British Journal of Anaesthesia 1991; 67: 73–78

EFFECT OF P6 ACUPRESSURE ON POSTOPERATIVE VOMITING IN CHILDREN UNDERGOING OUTPATIENT STRABISMUS CORRECTION

I. H. LEWIS, S. J. PRYN, P. I. REYNOLDS, U. A. PANDIT AND N. C. T. WILTON

SUMMARY

A prospective, double-blind study was conducted to compare the effect of pressure at the P6 (Neikuan) point with placebo as an antiemetic in children. Sixty-six patients, ages 3–12 yr, undergoing outpatient surgery for correction of strabismus, were allocated randomly to receive either bilateral P6 acupressure or placebo during the perioperative period. The study was designed to detect a 50% difference in the incidence of postoperative vomiting between the two groups, with a 90% power of achieving a statistically significant result at the 5% level (two-tailed). The incidence of postoperative vomiting for the placebo group was 58% before discharge from hospital, 73% at home and 82% in the first 24 h after surgery. The corresponding results for the acupressure group were 58% before discharge, 71% at home and 94% in the first 24 h. These differences were not significant; P6 acupressure did not reduce the incidence of postoperative vomiting in children undergoing strabismus surgery.

KEY WORDS

Acupuncture: acupressure, ophthalmological. Anaesthesia: paediatric. Complications: nausea, vomiting.

Traditional Chinese medical practice includes the use of acupuncture in the management of a wide range of medical conditions. The first comprehensive textbook on the subject appeared around 200 B.C. [1]. Acupuncture and massage (t'ui-na) are techniques suitable for adult and paediatric practice [2–3]. Stimulation of the P6 (Neikuan or neiguan) wrist point is used for the treatment of nausea and vomiting [2]. Since 1986 there have been several studies in the English language medical literature reporting beneficial antiemetic effects from P6 stimulation in adults using either needling (acupuncture) or pressure (acupressure) [4–11]. The majority of these studies have investigated postoperative nausea and vomiting, but P6 stimulation has also been shown to be an effective antiemetic for symptoms associated with pregnancy [8] and chemotherapy [9, 10]. There have been no reports of P6 stimulation in the paediatric population.

Strabismus surgery in children is associated frequently with postoperative vomiting; without antiemetic therapy the incidence ranges from 52 to 85% [12–15]. Antiemetic drugs given during the perioperative period may be associated with unwanted side effects, including sedation, hypotension and extrapyramidal reactions [16, 17]. As there are no reported adverse reactions to P6 stimulation in the literature [7], we decided to study the efficacy of P6 stimulation as a postoperative antiemetic in children undergoing strabismus surgery. We felt that P6 acupressure, rather than acupuncture, would be more appropriate in children.

PATIENTS AND METHODS

Approval for the study was granted by the local Ethics Committee on Human Research, and informed consent obtained from the parents of all children before participation. We studied 66 children (ASA physical status I or II, ages

I. H. LEWIS*, M.B., B.S., M.R.C.P., F.C.ANAES.; S. J. PRYN, M.B., B.CH., D.C.H., F.C.ANAES.; P. I. REYNOLDS, M.D.; U. A. PANDIT, M.D.; N. C. T. WILTON, M.B., B.S., M.R.C.P., F.C.ANAES.; Section of Paediatric Anesthesiology, University of Michigan, Room C4139, Box 0800, C. S. Mott Children's Hospital, Ann Arbor, Michigan, 48109, U.S.A. Accepted for Publication: February 11, 1991.

*Present address, for correspondence: Shackleton Department of Anaesthetics, Southampton General Hospital, Tremona Road, Southampton, Hants SO9 4XY.

3–12 yr) undergoing outpatient correction of strabismus. Children with anatomical or neurological abnormalities of the upper limbs were excluded from the study.

The P6 antiemetic point is the sixth point on the pericardial meridian; it lies at the wrist between the tendons of palmaris longus and flexor carpii radialis, 2 Chinese body-inches (ts'un) from the distal palmar crease [2]. In our study, bilateral acupressure was applied using "Sea-bands"—elasticated wrist bands available commercially for the prevention of seasickness: a plastic stud on the inner aspect of the band exerts continuous pressure at P6. Children participating in the study were allocated randomly to either an acupressure or a placebo group. The acupressure group wore Sea-bands and the placebo group wore bands without studs. Both types of band appeared identical unless turned inside out. The bands were positioned 1 h before operation by one investigator, and were worn continuously until discharge from hospital the same day. No one else involved in the study was aware of the type of band worn by an individual patient. Anxious or unco-operative children allowed the initial positioning of bands to be performed by their parents.

