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Transcutaneous Electrical Acupoint Stimulation Versus Ondansetron in the Prevention of Postoperative Vomiting Following Pediatric Tonsillectomy

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ABSTRACT

Objectives: Postoperative retching and vomiting is an important cause of morbidity that may lead to patient discomfort, distress, and complications. Stimulation of acupuncture points has been shown to be effective in the prevention as well as treatment of PONV. The current treatments of choice are the 5-hydroxytryptamine type 3-antagonists, such as ondansetron. We aimed to evaluate the efficacy and side-effects of either transcutaneous electrical acupoint stimulation (TEAS) or Ondansetron compared to a control group receiving no treatment in the prevention of postoperative retching and vomiting.

Subject and design: This randomized, controlled, prospective study was carried out in a group of 90 children (in three equal randomly assigned groups), aged between 4 and 12 who underwent tonsillectomy under general anesthesia. In the first group, electrical stimulation via surface electrodes on acupoints Neiguan and Shangwan was performed (20 Hz, 5 minutes). The second group received a single dose of Ondansetron (0.15 $mg \cdot kg^{-1}$). No treatment was given to the control group.

Outcome measures: The frequency of retching and vomiting attacks and side-effects were noted on the day of surgery in the postanesthesia care unit and the day surgery care unit, on the day of surgery after discharge, and on the first day after surgery. A satisfaction scale was completed by each family.

Results: There was a significant difference between the treatment groups and the control group in the incidence of emetic episodes occurring in the day surgery care unit and on the day after discharge ($p < 0.001$). In the ondansetron group, side-effects were seen in more patients than in the other groups ($p < 0.001$). The satisfaction scores of the parents were greater in the treatment groups than in the control group ($p < 0.05$).

Conclusion: Application of TEAS on sedated children is an easy, painless, reliable and effective method for the prophylaxis of postoperative retching and vomiting in pediatric tonsillectomy.

INTRODUCTION

Postoperative nausea and vomiting (PONV) are the most common anesthesia-related side-effects.[1] Especially in children, postoperative retching and vomiting causes discomfort in the patient and stress and unhappiness in the parents.[2] Moreover, postoperative vomiting brings about further problems such as dehydration, electrolyte imbalance, infection, acid aspiration, and Mallory-Weiss syndrome, all of which may delay the discharge of the patient from the hospital while creating additional stress and expense for the patient and the hospital.[3,4] The etiology has not been totally understood. Several predisposing factors have been identified, such as pain, postoperative opioids, anesthetic agents and anesthesiology techniques, surgical intervention site and surgical stimulation, sudden positional changes, hypotension, hypoxia, hypoglycemia, history of motion sickness, internal ear diseases, increases of intracranial pressure, infections, age (adults and older children > younger children and older adults), female sex, and emotional status.[2,5,6]

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Several medications or nonpharmacologic techniques have been employed in an attempt to prevent PONV. These medications include dexamethasone, trifluprom azine, dimenhydrinate, transdermal scopolamine, metoclopramide, droperidol, and ondansetron.[4,7] Recent studies show the superiority of 5-hydroxytryptamine type 3 ($5HT_3$)-antagonists such as ondansetron in preventing both PONV and postchemotherapy vomiting.[6,8,9] In children, ondansetron is mostly preferred for strabismus and tonsillectomy operations.[5,9,10] Although children generally tolerate ondansetron quite well, some side-effects such as headache, constipation, diarrhea, anxiety, drowsiness, dizziness, abdominal cramps, pyrexia, transient elevations of plasma aminotransferase and bilirubin levels, and anaphylactic or anaphylactoid reactions have been observed.[2,6,9,11] To decrease such side-effects and increase the antiemetic effect, combinations of low-dose ondansetron with dexamethasone or low dose ondansetron with propofol-based anesthetic agents have been proposed.[2,12,13] The severity of the side-effects that are observed with ondansetron has led researchers to new choices, and nonpharmacologic methods started to attract attention.[14,15] The effectiveness of these techniques, and their almost complete freedom from side-effects, has popularized them for use in children.[16] Approximately 13% of anesthesiologists prefer nonpharmacologic methods for both prophylaxis and treatment of PONV, as these are considered nearly free of side-effects.[7,17,18] Nevertheless, acupuncture was found to be ineffective in the prevention of PONV by some authors.[17,19–22] In addition, acupuncture can mask symptoms of cancer and tumor progression, and acupuncture needling is contraindicated in conditions such as an unstable spine, severe clotting disorder, neutropenia, or lymphedema.[28]

