic surgery and observed that stimulation at P6 acupressure point is an effective method and is comparable to Injection Metoclopramide (antiemetic) when given as prophylaxis for the prevention of postoperative nausea and vomiting with no side effects. TENS is a simple, inexpensive, and effective treatment alternative in the prevention of the PONV.

Limitations of the study

Even though we made every attempt to fulfill the aims and objectives of the study, there were a few limitations including the single-center study design and a lack of control group.

CONCLUSION

TENS stimulation at P6 acupressure point is comparable to injection of Metoclopramide in preventing postoperative nausea and vomiting after laparoscopic gastrointestinal surgeries.

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Authors' Contributions:

SJ- Concept and design of the study, prepared first draft of manuscript; **RA-** Interpreted the results; reviewed the literature and manuscript preparation; **RB-** Concept, coordination, statistical analysis and interpretation, preparation of manuscript and revision of the manuscript; **AKK-** Guidance.

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