All children were allowed solids up to 8 h before operation and clear liquids (up to approximately 4 ml kg^{-1}) 3 h before operation. The children were unpremedicated, and the anaesthetic technique for both groups was identical. Induction of anaesthesia was with 1–5% halothane and 66% nitrous oxide and oxygen, administered via a face mask and Mapleson D system. The same agents, including 0.5–1% halothane, were used for maintenance of anaesthesia. Following induction, the trachea was intubated using vecuronium 0.1 mg kg^{-1} i.v. to provide neuromuscular block and the lungs ventilated mechanically to an end-tidal carbon dioxide partial pressure of 4.0–4.7 kPa. During surgery, all patients received morphine 0.1 mg kg^{-1} i.v. for postoperative analgesia and atropine 0.01 mg kg^{-1} i.v. before manipulation of the eye, to prevent reflex bradycardia. At the end of surgery, the stomach was emptied with a suction catheter. Residual neuromuscular block was antagonized with atropine 0.02 mg kg^{-1} and edrophonium 1.0 mg kg^{-1}. All children received lactated Ringer's solution i.v. during the perioperative period. The hourly fluid requirements were calculated from the child's body weight as follows: 4 ml kg^{-1} for children up to 10 kg; an additional 2 ml kg^{-1} for each kilogram above 10 kg, up to 20 kg; and an additional 1 ml kg^{-1} for each kilogram above 20 kg. The total volume given was calculated to provide fluids for a 12-h period.

Standard monitoring was used throughout anaesthesia. Following tracheal extubation, the children were transported to the recovery area. After recovery (based on assessment of airway patency, vital signs and level of consciousness), they were transferred to the outpatient area. Children were discharged from hospital when, in addition to the previous criteria, they were able to ambulate and remained pain free. The ability to tolerate oral fluids was not included in the discharge criteria. Children were given droperidol 0.02 mg kg^{-1} i.v. for vomiting in hospital, at the discretion of the (blinded) anaesthetic staff. Prochlorperazine suppositories 5 mg were administered for treatment of vomiting at home, at the discretion of the parents. Paracetamol suppositories 10 mg kg^{-1} 4-hourly were prescribed for postoperative analgesia. Children did not wear eye patches following surgery. Patient characteristics were recorded by the first investigator when the bands were positioned. A second (blinded) investigator recorded all other perioperative data, including the incidence of postoperative nausea and vomiting in the recovery areas. Retching, defined as active efforts without expulsion of gastric contents, was graded as vomiting. Data after discharge from hospital were obtained by telephone interview within 48 h of surgery.

The sample size of our study was determined by power analysis [18]. Data from previous studies indicated that approximately 66% of the placebo group would vomit after operation [13–16]. We considered that an antiemetic able to reduce the incidence of postoperative vomiting to 33% would be clinically relevant. Thirty-one patients per group were therefore required to detect a 50% difference in the incidence of vomiting between two groups, with a 90% power (probability of a type II error = 0.1) of achieving a statistically significant result at the 5% level (two-tailed). The presentation of data for continuous variables is given as the mean (SD), and were analysed using the unpaired Student's t test. Discrete variables were analysed using the chi-square test with Yates' continuity correction. $P < 0.05$ was considered statistically significant.

TABLE I. *Patient characteristics (mean (range or SD)). No significant differences between the two groups (unpaired t test or chi-square)*

	Placebo ($n = 33$)	Acupressure ($n = 31$)
Age (yr)	5.2 (3–12)	5.8 (3–12)
Weight (kg)	20.9 (8.0)	22.1 (9.2)
Sex (No. (%))		
Male	19 (58)	22 (67)
Female	14 (42)	11 (33)

TABLE III. *Incidence of postoperative vomiting (No. (%)) during the first 24 h after surgery for the two groups of children. No significant differences between the two groups (chi-square)*

	Placebo ($n = 33$)	Acupressure ($n = 31$)	P
Within hospital: 0–2 h	19 (58)	18 (58)	0.84
At home: 2–24 h	24 (73)	22 (71)	0.90
Overall: 0–24 h	27 (82)	29 (94)	0.30

RESULTS

Sixty-six children were entered to the study but, results from two children in the acupressure group were incomplete and they were excluded. There were no significant differences between the two groups in their patient characteristics (table I). The mean duration of anaesthesia and surgery, and the amount of i.v. fluid given in the perioperative period were the same in both groups. The total recovery time, taken from the end of anaesthesia to discharge from hospital, was 85–250 min (overall mean for both groups, 116 min). There was no significant difference between the mean total recovery times for each group. The wrist bands were worn for an average of 237 min, the bands were tolerated well and none had to be removed (table II). The number of eye muscles operated upon ranged from one to four (mode of two) in each group.