The aim of our study was to evaluate the efficacy of transcutaneous electrical acupoint stimulation (TEAS) in the prevention of PONV compared to the medical treatment of choice (ondansetron): Thus, we carried out a randomized, prospective study in which we compared ondansetron and TEAS with control.

MATERIALS AND METHODS

After obtaining the consent of the parents and receiving the approval of local Research Ethics Committee, we recruited 90 children between the ages of 4 and 12 who were to undergo elective tonsillectomy under general anesthesia and who were American Society of Anesthesiologists (ASA) Grade I or II. The children were randomized into 3 groups. Exclusion criteria were allergy to ondansetron, antiemetic therapy within 10 days of surgery, auricular operation, any symptomatic medical disease or infectious disease within the previous 2 weeks, or local infection near an acupuncture site. Additionally, children who had respiratory distress, edema, or hemorrhage in the postoperative period were excluded.

Anesthetic and surgical techniques were standardized. Solid food was withheld for at least 8 hours before anesthesia, and clear liquids were permitted up until 2 hours before anesthesia for all groups. Thirty minutes prior to anesthesia, 0.5 mg $\cdot$ kg^{-1} midazolam was administered in 0.3 mL $\cdot$ kg^{-1} of coke with a view to mild sedation and amnesia. Noninvasive blood pressure, pulse-oximetry, and end tidal carbon dioxide fraction were recorded using an ADU S/5 monitor (Datex Ohmeda, Sweden) in the operation room. For the induction of anesthesia, 2–5% sevoflurane was given in 100% O_2 via mask and intravenous vecuronium 0.1 mg $\cdot$ kg^{-1} was given to facilitate nasotracheal intubation. Anesthesia was maintained with sevoflurane in 66% N_2O–33% O_2 and fentanyl in fractional doses of 1 μg $\cdot$ kg^{-1}. Residual neuromuscular block was reversed with atropine and neostigmine and then tracheal extubation was performed after orogastric suctioning. Postoperative pain was treated in the postanesthesia care unit (PACU) with intravenous fentanyl 1 μg $\cdot$ kg^{-1} in fractionated doses. All the children were discharged to the day surgery care unit (DSCU) when they achieved an Aldrete recovery score of 10.[24] Thereafter, 25 mg $\cdot$ kg^{-1} rectal acetaminophen was administered in the DSCU. The patients were evaluated with the Modified Postanesthesia Discharge Scoring System and patients who scored 9 and above were discharged.[25] Patients were assigned before induction of anesthesia, using a random number table, to one of three groups.

TEAS group

Five minutes before the induction of anesthesia, while the child was under deep sedation, skin surface electrodes were applied to the P6 points of the right and left arms and the CV13 point. A fourth electrode was applied at a neutral point with no known antiemetic properties midway up the forearm. Stimulation (Acmodermil Stimulator; SBJ International, France, with adaptable cables) was applied at 20 Hz and 10mA for 5 minutes. In the PACU, stimulation was repeated at the same points for 5 minutes.[20,26,27] For finding these points, we made use of a cunometer (a special measuring device commonly used in Traditional Chinese Medicine) and the warning feature of the E-acu device on finding these points. The P6 point was on the Pericardium Meridian, at 2 Cun proximal of the wrist and between the tendons of the flexor carpi radialis and palmaris longus. The CV13 point was located in the Conception Vessel Meridian, 1 Cun above the midpoint of the line between the xyphisternum and the umbilicus (1 Cun = the breadth of the patient's thumb, 2 Cun = 2 times the width of the interphalangeal joint of the patient's thumb) (Fig. 1).[28]

Ondansetron group

Following intubation, 0.15 mg.kg^{-1} ondansetron was diluted in 50 mL of physiologic saline and intravenous infusion was completed in 15 minutes.[2,8]

