

Acupressure using Ondansetron versus Metoclopramide on Reduction of Postoperative Nausea and Vomiting after Strabismus Surgery

Alireza Ebrahim Soltani MD¹, Hossein Mohammadinasab MD¹, Mehrdad Goudarzi MD¹, Shahriar Arbabi MD¹, Robab Mohtaram MD², Khosro Afkham MD², Sirius Momenzadeh MD³, Mohammad Esmail Darabi MD²

Abstract:

Objective: To compare the clinical efficacy of acupressure with treatment induced by ondansetron and metoclopramide on reduction of the severity of postoperative nausea and vomiting (PONV) after strabismus surgery.

Methods: There were 200 patients with ASA classes I-II, ages 10 to 60 years old, who underwent strabismus surgery that were included in this randomized, prospective, double-blind, placebo-controlled trial. Group I was the control, group II received metoclopramide 0.2 mg/kg, and group III received ondansetron 0.15 mg/kg intravenously immediately prior to anesthesia induction. In Group IV, acupressure wristbands were applied at the P6 points. Acupressure wrist bands were not placed appropriately for subjects of groups I-III. The acupressure wrist bands were applied 30 minutes before anesthesia induction and removed six hours after surgery completion. Anesthesia was standardized. PONV was evaluated within 0 – 2 hours and 2 – 24 hours after surgery by a blinded observer. Results were analyzed by the Chi-square or Fisher exact test. A *P* value of <0.05 was considered significant.

Results: The incidence of PONV was not significantly different among acupressure, metoclopramide and ondansetron groups during 24 hours. Also, the severity of PONV was not significantly different between acupressure, metoclopramide, and ondansetron in the recovery and ward.

Conclusion: Acupressure at the P6 point causes a significant reduction in the incidence and severity of PONV 24 hours after strabismus surgery as well as metoclopramide (0.2 mg/kg) and ondansetron (0.15 mg/kg) intravenous for patients aged 10 or older. (Irct ID: IRCT138807152556N1)

Keywords: nausea, P6 acupressure, strabismus surgery, vomiting

Introduction

Strabismus surgery is one of the most common operations which is accompanied by postoperative nausea and vomiting (PONV).¹⁻² These postoperative troubles have been explained as: “*big little*

problem”, “*final therapeutic challenge*” and a “*big big problem*” by anesthesiologists.³⁻⁴ The precise etiology of postoperative nausea and vomiting following strabismus surgery is still unknown⁵; however, there are a variety of reasons suggestive of the high incidence of PONV after strabismus surgery.⁶ Different factors influence the incidence of PONV, such as the anesthetic technique and prophylactic administration of antiemetic agents.² Various pharmacological agents and non-pharmacological methods have recently been utilized in order to prevent PONV following strabismus surgery. One of the non-pharmacological methods is P6 acupressure. It has been shown that this method reduces the drug requirement as well as the incidence of PONV after

Authors' affiliations: ¹Department of Anesthesiology, Children Medical Center, Tehran, ²Department of Anesthesiology, Farabi Eye Hospital, Tehran, ³Department of Anesthesiology, Imam Hossein Hospital, Tehran, Iran.

Corresponding author and reprints: Hossein Mohammadinasab MD, Children Medical Center, Keshavarz Blvd., Gharib St., Tehran 14149, Iran. Tel: +98-216-691-1030, Fax: +98-216-693-0024, E-mail: mohammadinasab@alumnus.tums.ac.ir

Accepted for publication: 15 December 2009

strabismus surgery.⁷ A study indicated that Korean hand acupoints also prevents PONV and reduces postoperative vomiting after strabismus surgery by 25%.⁸ PONV is a common complication after anesthesia and sedation in which no suitable treatment has thus been identified. In addition, prophylactic antiemetic drugs are not recommended in all patients undergoing strabismus surgery. On the other hand, prophylactic influence and the mechanism of action of non-pharmacological treatments on PONV are still unclear. The control of this phenomenon is still under debate amongst anesthesiologists. Regarding the aforementioned controversy, the present study is aimed to compare the effect of the acupressure method with treatment induced by ondansetron and metoclopramide on reduction in severity of PONV after strabismus surgery.

Patients and Methods

The study was approved by the Ethics Committee of the Tehran University of Medical Sciences, Tehran, Iran. Written informed consent was obtained from all patients. A total of 200 individuals with ASA classes I- II, ages 10 – 60 years old, who underwent strabismus surgery in Farabi Eye Hospital, Tehran, Iran during 2007 – 2008 were included in this randomized, prospective, double-blind, placebo-controlled study.

