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Acupuncture in the prevention of postoperative nausea and vomiting

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Summary

The efficacy of intra-operative acupuncture at the PC6 point in the prevention of postoperative nausea or vomiting was studied. A double-blind randomised controlled study of acupuncture versus placebo was performed in 81 patients scheduled for day case gynaecological laparoscopic surgery. Failure of treatment was defined as the occurrence of nausea or vomiting prior to or within 24 h of discharge. The use of acupuncture reduced the incidence of postoperative nausea or vomiting in hospital from 65% to 35% compared with placebo and after discharge from 69% to 31% compared with placebo.

Keywords *Acupuncture. Vomiting*; nausea.

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Despite advances in anaesthesia, prevention of postoperative nausea or vomiting remains a continuing problem and formidable challenge to the anaesthetist. Rowbotham, in his review of the management of postoperative nausea and vomiting, concluded that the efficacy of currently available anti-emetics is often poor [1]. Anti-emetic drugs have a variety of actions including anticholinergic, antihistamine and antidopaminergic and these actions can result in a wide variety of side-effects which can occur even with low doses.

For certain groups of patients, postoperative nausea or vomiting may be more debilitating than the effects of surgery and it is common experience for day surgery patients to have to be admitted overnight because of uncontrolled emesis [2]. Factors affecting postoperative emesis include the patient's history, the type of surgery being performed and the anaesthetic technique [3, 4]. These factors must be addressed in the design of a study of anti-emesis. Several studies of the effect of acupuncture on postoperative nausea and vomiting have been undertaken. Dundee and co-workers [5–7] compared acupuncture at the PC6 point to 'sham' acupuncture (applied to a point not recognised as an acupuncture point). The patients were not stratified for variables recognised to influence the incidence of postoperative nausea and vomiting and they were followed for only 6 h. These authors concluded that PC6 acupuncture was effective as an anti-emetic.

Only the most recent trials of anti-emetic drugs have included and stratified all the variables: age, weight, history of postoperative nausea or vomiting or motion sickness, menstrual phase or administration of opioids [3, 8] and no such trial has been undertaken to assess the efficacy of acupuncture as a prophylactic anti-emetic.

We have studied the efficacy of PC6 acupuncture in the prevention of postoperative nausea or vomiting in patients undergoing day case laparoscopic gynaecological surgery. This group of patients is recognised as suffering a particularly high incidence of postoperative nausea or vomiting of up to 60% [3] and can be safely subjected to a standardised anaesthetic technique.

Methods

Approval for the study was obtained from the hospital Ethics and Research Committee. Eighty-one patients scheduled for gynaecological laparoscopic surgery as day cases were stratified according to history of postoperative nausea or vomiting and whether they were to undergo diagnostic or therapeutic laparoscopy. They were randomly allocated to one of two groups to receive either acupuncture or control. It was estimated that 41 patients in each group would be required to detect a reduction from 70% to 35% of postoperative nausea or vomiting in hospital at the 5% level with 90% power [9].

Written consent was obtained from all patients. All patients were ASA 1 or 2 and received no premedication. Patients in whom tracheal intubation was mandatory were excluded from the study. All patients were informed prior to surgery that acupuncture may prevent postoperative nausea and vomiting and that they may or may not have an acupuncture needle sited after induction of anaesthesia and removed before recovering consciousness. All were told to expect a small adhesive dressing on both wrists on awakening.

In the study group, after induction of anaesthesia but before the start of surgery and before administration of morphine, a sterile acupuncture needle (0.18 mm in diameter) was inserted bilaterally at the PC6 point which is located three fingers breadth proximal to the proximal flexor palmar crease at a depth of 5 mm between the tendons of flexor carpi radialis and palmaris longus [10]. The needles were rotated manually for 5 s and left *in situ* for the duration of the surgery. The acupuncture needles were removed at the end of surgery. In both acupuncture and control groups, the PC6 sites were covered with an identical adhesive dressing prior to leaving the operating theatre.

