Transcutaneous Electrical Nerve Stimulation Reduces the Incidence of Vomiting After Hysterectomy

Argyro Fassoulaki, MD, PhD, DEAA, Konstantinos Papilas, MD, Constantine Sarantopoulos, MD, and Mariana Zotou, MD

Department of Anesthesia, St Savas Hospital, Athens 11522, Greece

The possible postoperative antiemetic effect of transcutaneous electrical nerve stimulation (TENS) on the P_6 point (on the Pericardium Channel of Hand-Jueyin) was evaluated in 103 women undergoing hysterectomy. TENS on the P_6 point was applied 30–45 min before induction of anesthesia in 51 patients and continued for 6 h postoperatively. The control group, 52 patients, was treated exactly in the same way but with the electrical stimulator turned off. Incidence of vomiting was assessed blindly 2 h, 4 h, 6 h, and 8 h postoperatively. The incidence of vomiting postoperatively was significantly less in the TENS-treated group when compared with the control group (between 0 h and 2 h: 23% vs 43%, $P < 0.05$; between 2 h and 4 h: 27% vs 50%, $P < 0.025$; and between 4 h and 6 h: 31% vs 67%, $P < 0.001$, respectively). Six hours postoperatively TENS was discontinued, and 8 h postoperatively the two groups did not differ significantly for incidence of vomiting (between 6 h and 8 h: 51% vs 65%). The authors conclude that TENS reduces the incidence of vomiting after hysterectomy.

(Anesth Analg 1993;76:1012–4)

Electrical stimulation of the P_6 Neiguan (antiemetic) point, either invasively (acupuncture needles) or noninvasively by transcutaneous electrical nerve stimulation (TENS) decreases the incidence of vomiting in cancer chemotherapy (1–3). There is no agreement among the studies evaluating the efficacy of the antiemetic effect produced by stimulating the P_6 point postoperatively (4,5). The aim of the present study was to evaluate the antiemetic efficacy of TENS postoperatively in patients undergoing hysterectomy.

Methods

One hundred six unpremedicated patients (ASA I–II) scheduled for abdominal hysterectomy were assigned randomly to either the TENS-treated group (51 patients) or the control group (55 patients). The study was approved by the Hospital Ethics Committee. None of the patients had received any medication for the previous 2 mo. At the time of the preoperative visit, the patients were informed about the nature of the study (attaching two electrodes without specifying active or inactive), and they provided their consent for participation.

All patients in the TENS-treated group received TENS via standard electrodes of silicone conduction rubber in the ward 30–45 min before induction of anesthesia. TENS was discontinued 6 h after extubation of the trachea. One electrode was applied over the P_6 point of the right arm, and the second electrode was applied on a neutral point (dorsal surface of the right arm). The P_6 (Neiguan) point (on the Pericardium Channel of Hand-Jueyin) is located 2 Chinese inches (Cun, 1 Chinese inch = 1.5–2 cm) proximal to the distal wrist crease and lies between the tendons of the palmaris longus and flexor carpii radialis.

Stimulation with a pulse repetition frequency of 10 Hz was delivered by a TENS SM2 stimulator (Medtronic, Selectra®, Model 7720). The output voltage was increased slowly until pain was experienced and then was decreased slowly to a voltage just below that which caused pain. Electrodes were attached to patients in the control group, exactly as above, regarding the site and time of attachment, but the stimulator was turned off. In the TENS-treated group, stimulation was continued at a frequency of 10 Hz and with an intensity varying between 27 and 45 mA, with mean value ± SD of 35 ± 5.6 mA.

Anesthesia was induced by the intravenous (IV) administration of thiopental, 5 mg/kg, and vecuronium, 0.1 mg/kg. After intubation of the trachea, anesthesia

Preliminary results of the study were presented in the 13th Scientific Meeting of the European Academy of Anaesthesiology, Strasbourg, September 1991.

Accepted for publication December 30, 1992.

Address correspondence to A. Fassoulaki, MD, 57–59 Raftopoulou Street, 11744 Athens, Greece.