Patients were randomized into four groups using random numbers, with 50 cases in each group as follows: group I (control), group II (metoclopramide), group III (ondansetron), and group IV (acupressure).

In groups I, II and III, the spherical beads of the acupressure wrist bands were placed inappropriately on the posterior surface of both forearms 30 minutes before anesthesia induction. Patients of group II received metoclopramide 0.2 mg/kg intravenously immediately prior to induction. Group III patients received intravenous (iv) ondansetron 0.15 mg/kg just before induction. In group IV patients, acupressure bands were applied at the P6 point on both forearms 30 minutes before anesthesia induction. Bands were removed six hours later. For blinding, a saline (1 mL, intravenously) solution was administered to patients of groups I and IV immediately prior to anesthesia induction.

The acupressure wrist-band has an adjustable strap 1.5 cm in width, a spherical plastic bead and a Vel-

cro fastener to hold the bead in position. The treatment point P6 (Nei-Guan) was placed on the anterior surface of the forearm approximately 1 cm deep in the skin, and two body inches proximal to the distal crease of the wrist joint between the flexor carpi radialis and palmaris longus tendons. One body inch was equal to the width of the interphalangeal joint of the patient's thumb.

The acupressure band was placed around the wrist, in such a way that the patient felt only a gentle pressure and no discomfort. To determine that the compression was not excessive, a pulse oximeter was placed on the index finger to confirm adequate blood flow. Wrist bands that were considered too loose were tightened such that a piece of paper could fit between the pressure band and skin. Patients' forearms were raised by 60 degrees at the elbow and venous emptying occurred normally in all cases.

Patients who refused to enroll in the study or those with nausea or vomiting in the preceding week, local infection near the acupuncture point, symptomatic medical illness, travel sickness, recovery of greater than two hours and those who received any medical therapy immediately prior to surgery were excluded. For all patients; gender, body weight, duration of surgery, retching, nausea, vomiting during recovery and in the ward was noted. All patients were premedicated with 1 mg midazolam and 2 mcg/kg fentanyl, and patients fasted for at least 6 – 8 hours prior to surgery. Heart rhythm (with ECG), noninvasive blood pressure, peripheral oxygen saturation and EtCO₂ were monitored. Anesthesia induction was achieved with 5 mg/kg thiopental (T) and 0.5 mg/kg atracurium which were administered via an iv-line. Anesthesia was maintained with halothane 1MAC in 50% N₂O-O₂ and atracurium 0.2 mg/kg when deemed necessary.

Patients were followed up at the recovery (0 – 2 hr) and in the ward (2 – 24 hr) during first 24 hours and were assessed for PONV. Postoperative retching, nausea and vomiting were recorded by the nursing staffs that were unaware of the group assignments.

In the present investigation, the following definitions were clarified as listed below. Retching: an unproductive effort to vomit; nausea: an uneasiness of the stomach that often preceded vomiting without muscle spasms; vomiting: the forcible voluntary or involuntary emptying of stomach contents through the mouth. Numeric analog scales were graded as

follows: lack of retching, nausea and vomiting (0); incidence of nausea (I); incidence of retching (II); incidence of vomiting (III).⁹⁻¹⁰

Statistical analysis

Our statistical power calculation showed that 50 patients were needed in each group for 90% power, with a PONV risk of 50% and an alpha of 95%. Age and other normally distributed data were compared with ANOVA. In this study the incidence of retching, nausea and vomiting in addition to other nominal data were compared with Chi-squared or Fisher's exact tests. In this study, $P < 0.05$ was considered significant. SPSS version 13.00 software was used for all computations.

Results

Patients were comparable in all groups with regard to age, sex, weight, and duration of surgery. There were no statistically significant differences with respect to demographic data between groups in the study (Table 1). Also, in this study, no patient was excluded after admission to the study.

The incidence of vomiting during recovery following strabismus surgery in the placebo group was 16%. The metoclopramide, ondansetron and acupressure groups had a significant decrease in the incidence of vomiting during the recovery (6%, 0% and 0%, $P = 0.001$; Figure 1). The incidences of retching, nausea and vomiting in the ward after strabismus surgery in the placebo group were 20%, 38%, and 49%, respectively. The metoclopramide, ondansetron and acupressure groups showed a significant decrease in the incidence of retching during recovery (10%, 2%, and 8%; $P = 0.025$, respectively). There was also a significant decrease in the incidence of nausea in the metoclopramide, ondansetron, and acupressure groups (14%, 18%, 12%; $P = 0.004$) as well as vomiting (10%, 18%, 20%; $P = 0.000$, respectively) in the ward after strabismus surgery (Figure 2).