Anaesthesia was induced with propofol 2.5 $mg.kg^{-1}$ and maintained with nitrous oxide (66%) in oxygen and isoflurane 1%. Muscle relaxation was provided by atracurium 0.3 $mg.kg^{-1}$ and intermittent positive pressure ventilation of the lungs was provided via a laryngeal mask airway. Following induction and the application of acupuncture in the test group, morphine 0.15 $mg.kg^{-1}$ was given intramuscularly and diclofenac 100 mg per rectum. Residual neuromuscular blockade was antagonised in all patients with neostigmine 2.5 mg and glycopyrrolate 0.5 mg. Intramuscular morphine was prescribed for postoperative pain and intravenous ondansetron for postoperative nausea or vomiting

The patient, recovery nurses (six) and ward nurses (eight) were not aware as to which group a patient had been allocated. These nurses recorded the incidence of nausea and vomiting in the recovery ward and day ward. The patients were not asked explicitly about nausea but were asked if they felt comfortable. If nausea was reported, this was recorded. All patients but one were contacted by telephone not less than 24 h after leaving hospital to record the incidence and timing of postdischarge nausea and or vomiting. In the analysis, failure of treatment was defined as one episode of reported nausea or one episode of vomiting or retching.

The data were analysed in the SPSS/PC+ statistical package using logistic regression. The variables age, weight, history of postoperative nausea or vomiting or motion sickness, postoperative administration of morphine, postoperative administration of ondansetron, laparoscopy type (diagnostic or therapeutic), menstrual phase (luteal = phase L, follicular = phase F or postmenopausal) were entered into the model concurrently with treatment to eliminate imbalances The change in the $-2\star$Log-Likelihood χ^2 was used to assess significance.

Results

Eighty-one patients participated in the study. The average time of PC6 acupuncture stimulation was 20 min in the study group. The mean (SD) age of the placebo group was 35.8 (8.0) years and of the treatment group 34.2 (6.1) years whilst the mean (SD) weights were 64.0 (9.6) kg and 61.7 (9.7) kg, respectively. One patient could not be contacted after discharge. This patient underwent diagnostic laparoscopy, did not receive acupuncture and suffered nausea and vomiting postoperatively.

The incidence of risk factors for postoperative nausea or vomiting are shown for each group in Table 1. The incidence of postoperative nausea and/or vomiting are shown in Tables 2 and 3, which present the data not stratified for variables which may influence the incidence of nausea or vomiting. The multivariate analysis of data is presented in Table 4. These results demonstrate a statistically significant reduction of nausea or vomiting both before and for 24 h after discharge. Interestingly, acupuncture was effective in reducing the incidence of emesis in patients with a history of postoperative nausea and vomiting and/or motion sickness (Table 5). This subset has a lower threshold for experiencing nausea and vomiting after surgery and they usually require higher doses of ondansetron to prevent postoperative emesis [11].

The calculation of odds ratios or 'risks' (Table 4) is

Table 1 Distribution of patients and risk factors for postoperative nausea or vomiting. (F = follicular, L = luteal, PM = postmenopausal.)

	Laparoscopy type		History of motion sickness or postoperative nausea or vomiting	Menstrual phase: F/L/PM	Received postoperative morphine	Received postoperative anti-emetic
	Diagnostic	Therapeutic				
Acupuncture	19	21	19	17/21/2	5	10
Placebo	20	21	21	21/15/5	7	13

Table 2 Incidence of postoperative nausea and vomiting.

	Hospital nausea	Hospital vomiting	Postdischarge nausea	Postdischarge vomiting
Acupuncture	9	7	2	8
Placebo	15	16	15	12

Table 3 Incidence of postoperative nausea or vomiting.

	Predischarge	Postdischarge
Acupuncture	12	8
Placebo	22	18

useful as it gives a measure of the extent to which the patients receiving placebo were more likely to suffer postoperative nausea or vomiting before or after discharge. In hospital, patients receiving placebo were 16 times more likely to suffer either nausea or vomiting than those receiving acupuncture prophylaxis and in the 24 h after discharge, the placebo group was four times more likely to suffer postoperative nausea or vomiting than those receiving acupuncture. Three patients in the placebo group had to be admitted overnight because of uncontrolled emesis.