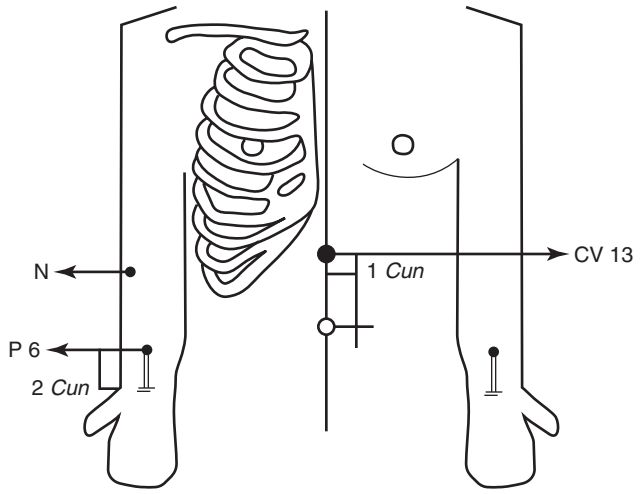

FIG. 1. The P6 point was on the Pericardium Meridian, 2 *Cun* proximal of the wrist and between the tendons of the flexor carpi radialis and palmaris longus. (2 *Cun* = 2 times the width of the interphalangeal joint of the patient's thumb). The CV13 point was located in the Conception Vessel Meridian, 1 *Cun* above the midpoint of the line between the xyphisternum and the umbilicus (1 *Cun* = the breadth of the patient's thumb). The neutral electrode was applied at a point (N) with no known antiemetic properties midway up the forearm.

Control group

Patients in this group received no antiemetic treatment.

Data collection and analysis

Anesthesia and surgery times, duration of stay in the PACU and DSCU, the complications related to anesthesia and surgery, and the administered treatments were all recorded. The number of retching and vomiting attacks was recorded, first by the nurses in the PACU and DSCU, and following discharge by the parents until 24 hours postoperatively. Nausea, a subjective feeling of the urge to vomit, is difficult to quantify in children, so it was not assessed. Parents were informed how they should fill out the satisfaction surveys. Twenty four (24) hours following the termination of surgery, the patients were reached by telephone at their homes. They were questioned about the number of emetic attacks on the day of the surgery and the day after, and they were asked whether they were satisfied with the antiemetic treatment. In addition, the parents were told to ask the children if they remembered anything about the procedure. They were asked to score their level of satisfaction on a scale of 1 to 10 (1 = I was not satisfied to 10 = Excellent). The children, parents, nurses, and the anesthetist performing the telephone survey were unaware of the subjects' group allocation.

The variables obtained by measurements were compared in terms of mean and standard deviation. Comparisons of the incidence of emetic episodes and the satisfaction scores between the three groups were performed by Kruskal Wallis analysis of variance. Comparison of the fentanyl doses between the three groups was performed using one-way analysis of variance. Chi- square test was performed for the side-effects. P values < 0.05 were considered to be significant. All tests were performed using SPSS 11 for Windows software (SPSS Inc., Chicago, IL).

RESULTS

Ninety (90) individuals were recruited in the study, with 30 children in each of the three groups. One patient from the TEAS group developed bleeding from the tonsillary lodge in the 30th postoperative minute; he was followed-up and excluded from the study. Two patients from the same group could not be reached by telephone postoperatively and were excluded as well. One patient from the control group developed respiratory distress due to edema, was administered steroids and steam, and excluded from the study. Four other children were randomly selected to replace these four patients. Demographical data of these three groups were compared. There were no statistically significant differences in the time spent in anesthesia, surgery, PACU, or DSCU among the three groups, or in the doses of fentanyl given during or after surgery (Table 1). Vital findings remained stable in all three groups during the anesthesia and surgery and in the postoperative period.