There was no significant difference in the incidence of vomiting between the two groups (table III); only eight children (six placebo, two acupressure) of 64 in the study did not vomit in the first 24 h after surgery. The frequency distribution for the number of episodes of vomiting per child in hospital was similar for both groups (fig. 1); no child had more than five episodes of vomiting. Droperidol was administered during recovery to 10 children (six placebo, four acupressure); eight of the 10 vomited at home (five placebo, three acupressure). Only one child in the study (placebo group) complained of nausea without vomiting whilst in hospital; that child vomited later at home. Five children (three placebo, two acupressure) had not taken oral fluids 24 h after surgery. There were no complications in each group, other than vomiting, following discharge. No child remained in hospital, and none required readmission within the period of follow-up.

DISCUSSION

We were unable to demonstrate a reduction in the incidence of postoperative vomiting in children undergoing strabismus surgery using P6 acupressure. This result should be considered in relation to previous studies investigating both vomiting in children following strabismus surgery, and the antiemetic effect of P6 stimulation in adults.

Several factors may have contributed to the high incidence of postoperative vomiting found in this study. These include surgical manipulation of the eye, opioid analgesia and ambulation. Strabismus surgery in children is associated with a high incidence of postoperative vomiting: values of 52% [12], 56% [13], 68% [14] and 85% [15] have been reported. Stretching of the eye muscles and visual sensory disturbance may be important

TABLE II. *Perioperative data (mean (SD)). No significant differences between the two groups (unpaired t test)*

	Placebo ($n = 33$)	Acupressure ($n = 31$)
Duration of surgery (min)	60 (36)	57 (28)
Duration of anaesthesia (min)	96 (33)	97 (29)
Total recovery time (min)	117 (30)	115 (32)
Total time spent wearing bands (min)	244 (64)	230 (46)
Total i.v. fluids (ml)	724 (174)	729 (148)

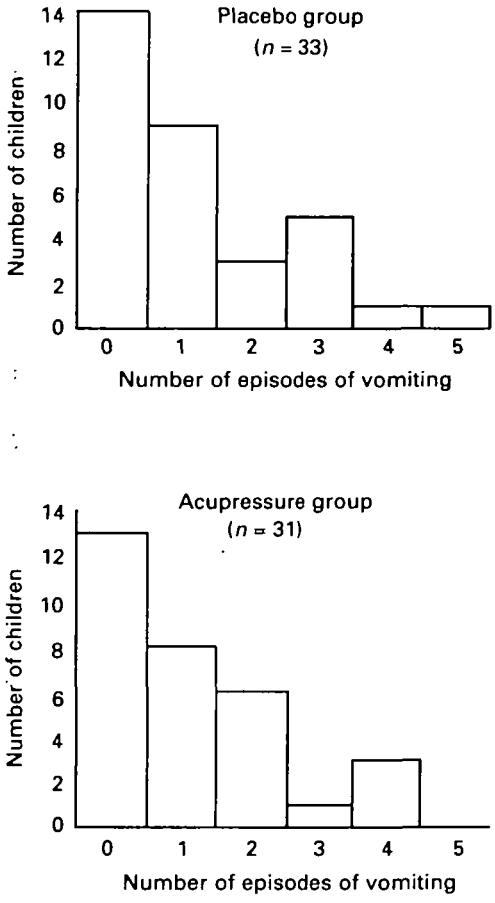

FIG. 1. Frequency distribution for the number of episodes of vomiting per child, before discharge from hospital.

factors in the aetiology of vomiting [12]. Droperidol 0.075 mg kg^{-1}, given before manipulation of the eye [14], is an effective antiemetic in this group of children. Smaller doses (0.05 mg kg^{-1}) appear to be ineffective [13, 15] and larger doses (0.1 mg kg^{-1}) may be associated with extrapyramidal reactions [16]. Postoperative pain in children caused by the operative procedure is common, and may delay recovery from the outpatient unit [17]. Unfortunately, the use of opioid analgesics in paediatric outpatient surgery is associated with a high incidence of vomiting after operation [19]. One study has investigated the effect of opioid analgesics on the incidence of vomiting in children after strabismus surgery: Lerman, Eustis and Smith [14] found that 68% of children using i.m. codeine 1.5 mg kg^{-1} vomited, compared with 60% using rectal paracetamol 10 mg kg^{-1}. This difference was not statistically significant. In the present study, we administered a small dose of morphine (0.1 mg kg^{-1} i.v.) during surgery, for postoperative analgesia.