0003-2999/93/$5.00

was continued with 60% N_2O in O_2. Fentanyl, 10 μg/kg, and midazolam, 0.1 mg/kg, were administered IV before skin incision. None of these drugs was repeated throughout surgery. Vecuronium and isoflurane, 0.5–1%, were given intraoperatively as required. The usual monitors were used intraoperatively. No nasogastric tube was placed in patients of either the TENS-treated or control group. At the end of anesthesia, residual neuromuscular block was antagonized with atropine, 1.2 mg, and neostigmine, 2.5 mg IV. When the peritoneum was closed, 75 mg of propoxyphene and 300 mg of paracetamol were injected intramuscularly (IM) and repeated every 4 h. All patients were admitted to the recovery room, with an inspired F_{IO_2} of 0.35 via a ventimask. Vomiting, including retching, was assessed every 2 h (if patient vomited or retched during this time interval) for the first 8 postoperative hours by an independent observer who was unaware of the patient randomization and of TENS treatment. For each 2-h period, vomiting or retching was recorded as "yes" or "no" but not quantitated. Six hours postoperatively the observer removed the electrodes from all patients. The stimulator, active or inactive, was covered with dark plastic bags, not allowing distinction between active and inactive stimulators.

Demographic data (age, body weight) and duration of anesthesia and surgery between the groups were compared with unpaired Student's *t*-test. Incidence of vomiting between the groups was compared (2, 4, 6, and 8 h postoperatively) by applying χ^2 test. The incidence of vomiting in the TENS-treated group was also compared with that of the control group during the total 6-h period postoperatively by means of the χ^2 test.

Results

The two groups did not differ in age, body weight, duration of anesthesia, and duration of surgery (Table 1). Three patients, originally assigned to the control group, who received postoperatively metoclopramide because of persistent vomiting were eliminated from further vomiting evaluation and consequently from the study. Thus, 52 patients were evaluated for postoperative vomiting in the control group.

Table 1. Demographics of Control Group Patients and TENS Group Patients with TENS Applied on the P_6 (Neiguan) Point

	Control group (n = 52)	TENS group (n = 51)
Age (yr)	47.2 ± 9.5	46.5 ± 10.0
Age (range)	26–68	24–73
Weight (kg)	67 ± 10.6	66 ± 8.8
Duration of anesthesia (min)	119 ± 21.0	120 ± 25.2
Duration of surgery (min)	100 ± 19.7	99 ± 24.8

Values are expressed as mean ± SD. The differences between the control and TENS group were not statistically significant.
TENS = transcutaneous electrical nerve stimulation.

At all times of observation TENS treatment was associated with a significantly lower incidence of vomiting than the control group (0–2 h, $\chi^2 = 4.1059$; 2–4 h, $\chi^2 = 5.508$; 4–6 h, $\chi^2 = 13.013$, $P < 0.05$–0.001). This significant difference disappeared for the interval 6–8 h ($\chi^2 = 2.187$, $P > 0.1$) when TENS on the P_6 point was discontinued. The overall incidence of vomiting during the 6-h postoperative period of TENS application was significantly lower in the TENS-treated group when compared with the control group ($\chi^2 = 9.010$, $P < 0.005$) (Table 2).

Discussion

The results of this study demonstrate that, under the present experimental conditions, TENS of the P_6 point significantly reduces the incidence of postoperative vomiting associated with total hysterectomy. This antiemetic effect disappeared when TENS was discontinued.

The mechanism by which acupuncture achieves its antiemetic effect is not well understood. Dopamine receptor antagonists, such as spiroperidol (6), augment acupuncture effects whereas apomorphine, the dopamine receptor agonist, or L-Dopa, the dopamine precursor, suppress acupuncture effects in rabbits. Although the role of central dopamine in acupuncture is not yet clear (7), the antiemetic effect of P_6 point may

Table 2. The Incidence of Postoperative Vomiting in the Control Group and in the TENS-Treated Group

	Postoperative time			
	2 h	4 h	6 h	8 h
Control group (n = 52)	22/52 (42.3%)	26/52 (50%)	35/52 (67.3%)	34/52 (65.4%)
TENS group (n = 51)	12/51[a] (23.5%)	14/51[b] (27.4%)	16/51[c] (31.4%)	26/51[d] (51%)

[a] $P < 0.05$, compared to control.
[b] $P < 0.025$, compared to control.
[c] $P < 0.001$, compared to control.
[d] No significant difference, compared to control.

be mediated by an action opposing that of central dopamine.