The incidence of emetic episodes was significantly different in the TEAS group compared to the control group in the DSCU and on the day of surgery after discharge ($p < 0.001$). The incidence of emetic episodes was significantly different in the ondansetron group compared to the control group in the DSCU and on the day after discharge ($p < 0.001$) (Table 2). There was no significant difference between the treatment groups and the control group in the incidence of emetic episodes in the PACU and on the first day after surgery ($p = 0.2$). Comparing the TEAS group with the ondansetron group in the PACU, DSCU, on the day of surgery after discharge, and on the first day after surgery, there were no statistically significant differences in the incidence of emetic episodes ($p = 0.2$, $p = 0.1$, $p = 0.2$, and $p = 0.1$, respectively) or in the number of patients who suffered an emetic episode ($p = 0.5$, $p = 0.6$, $p = 0.6$, and $p = 0.7$, respectively). Two patients in the control group experienced frequent retching and nausea attacks upon discharge from the hospital following the surgery. Due to the frequency of the emetic attacks, these children were rehospitalized overnight. They were treated with intravenous fluids and 0.15 mg $\cdot$ kg^{-1} ondansetron. As they did not develop any further complications, they were discharged the next day.

When a comparison was made between the groups with regards to side-effects, the ondansetron group differed significantly from the other two groups in terms of the frequency of clinical and symptomatic side-effects ($p < 0.001$) (Table 3). In two children from the TEAS group, erythemas

Table 1. Patient Demographics and Perioperative Data

	Transcutaneous electrical acupoint stimulation group (n = 30)	*Ondansetron group (n = 30)*	*Control group (n = 30)*
Age (years)	6.9 ± 3.6	7.3 ± 3.4	6.7 ± 3.8
Gender (female : male)	11 : 9	10 : 10	8 : 12
Weight (kg)	26.1 ± 9.1	24.6 ± 9.2	25.6 ± 9.3
Duration of anesthesia (min)	34.1 ± 5.2	34.6 ± 4.7	34.0 ± 5.8
Duration of surgery (min)	25.7 ± 6.1	26.0 ± 5.8	26.9 ± 6.4
Time in PACU (min)	60.0 ± 14.6	59.2 ± 12.5	57.0 ± 14.6
Time in DSCU (min)	192.2 ± 57.2	181.5 ± 48.1	188.6 ± 43.6
Fentanyl, during surgery (μg)	22.4 ± 10.2	20.6 ± 10.8	21.5 ± 11.1
Fentanyl, after surgery (μg)	10.3 ± 5.8	9.7 ± 6.2	9.4 ± 5.6

PACU, postanesthesia care unit; DSCU, day surgery care unit. No significant differences were found between groups.

Table 2. Incidence of Postoperative Emetic Episodes Expressed as Number of Patients and (Number of Episodes)

	Transcutaneous electrical acupoint stimulation group (n = 30)	*Ondansetron group (n = 30)*	*Control group (n = 30)*
Postanesthesia care unit	3 (4)	2 (3)	6 (7)
Treatment needed	1	0	1
Day surgery care unit	2 (3)	2 (2)	9* (15)**
Treatment needed	1	1	2
Day of surgery after discharge	1 (2)	1 (1)	11* (16)**
First day after surgery	2 (2)	1 (2)	2 (4)
Readmission required	0	0	2

*$p < 0.001$.
**$p < 0.001$.

of 0.3 diameters developed on the P6 and CV13 points. These two children were positive for dermographism findings. Erythemas of both children disappeared before leaving the PACU. Two children in the ondansetron group developed flushing of the head and neck following the infusion of ondansetron. Flushing of one child spontaneously regressed within 3 minutes. The other child had to be administered antihistamine. This child was not excluded from the study; however, the postoperative side-effects were evaluated in line with the side-effects of the antihistamine. Also in this group, 4 children had drowsiness and dizziness that continued on the first postoperative day, and 2 children had stomach ache.

The parents stated that none of the children remembered anything about acupuncture 24 hours after the procedure. The satisfaction scores of the parents in the TEAS, ondansetron, and control groups were 8.5, 9.0, and 6.0, respectively. A significantly greater number of parents in the

Table 3. The Number of Clinical and Symptomatic Side-effects

	Transcutaneous acupoint stimulation group (n = 30)	*Ondansetron group (n = 30)*	*Control group (n = 30)*
Erythema	2	0	0
Flushing	0	2	1
Drowsiness, dizziness	0	4	0
Abdominal cramps	0	2	0
Total	2	8*	1

*$p < 0.001$.

treatment groups expressed overall satisfaction with the antiemetic treatment than in the control group ($p < 0.05$). There was no statistically significant difference between the treatment groups.