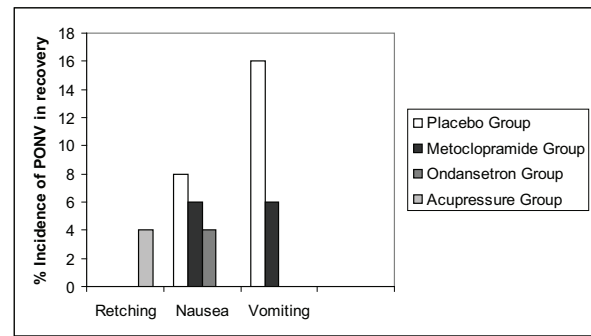


Figure 1. Comparison of incidence of PONV during recovery

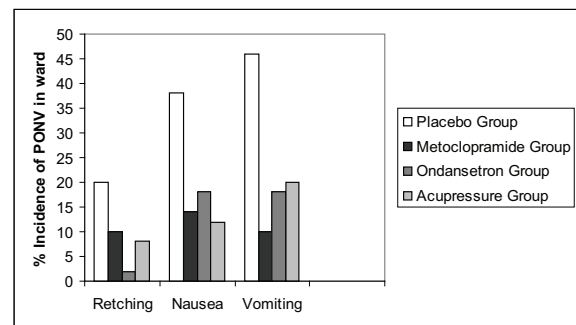


Figure 2. Comparison of incidence of PONV in ward

In this study, it was noted that the acupressure group showed a significant decrease in the incidences of nausea and vomiting when compared to the placebo group during the recovery time and in the relevant ward. A comparison between the acupressure and ondansetron groups implicated and proved no significant difference between the acupressure and metoclopramide groups in PONV incidence (Table 2).

The severity of PONV in the acupressure group was significantly reduced in comparison with the placebo group in both the recovery room and ward ($P < 0.05$). However, the severity of this event was not significantly different between the acupressure group and the patients who received metoclopramide in both the recovery room and ward ($P > 0.05$). Similarly, the severity of PONV between the acupressure and ondansetron groups in the recovery room and

Table 1: Demographic and relevant data

| | Acupressure (n=50) | Metoclopramide (n=50) | Ondansetron (n=50) | Placebo (n=50) |
|----------------------------|-----------------------|--------------------------|-----------------------|-------------------|
| Age | 19.44±10.12 | 17.68±8.52 | 22.04±11.97 | 18.06±9.29 |
| Sex ratio (Male:Female) | 31:19 | 28:22 | 27:23 | 22:28 |
| Weight (kg) | 46.54±19.91 | 43.52±18.43 | 52.86±17.56 | 45.46±20.59 |
| Duration of surgery (min.) | 70±40.54 | 63.30±17.54 | 63.50±17.12 | 71.30±20.29 |

Table 2. Comparison of incidence of PONV between acupressure and study groups

| | Metoclopramide (n=50) | Ondansetron (n=50) | Acupressure (n=50) | Placebo (n=50) | P-value ap | P-value ao | P-value am |
|-------------|--------------------------|-----------------------|-----------------------|-------------------|------------|------------|------------|
| Retching * | 0 (0%) | 0 (0%) | 2 (4%) | 0 (0%) | 0.153 | 0.153 | 0.153 |
| Nausea * | 3 (6%) | 2 (4%) | 0 (0%) | 4 (8%) | 0.041 | 0.153 | 0.079 |
| Vomiting* | 3 (6%) | 0 (0%) | 0 (0%) | 8 (16%) | 0.003 | — | 0.079 |
| Retching ** | 5 (10%) | 1 (2%) | 4 (8%) | 10 (20%) | 0.084 | 0.401 | 0.727 |
| Nausea ** | 7 (14%) | 9 (18%) | 6 (12%) | 19 (38%) | 0.003 | 0.169 | 0.766 |
| Vomiting ** | 5 (10%) | 9 (18%) | 10 (20%) | 23 (46%) | 0.006 | 0.799 | 0.161 |

P-value of ap=acupressure to placebo; *P*-value of ao=acupressure to ondansetron; *P*-value of am=acupressure to metoclopramide; *During recovery phase; **In the ward

ward was not significant, as well ($P>0.05$; Figures 3 and 4).