The antiemetic effect of stimulation of the P_6 point associated with anesthesia is controversial. Some studies have demonstrated the antiemetic effect of P_6 point stimulation postoperatively (8–10). In other studies P_6 stimulation failed to reduce the incidence of postoperative vomiting (4,5). The factors influencing the P_6 antiemetic point have not been clearly defined. Dundee et al. (11) attributed the different results to inappropriate timing of stimulation of P_6 point; this stimulation is effective as antiemetic, when applied before the emetic stimulus. However, in another study P_6 acupressure applied 1 h before anesthesia and continued until the patient's discharge from the hospital the same day did not reduce the incidence of postoperative vomiting in children undergoing strabismus surgery (5). Noninvasive methods of P_6 stimulation are as effective as invasive acupuncture during the early postoperative period, have a less prolonged antiemetic action, but are more acceptable to patients than acupuncture (9). In this study TENS was applied on the P_6 point at least 30 min before induction of anesthesia and continued for 6 h postoperatively.

Our study differs from the studies of Dundee et al. (9) with respect the anesthetic technique, the type of operation (major gynecologic procedure) and the reassessment of incidence of vomiting 2 h after TENS discontinuation. The application of an inactive and properly placed stimulator may be considered a limitation of the study as a misplaced stimulus rules in/out the importance of location. Nevertheless, the latter would draw the attention of the independent observer.

The differences in incidence of vomiting postoperatively between the two groups are more evident 6 h postoperatively, either because vomiting is enhanced as recovery progresses, or because along with the elimination of anesthetic drugs the antiemetic effect of TENS is becoming more eminent. If anesthesia inhibits the effects of TENS, an explanation may be that along with the elimination of anesthetic drugs TENS antiemetic efficacy is becoming more eminent. Regardless of the mechanisms by which TENS produces its antiemetic effect, the method is simple, free of undesirable effects, and easily applicable.

References

1. Dundee JW, Ghaly RG, Fitzpatrick KTJ, et al. Acupuncture prophylaxis of cancer chemotherapy-induced sickness. J R Soc Med 1989;82:268–71.
2. Dundee JW, Yang J. Prolongation of the antiemetic action of P6 acupuncture by acupressure in patients having cancer chemotherapy. J R Soc Med 1990;83:360–2.
3. Dundee JW, Yang J, McMillan C. Non-invasive stimulation of the P6 (Neiguan) antiemetic acupuncture point in cancer chemotherapy. J R Soc Med 1991;84:210–2.
4. Weightman WM, Zacharias M, Herbison P. Traditional Chinese acupuncture as an antiemetic. Br Med J 1987;295:1379–80.
5. Lewis IH, Pryn SJ, Reynolds PI, et al. Effect of P_6 acupressure on postoperative vomiting in children undergoing outpatient strabismus correction. Br J Anaesth 1991;67:73–8.
6. Han JS, Terenius L. Neurochemical basis of acupuncture analgesia. Annu Rev Pharmacol Toxicol 1982;22:193–220.
7. Chestnutt WN, Dundee JW. Acupuncture for relief of meptazinol-induced vomiting. Br J Anaesth 1985;57:825–6.
8. Ho RT, Jawan B, Fung ST, et al. Electro-acupuncture and postoperative emesis. Anaesthesia 1989;45:327–9.
9. Dundee JW, Ghally RG, Bill KM, et al. Effect of stimulation of the P_6 antiemetic point on postoperative nausea and vomiting. Br J Anaesth 1989;63:612–8.
10. Barsoum G, Perry EP, Fraser IA. Postoperative nausea is relieved by acupressure. J R Soc Med 1990;83:86–9.
11. Dundee JW, Ghally RG. Does the timing of P_6 acupuncture influence its efficacy as a postoperative anti-emetic? Br J Anaesth 1989;63:630.