DISCUSSION

The antiemetic efficacy of acupuncture might be due to increases of beta endorphin levels in the cerebrospinal fluid or due to the fact that the P6 point is located in the vicinity of the median nerve. Thus, the stimuli originating from this nerve might be responsible for the secretion of neurochemical substances that are responsible for desensitizing the chemoreceptor trigger zone or the emetic center in the medulla oblongata.[29] Although the mechanisms of effect have not been clearly understood, in several studies conducted on adults, nonpharmacologic treatments were shown to be effective on emetic attacks.[14,15,18]

Dundee et al. studied women who were to undergo minor gynecologic surgery, to compare the effectiveness of premedication by opiates and acupuncture and dummy acupuncture on preventing PONV.[30] They found the frequency of PONV to be 24% in the opiate and acupuncture groups and 88% in the dummy acupuncture group. In the dummy acupuncture group, the needles were placed at some point other than P6. There are studies demonstrating that these techniques are also effective in children. Schlager et al. applied hand acupressure to K-K9 points in children going through strabismus surgery and found the incidence of PONV to be lower than that of the placebo group.[16] Somri et al. compared acupuncture (P6; Nei-Guan, CV13; Shang Wen acupoint) with ondansetron in children having dental surgery.[14] They found the incidence of PONV to be low in the acupuncture group and advocated that acupuncture could be an alternative to ondansetron, given its low level of side-effects. The success of the acupuncture was related to its application before the surgical stimulus, to the bilateral stimulation of the P6 point, to the additive effects of stimulating the CV13 point as well, and to the utilization of the Cunometer for making better localizations.

On the other hand, there are studies showing the ineffectiveness of nonpharmacologic techniques in children. Lee and Done reported in their meta-analysis that nonpharmacologic techniques were more effective than placebo in preventing PONV in adults, but there was no benefit in children.[17] Lewis et al. reported that acupressure did not prevent PONV in children having strabismus correction.[19] Shenkman et al. stated that in children undergoing tonsillectomy, acupuncture and acupressure had no effect on PONV.[21] Rusy et al. showed that electro-acupuncture before the induction of anesthesia with needles reduced the incidence of nausea but not vomiting after tonsillectomy in pediatric patients.[20] In their study, Yentis and Bissonette concluded that acupuncture was ineffective in controlling the vomiting that followed tonsillectomy in children, for three possible reasons: First, P6 acupuncture might be ineffective in children, although their description as "strong reactors" would suggest otherwise. Second, it may be ineffective for tonsillectomy; vomiting after tonsillectomy is likely to be multifactorial, related to pharyngeal stimulation, psychological factors, swallowing of blood, and administration of opioid drugs. Third, a longer period of time might be required between the acupuncture and surgery, as better results have been achieved when acupuncture was performed 1 hour before surgery than immediately before induction.[22] In our study, when compared with the control group, the antiemetic efficacy of acupoint stimulation is significant in the DSCU and on the day of surgery after discharge. However, in the PACU and the first day after surgery, acupoint stimulation seemed to be noneffective. This situation may be due to activation of pharyngeal reflexes in the PACU. The effect of TEAS became significant as the pharyngeal stimulation decreased in the DSCU. However, on the first day after surgery, the electroacupuncture's antiemetic efficacy might decrease.