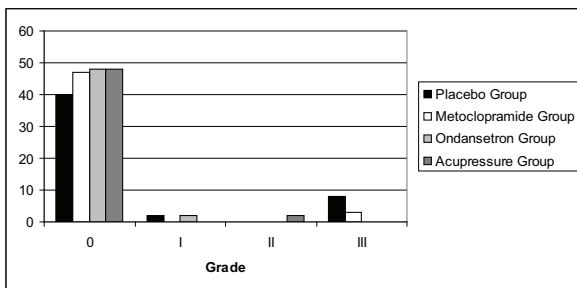


Figure 3. Comparison of severity of PONV during recovery

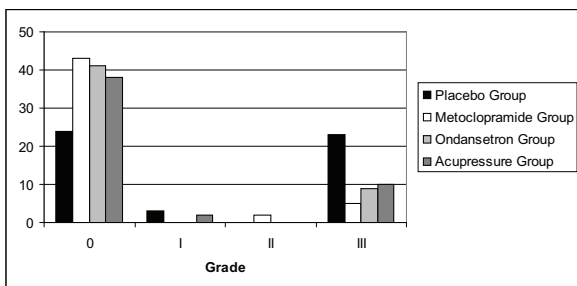


Figure 4. Comparison of severity of PONV in ward

Discussion

The present study was designed to determine the effects of acupressure as well as metoclopramide and ondansetron on reducing PONV in both the recovery room and ward. The incidence of PONV in the acupressure group has shown a significant decrease when compared with the placebo group in both the recovery room and ward. These findings were in agreement with a number of previous studies. Other studies, however, have reported a similar effect with both (concurrent) treatments by acupressure and metoclopramide on decreasing PONV. Acupressure has been reported as a method without any side ef-

fects, however in contrast, metoclopramide is a drug with extra-pyramidal side effects which also interact with anesthetic agents.⁹ However, the lack of side effects from metoclopramide in the present study might be related to its applied dose. Another investigation indicated that P6 acupressure caused a considerable reduction in PONV, especially during the first six postoperative hours after surgery, which is similar to the effect of ondansetron.¹⁰ Consistently, it has been shown that P6 acupressure has the same effect as ondansetron, and it is the most effective non-pharmacological method available during the first six postoperative hours. In addition, it should be considered that acupressure shows diverse treatment outcomes on nausea and vomiting following different types of surgical procedures.¹¹⁻¹⁴ It seems that the acupressure technique has been performed correctly, as it caused successful relief of PONV symptoms. The action mechanism of acupressure is still unclear and various hypotheses have been formulated to explain this ambiguity. It has been reported that improving the effect of acupressure might be due to its influence on restoring the body's energy balance. It is presumed that the body's energy balance attains maximum levels at certain points throughout the body. When skillfully applied, the body's energy balance will be restored. This peak of energy is called the P6 point in Chinese medicine.¹⁵

Likewise, in other studies, the antiemetic effect of acupressure has been highlighted.¹⁶ In another research it has been reported that P6 acupressure was used as a standard method in order to treat PONV.¹⁷ It has also been suggested that α - and β -fiber, which make synapses in the dorsal corona, are activated via sensory receptors of the skin and cause a low frequency stimulation terminating in increasing the secretion of endorphins in the hypothalamus. An augmentation of the cerebro-spinal fluid level of

β -endorphin has been demonstrated following acupressure.^{18–19} Alternatively, it has been proposed that this technique activates the serotonergic and norepinephrinergic fibers and possibly changes in the serotonin levels have a preventive effect on PONV.^{18–19} There is also a possible role of central dopaminergic receptors in the acupressure antiemetic mechanism, and P6 acupressure might indirectly cause an affect through these central dopaminergic receptors.²⁰

There are numerous research that has clarified the protective role of P6 acupressure against PONV.^{18,21–23} The key points in the effectiveness of this method is the correct placement of stimulation as well as the stimulation time.^{21,24,25} In order to perform a useful acupressure technique for prevention of PONV, it is necessary to apply it before the onset of nausea and vomiting. A meta-analytical study has investigated the preventive effect of non-pharmacological techniques on PONV.²⁶ Subsequently the practical influence of non-pharmacological methods on prevention of PONV in adults in comparison with a placebo group (>10 years old) during the first six postoperative hours according to one study²⁶ is consistent with the present research. However, regarding the performed P6 acupressure in previous investigations, some conflicts have been observed in the clinical cases. Therefore, the P6 acupressure technique would not be a useful method to reduce PONV after strabismus and tonsillectomy surgeries in children.^{27–29} Moreover, this technique is not a useful method on PONV after endoscopy and urology surgery, in addition to nausea and vomiting during the pregnancy period.^{30–31} It would not also be a good procedure to prevent PONV following cardiac surgery.³² On the other hand, it has been reported that it is an applicable and useful method in preventing the PONV following cesareans.³³