Discussion

Stimulation of the acupuncture point PC6 (Nieguan) on the pericardium meridian has been used for centuries in China to treat morning and travel sickness and postoperative emesis [10]. Side-effects of PC6 acupuncture have not been described although there is the remote possibility of trauma to nerves and blood vessels or sepsis. These are limited by use of a sterile technique and a fine needle.

It is difficult to pinpoint the mechanism of PC6 antiemetic action. Stimulation analgesia by manual or electrical acupuncture may be mediated by central endogenous opioid peptides. Clement-Jones [12] reported an increased β-endorphin but not met-enkephalin level in human cerebrospinal fluid after acupuncture stimulation. From the results of studies in animals it has been postulated that opioids have both emetic and anti-emetic actions and that the emetic action is mediated by the δ receptors and the anti-emetic by the μ receptors. Costello & Borison [13] discovered that naloxone administered systemically blocked the anti-emetic effect of opioid but, when administered directly into the cerebral ventricles, naloxone blocked the emetic effect. β endorphin has equal affinity for μ and δ receptors whereas enkephalin binds predominantly to δ receptors [14]. The anti-emetic effect of acupuncture may therefore be mediated by the release of β endorphin into cerebrospinal fluid, potentiating the endogenous anti-emetic tone. The levels of β endorphin reach maximum 25 min after stimulation with acupuncture [15] and this duration may explain the differences between our results and those of Weightman *et al.* [16]. Other mechanisms may also be involved.

A wide variety of factors influence the incidence and severity of postoperative nausea or vomiting and bias from these must be eliminated from a study of the management of postoperative nausea or vomiting to draw valid conclusions. The principal factors include the sex and age of the patient, administration of opioids [17] and a history of postoperative nausea or vomiting or motion sickness [3]. It has also been suggested that the highest incidence of emesis in ovulating women occurs in the luteal phase of the menstrual cycle [8]. Many of these risk factors were not addressed in earlier studies of postoperative nausea or vomiting.

Gastric distension due to the use of a laryngeal mask airway may have contributed in some way to the incidence of postoperative nausea and vomiting. However, all patients in this study were anaesthetised using the laryngeal mask airway and the inflation pressure was kept to the minimum required to achieve adequate ventilation. Any effect should have been evenly distributed between the two groups of patients.

Various methods of scoring the severity of nausea have been described. As the purpose of this study was to establish

Table 4 Pre- and postdischarge nausea and/or vomiting.

	−2*Log-Likelihood χ^2	d.f.	p value	Risk	95% CI
Predischarge					
Nausea	2.267	1	0.132	3.450	0.645–18.447
Vomiting	2.986	1	0.084	2.936	0.843–10.210
Nausea or vomiting	8.049	1	0.005	16.027	1.937–132.605
Postdischarge					
Nausea	15.238	1	0.001	15.140	2.812–81.520
Vomiting	2.179	1	0.139	2.303	0.747–7.095
Nausea or vomiting	7.189	1	0.007	4.260	1.407–12.891

Table 5 Incidence of nausea and vomiting in patients with a history of previous postoperative nausea and vomiting and/or motion sickness.

	Nausea (p = 0.01)	Vomiting (p = 0.2)
Placebo ($n = 21$)	12	10
Acupuncture ($n = 19$)	2	5

whether acupuncture administered intra-operatively has any anti-emetic effect, severity was not measured. Failure to prevent postoperative nausea or vomiting was defined as one spontaneous report of nausea or one episode of vomiting postoperatively prior to discharge or within 24 h following discharge. This simple standard was used to enhance discrimination between statistically demonstrable but clinically insignificant effects of the treatment and clinically relevant effects of acupuncture.

Few double-blind controlled trials of PC6 acupuncture to prevent postoperative nausea or vomiting have been published and these have produced some conflicting results. Most of the studies had shortcomings in the randomisation process or failed to record and eliminate the influence of recognised risk factors. In no study were the patients followed for 24 h or after discharge from hospital.