Acupuncture requires intact transmission from periphery to central nervous system. General anesthetic agents may reduce transmitter release in spinal cord neurons, with the result that excitatory synaptic transmission is blocked preferentially at low concentrations and inhibitory transmission is at least unaffected, if not enhanced.[31] Therefore, some authors argue that acupuncture applied to the awake patient before or after the emetic stimulus occurs during anesthesia and surgery is more effective.[14,19,26–28] Nevertheless, some authors believe that it is also effective when applied after emetic stimuli and during anesthesia.[7,22] In children who are awake, the use of invasive acupuncture techniques is difficult, time-consuming, and not appropriate.[27,32] It is more appropriate to use acupressure, laser stimulation, or transcutaneous electrical stimulation in children.[17,18,20,26,27,32] In our study, in accordance with the recommendations of other researchers, we initiated the application of transcutaneous electrical stimulation before anesthesia and surgical stimulus. On the other hand, many of characteristics of electroacupuncture are unknown, such as the most suitable frequency, intensity and interval of electrical stimulation, and the duration of clinical effects. In a frequency finding study, Ghaly et al. used 10, 20, 50, and 100 Hz and concluded that 10–20 Hz produced maximum benefit, while 100 Hz was mostly ineffective.[26] Likewise, there was no benefit from increasing the duration of stimulation from 5 to 15 minutes. In our study, we applied acupuncture on both P6 points and additionally on CV13 point with a preferred current and frequency of 20 Hz for 5 minutes. The electrical acupoint stimulation device we used did not hurt the skin, was painless, and allowed us to administer the stimuli for 5 minutes, thereby we were able to use the technique before both the anesthesia and the surgical stimulus. Based on the findings of Ho et al.[27] and Rusy et al.,[20] we repeated the acupoint

application in the PACU. In line with the recommendations of Somri et al., in order to take advantage of the additive effect, we applied the stimulus on the CV13 point in addition to the P6 point.[14] Correct localization of the acupuncture point and adequate administration of the stimulus are also important for antiemetic effectiveness.[14,27] To finding the correct points, we used cunometers and we made use of the signal-generating feature of the electroacupuncture device upon finding the point. The device operates with the principle that electrical resistance is low at acupuncture points. The anesthetic technique, administration of opioid and anticholinergic drugs during anesthesia and postoperative pain factors were controlled in our study. Furthermore, we introduced the orogastric tube with the purpose of aspirating the blood, secretions, and air that might trigger vomiting before the extubation.

In the treatment groups, we obtained similar successful antiemetic results in the PACU, the DSCU on the day of surgery, and after discharge and the results were significantly different from the control group. We also found out that the children did not remember anything about the acupuncture procedure with the dose of sedation we applied. We conclude that application of TEAS on sedated children can be an easy, painless, reliable, and effective method for the prophylaxis of postoperative retching and vomiting in pediatric tonsillectomy. However, the exact mechanism of action of acupuncture treatment is yet to be determined. Further exploration of the mechanism may assist in our understanding of the neural pathways and receptor specificities of the vomiting reflex.