Our data is in agreement with a recent report that showed a significant reduction of PONV in an acupressure-treated group in comparison with a placebo group in both the recovery room and ward, as we did not observe any vomiting in the patients in the recovery room. The present findings are consistent with other studies.^{36–34} It should be noted that the technique to be used after strabismus surgery plays a crucial role in preventing PONV and we suggest that it could be used in the future investigations. Although there are considerable progresses in the anesthetic techniques and antiemetic agents in order to

treat PONV, however, it seems that more research is needed in the future.

Conclusion

PONV is an unpleasant symptom. It seems that prophylactic antiemetic agents tend not to eliminate PONV, but significantly reduce this postoperative side effect. Using the correct selection process of patients and improving techniques in order to control PONV, would enable physicians to successfully prevent this side effect. Over all, there is not a definite clinical recommendation based on non-pharmacological methods; however, it could be suggested that in order to achieve the useful effect of acupressure against PONV, thus P6 stimulation must be applied prior to the onset of nausea and vomiting.

References

1. Sinclair DR, Chung F, Mezei G. Can postoperative nausea and vomiting be predicted? *Anesthesiology*. 1999; **91**: 109 – 118.
2. Mendel HG, Guarnieri KM, Sundt LM, Torjman MC. Ketorolac vs. fentanyl on postoperative vomiting and analgesic requirements. *Anesth Analg*. 1995; **80**: 1129 – 1133.
3. Fisher DM. The “big little problem” of postoperative nausea and vomiting; do we know the answer yet? *Anesthesiology*. 1997; **87**: 1271 – 1275.
4. Kapur PA. The big “little problem”. *Anesth Analg*. 1991; **73**: 243 – 245.
5. Tramer M, Moore A, McQuay H. Prevention of vomiting after paediatric strabismus surgery: a systematic review using the numbers-needed-to-treat method. *Br J Anaesth*. 1995; **75**: 556 – 561.
6. Warner LO, Rogers GL, Martino JD, Bremer DL, Beach TP. Intravenous lignocaine reduces the incidence of vomiting in children after strabismus surgery. *Anesthesiology*. 1988; **68**: 618 – 621.
7. Lee A, Done ML. Stimulation of the wrist acupuncture point P6 for preventing postoperative nausea and vomiting. *Cochrane Database Syst Rev*. 2004; **3**: CD003281.
8. Kim KS, Koo MS, Jeon JW, Park HS, Seung IS. Capsicum plaster at the Korean hand acupuncture point reduces postoperative nausea and vomiting after abdominal hysterectomy. *Anesth Analg*. 2002; **95**: 1103 – 1107.
9. Watcha MF, White PF. Postoperative nausea and vomiting: its etiology, treatment, and prevention. *Anesthesiology*. 1992; **77**: 162 – 184.