Weightman *et al.* [16] found no beneficial postoperative anti-emetic effect from PC6 acupuncture. These authors appear to have applied acupuncture intra-operatively after the administration of an opioid intravenously. No mention is made as to whether the acupuncture was bilateral or unilataral, or, if unilateral, which side and this may well be relevant [18]. A subsequent study by Dundee & Ghaly [19] demonstrated that application of acupuncture prior to administration of an opioid has a significant beneficial effect.

References

1 Rowbotham DJ. Current management of postoperative nausea and vomiting. *British Journal of Anaesthesia* 1992; **69 (Suppl.1):** 46S–59S.

2 Gold BS, Kitz DS, Lecky JH, Neuhaus JM. Unanticipated admission to the hospital following ambulatory surgery. *Journal of the American Medical Association* 1989; **262:** 3008–10.

3 Lerman J. Surgical and patient factors involved in postoperative nausea and vomiting. *British Journal of Anaesthesia* 1992; **69** (**Suppl. 1):** 24S–32S.

4 Watcha MF, White PF. Postoperative nausea and vomiting. Its etiology, treatment and prevention. *Anesthesiology* 1992; **77:** 168–84.

5 Dundee JW, Chestnut WN, Ghali RG, Lynas AGA. Traditional Chinese acupuncture: a potentially useful antiemetic. *British Medical Journal* 1986; **293:** 583–4.

6 Dundee JW, Ghaly RJ, Bill KM, Chestnutt WN, Fitzpatrick KTJ, Lynas AJA. Effect of stimuation of the P6 antiemetic point on postoperative nausea and vomiting. *British Journal of Anaesthesia* 1989; **63:** 612–8.

7 Dundee JW, Milligan KR, McKay AC. Influence of intraoperative acupuncture and droperidol on postoperative emesis. *British Journal of Anaesthesia* 1988; **61:** 116–7.

8 Honkavaara P, Lehtinen AM, Hovorka J, Korttila K. Nausea and vomiting after gynaecological laparoscopy depends upon the phase of the menstrual cycle. *Canadian Journal of Anaesthesia* 1991; **38:** 876–9.

9 Machin D, Campbell MJ. *Statistical Tables for the Design of Clinical Trials*. Oxford: Blackwell Scientific Publications, 1987.

10 *A Barefoot Doctor's Manual (the American Translation of the Official Chinese Paramedical Manual)*. Philadelphia Running Press, 1990.

11 Rust M, Cohen LA. Single oral ondansetron in the prevention of postoperative nausea and emesis. *Anaesthesia* 1994; **49 (Suppl.):** 16–23.

12 Clement-Jones. Increased β-endorphine but not met-enkephaline levels in human cerebro spial fluid after acupuncture for recurrent pain. *Lancet* 1980; **2:** 946–9.

13 Costello DJ, Borison HL. Naloxone antagonises narcotic selfblockade of emesis in the cat. *Journal of Pharmacology and Experimental Theraeputics* 1977; **203:** 222–30.

14 Harris *et al.* Cytotoxic therapy induced vomitying is mediated via enkephalin pathway. *British Journal of Anaesthesia* 1982; **1:** 714–6.

15 Abenyaker S, Boneval F. Increased plasma (endorphine concentrations after acupuncture: comparison of electoacupunctre, traditional Chinese acupunctre,TENS and placebo TENS. *Acupuncture in Medicine*; 1994; **12:** 21–3.

16 Weightman A, Herbison Z. Traditional Chinese acupuncture as an antiemetic. *British Medical Journal* 1987; **295:** 1379–80.

17 Rabey PG, Smith G. Anaesthetic factors contributing to postoperative nausea and vomiting. *British Journal of Anaesthesia* 1992; **69 (Suppl. 1):** 40S–45S.

18 Fitzpatrick KTJ, Dundee JW, Ghaly RG, Patterson CC. Is it necessary always to use the right forearm for acupuncture anti-emesis. *British Journal of Anaesthesia* 1988; **61:** 117P–8P.

19 Dundee JW, Ghaly RG. Does the timing of P6 acupuncture influence its efficacy as a postoperative antiemetic? *British Journal of Anaesthesia* 1989; **63:** 630P.