REFERENCES

1. Cohen MM, Duncan PG, DeBoer DP, Tweed SA. The postoperative interview: Assessing risk factors for nausea and vomiting. Anesth Analg 1994;78:7–16.
2. Watcha MF, White PF. Postoperative nausea and vomiting: Its etiology, treatment, and prevention. Anesthesiology 1992;77:162–184.
3. Gold BS, Kitz DS, Lecky JH, Neuhaus JM. Unanticipated admission to the hospital following ambulatory surgery. JAMA 1989;262:3008–3010.
4. Palazzo MGA, Strunin L. Anaesthesia and emesis. Can J Anaesth 1984;31:178–187.
5. Splinter WM, Rhine EJ. Prophylactic antiemetics in children after tonsillectomy: High dose vs low dose ondansetron. Paediatr Anaesth 1997;7:125–129.
6. Tramer MR. Review article. A rational approach to the control of postoperative nausea and vomiting: evidence from systematic reviews. Part 1. Efficacy and harm of antiemetic interventions and, methodological issues. Acta Anaesthesiol Scan 2001;45:4–13.
7. Eberhart LH, Morin AM, Felbinger TW, Falkner Y, et al. Results of a survey of anesthetists on postoperative nausea and vomiting. Anasthesiol Intensivmed Notfallmed Schmerzther 1998;33:545–551.
8. Alon E, Himmelseher S. Ondansetron in the treatment of postoperative vomiting: A randomized, double blind comparison with droperidol and metoclopramide. Anesth Analg 1992;75: 561–565.
9. Culy CR, Bhana N, Plosker GL. Ondansetron: A review of its use as an antiemetic in children. Paediatr Drugs 2001;3:441–479.
10. Morton NS, Camu F, Dorman T, Knudsen KE, et al. Ondansetron reduces nausea and vomiting after paediatric adenotonsillectomy. Paediatr Anaesth 1997;7:37–45.
11. Frigerio C, Buchwalder PA, Spertini F. Ondansetron: Reasons to be restrictive. Lancet 1996;347:1484–1485.
12. Barst SM, Leiderman JU, Markowitz A, Rosen AM, et al. Ondansetron with propofol reduces the incidence of emesis in children following tonsillectomy. Can J Anaesth 1999;46: 359–362.
13. Splinter WM, Rhine EJ. Low-dose ondansetron with dexamethasone more effectively decreases vomiting after strabismus surgery in children than does high-dose ondansetron. Anesthesiology 1998;88:72–75.
14. Somri M, Vaida SJ, Sabo E, Yassain G, et al. Acupuncture versus ondansetron in the prevention of postoperative vomiting: A study of children of undergoing dental surgery. Anaesthesia 2001;56:927–932.
15. Tangs J, Watcha MF, White PF. A comparison of costs and efficacy of ondansetron and droperidol, as prophylactic antiemetic therapy for elective outpatient gynecologic procedures. Anesth Analg 1996;83:304–313.
16. Schlager A, Boehler M, Puhringer F. Korean hand acupressure reduces postoperative vomiting in children after strabismus surgery. Br J Anaesth 2000;85:267–270.
17. Lee A, Done ML. The use of nonpharmacologic techniques to prevent postoperative nausea and vomiting: A meta analysis. Anesth Analg 1999;88:1362–1369.
18. Pusch F, Freitag H, Goll V, Wildling E, et al. Electrical stimulation of the vestibular system prevents postoperative nausea and vomiting. Acta Anaesthesiol Scand 2000;44:1145–1148.
19. Lewis IH, Pryn SJ, Reynolds PI, Pandit UA, Wilton NCT. Effect of P6 acupressure on postoperative vomiting in children undergoing outpatient strabismus correction. Br J Anaesth 1991;67:73–78.
20. Rusy LM, Hoffmann GM, Weisman SJ. Electroacupuncture prophylaxis of postoperative nausea and vomiting following pediatric tonsillectomy with or without adenoidectomy. Anesthesiology 2002;96:300–305.
21. Shenkman Z, Holzman RS, Kim C, Ferrari LR, et al. Acupressure-acupuncture antiemetic prophylaxis in children undergoing tonsillectomy. Anesthesiology 1999;90:1311–1316.
22. Yentis SM, Bissonette B. P6 acupuncture and postoperative vomiting after tonsillectomy in children. Br J Anaesth 1991; 67:779–780.
23. Filshie J. Safety aspects of acupuncture in palliative care. Acupunct Med 2001;19:117–122.
24. Aldrete JA, Kroulik D. A postanesthetic recovery score. Anesth Analg 1970;49:924–934.
25. Chung F. Discharge criteria—a new trend. Can J Anaesth 1995;42:1056–1058.

26. Ghaly RG, Fitzpatrick KTJ, Dundee JW. Antiemetic studies with traditional Chinese acupuncture: A comparison of manual needling with electrical stimulations and commonly used antiemetics. Anaesthesia 1987;42:1108–1110.
27. Ho RT, Jawan B, Fung ST, Cheung HK, Lee JH. Electroacupuncture and postoperative emesis. Anaesthesia 1989;45: 327–329.
28. Ross J. Acupuncture Point Combinations: Their Point to Clinical Success. Edinburgh: Churchill Livingstone, 1995:138.
29. Clement-Jones V, McLoughlin L, Tomlin S, Besser GM, et al. Increased β-endorphin but not met-enkephalin levels in human cerebrospinal fluid after acupuncture for recurrent pain. Lancet 1980;2:946–949.
30. Dundee JW, Ghaly RG, Bill KM, Chestnutt WN, et al. Effect of stimulation of the P6 antiemetic point on postoperative vomiting. Br J Anaesth 1989;63:612–618.
31. Richter J, Landau EM, Cohen S. The action of volatile anesthetics and convulsants on synaptic transmission: A unified concept. Mol Pharmacol 1977;13:548–549.
32. Dundee JW, Millan CMM. Clinical uses of P6 acupuncture antiemesis: Acupuncture and electro-therapeutics. Res Int J 1990;15:211–215.

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