10. Vakil JR, Golwala FA. *Physical Diagnosis-A Textbook of Symptoms and Signs*. 7th ed. Philadelphia: WB Saunders; 1992; 52.
11. Fisher AA, Davis MW. Serotonin syndrome caused by selective serotonin reuptake-inhibitors metoclopramide interaction. *Ann Pharmacother*. 2002; **36**: 67 – 71.
12. Agarwal A, Bose N, Gaur A, Singh U. Acupressure and ondansetron for postoperative nausea and vomiting after laparoscopic cholecystectomy. *Can J Anesth*. 2002; **49**: 554 – 560.
13. Dundee JW, Sourial FBR, Ghaly RG, Bell PF. P6 acupressure reduces morning sickness. *JR Soc Med*. 1988; **81**: 456 – 457.
14. Dundee JW, Ghaly RG, Fitzpatrick KTJ, Lynch G, Abram P. Optimising antiemesis in cancer chemotherapy (Letter). *Br Med J (Clin Res Ed)*. 1987; **294**: 179.
15. Dundee JW, Ghaly RG, Bill KM, Chestnutt WN, Fitzpatrick KT, Lynas AG. Effect of stimulation of the P6 antiemetic point on postoperative nausea and vomiting. *Br J Anaesth*. 1989; **63**: 612 – 618.
16. Ho CM, Hseu SS, Tsai SK, Lee TY. Effect of P-6 acupressure on prevention of nausea and vomiting after epidural morphine for post-cesarean section pain relief. *Acta Anaesthesiol Scand*. 1996; **40**: 372 – 375.
17. Vincent CA, Richardson PH. The evaluation of therapeutic acupuncture: concepts and methods. *Pain*. 1986; **24**: 1 – 13.
18. White PF. Are nonpharmacologic techniques useful alternatives to antiemetic drugs for the prevention of nausea and vomiting? *Anesth Analg*. 1997; **84**: 712 – 714.
19. Dundee JW. Belfast experience with P6 acupuncture antiemesis. *Ulster Med J*. 1990; **59**: 63 – 70.
20. Stein DJ, Birnbach DJ, Danzer BI, Kuroda MM, Grunebaum A, Thys DM. Acupressure versus intravenous metoclopramide to prevent nausea and vomiting during spinal anesthesia for cesarean section. *Anesth Analg*. 1997; **84**: 342 – 345.
21. Clement-Jones V, McLoughlin L, Tomlin S, Besser GM, Rees LH, Wen HL. Increased β -endorphin but not met-enkephalin levels in human cerebrospinal fluid after acupuncture for recurrent pain. *Lancet*. 1980; **1**: 946 – 948.
22. Fassoulaki A, Papilas K, Sarantopoulos C, Zotou M. Transcutaneous electrical nerve stimulation reduces the incidence of vomiting after hysterectomy. *Anesth Analg*. 1993; **76**: 1012 – 1014.
23. Fan CF, Tanhui E, Joshi S, Trivedi S, Hong Y, Shevde K. Acupressure treatment for prevention of postoperative nausea and vomiting. *Anesth Analg*. 1997; **84**: 821 – 825.
24. Dundee JW, McMillan CM. Clinical uses of P6 acupuncture antiemesis. *Acupunct Electrother Res*. 1990; **15**: 211 – 215.
25. Dundee JW, Ghaly G. Local anesthesia blocks the antiemetic action of P6 acupuncture. *Clin Pharmacol Ther*. 1991; **50**: 78 – 80.
26. Dundee JW, Ghaly RG. Does the timing of P6 acupuncture influence its efficacy as a postoperative anti-emetic? *Br J Anaesth*. 1989; **63**: 630.
27. Fitzpatrick KTJ, Dundee JW, Ghaly RG, Patterson CC. Is it necessary always to use the right forearm for acupuncture antiemesis? *Br J Anaesth*. 1988; **61**: 117 – 118.
28. Lee A, Done ML. The use of nonpharmacologic techniques to prevent postoperative nausea and vomiting: a meta-analysis. *Anesth Analg*. 1999; **88**: 1362 – 1369.
29. Shenkman Z, Holzman RS, Kim C, Ferrari LR, DiCanzio J, Highfield ES, et al. Acupressure-acupuncture antiemetic prophylaxis in children undergoing tonsillectomy. *Anesthesiology*. 1999; **90**: 1311 – 1316.
30. Yentis SM, Bissonnette B. P6 acupuncture and postoperative vomiting after tonsillectomy in children. *Br J Anaesth*. 1991; **67**: 779 – 780.
31. 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.
32. Agarwal A, Pathak A, Gaur A. Acupressure wristbands do not prevent postoperative nausea and vomiting after urological endoscopic surgery. *Can J Anesth*. 2000; **47**: 319 – 324.
33. O'Brien B, Relyea MJ, Taerum T. Efficacy of P6 acupressure in the treatment of nausea and vomiting during pregnancy. *Am J Obstet Gynecol*. 1996; **174**: 708 – 715.
34. Turgut S, Ozalp G, Dikmen S. Acupressure for postoperative nausea and vomiting in gynaecological patients receiving patient-controlled analgesia. *Eur J Anaesthesiol*. 2006; **8**: 1 – 5.
35. Klein AA, Djajani G, Karski J. Acupressure wristbands for the prevention of postoperative nausea and vomiting in adults undergoing cardiac surgery. *J Cardiothoracic Vasc Anesth*. 2004; **18**: 68 – 71.
36. Boehler M, Mitterschiffthaler G, Schlager A. Korean hand acupressure reduces postoperative nausea and vomiting after gynecological laparoscopic surgery. *Anesth Analg*. 2002; **94**: 872 – 875.