Early ambulation may have increased the incidence of vomiting in our study, as the average time from the end of anaesthesia to discharge from hospital was 116 min (table II), compared with times of 3.3 h [13], 3.6 h [12] and 6.7 h [14] in three similar studies.

In 1986 Dundee and colleagues [4] reported the results of two consecutive studies using P6 acupuncture as a postoperative antiemetic. The patients were women, premedicated with either meptazinol or nalbuphine, undergoing minor gynaecological surgery of less than 12 min duration. Anaesthesia was induced and maintained with methohexitone, nitrous oxide and oxygen; no volatile agent was used. In patients premedicated with nalbuphine there was a significant reduction in the incidence of postoperative nausea and vomiting following preoperative P6 acupuncture needling, compared with either "dummy" acupuncture (administered at a site remote from P6) or no treatment. In patients premedicated with meptazinol, acupuncture was significantly better than no treatment alone; there was no dummy group in this study. Since this report, there have been several prospective studies of the antiemetic effect of P6 stimulation (both acupuncture and acupressure) reported in the English language medical literature. The majority of these studies have been reported by Dundee's group [4–10]. These authors demonstrated consistently that acupuncture is an effective postoperative antiemetic in women undergoing minor gynaecological surgery and premedicated with opioid analgesics (nalbuphine, meptazinol or pethidine) [4–7]. Dundee and colleagues [9] and Fitzpatrick, Ghaly and Dundee [10] also demonstrated that acupuncture was effective in reducing emetic symptoms in patients undergoing chemotherapy for testicular or breast cancer.

We decided that non-invasive P6 acupressure would be more acceptable than acupuncture in children. There are only three previous reports of the antiemetic effect of P6 acupressure in adults; all demonstrate beneficial results [7, 8, 11]. Dundee and colleagues [8] reported a significant ($P < 0.001$) decrease in emetic symptoms in a group of pregnant women treated with P6 acupressure, compared with two other groups, receiving either dummy acupressure (at a point remote to P6) or no treatment (controls). There was also a

significant ($P < 0.01$) decrease in emetic symptoms in the dummy acupressure group, compared with controls. The authors stated that they were unable to exclude a psychological explanation for their findings. Fry [11] reported the incidence of postoperative nausea or vomiting in two groups of inpatients undergoing various surgical procedures, including ophthalmic surgery (16% of all procedures). Assessment was confined to the recovery period, and there was no information on premedication, anaesthetic technique or drugs given perioperatively. Forty of 250 controls complained of nausea, or vomited, compared with 11 of 250 in the group treated with digital P6 acupressure. This difference was significant ($P < 0.001$). Dundee and colleagues [7] pooled their data on postoperative vomiting from more than 500 women, all premedicated with nalbuphine, undergoing minor gynaecological surgery. There were four groups of patients; each received a different type of P6 stimulation: manual acupuncture needling, electrical stimulation of acupuncture needles, non-invasive electrical stimulation, or acupressure using Sea-bands. All four groups showed significantly less postoperative sickness in the first 1 h after surgery than a control group; only invasive acupuncture remained effective after the first 1 h. Furthermore, the efficacy of these four methods was similar to either cyclizine 50 mg or metoclopramide 10 mg, given with the premedication. In a similar study, Dundee, Milligan and McKay [20] reported that P6 acupuncture was less effective than droperidol 2.5 mg as a postoperative antiemetic.

There are only two studies of P6 stimulation in adults which are comparable to the work of Dundee's group. The study by Fry [11] using acupressure has been discussed earlier. Weightman, Zacharias and Herbison [21] investigated the effect of P6 acupuncture, administered during surgery, in women undergoing elective laparoscopy. The patients were premedicated with oral temazepam, and morphine 0.1 mg kg^{-1} was administered during surgery. Anaesthesia was induced with thiopentone, and maintained with nitrous oxide and isoflurane in oxygen. The trachea was intubated, using vecuronium for neuromuscular block. There were no significant differences in the incidence of postoperative nausea and vomiting in the group of women receiving acupuncture, compared with an untreated group. The authors concluded that acupuncture, as used in their study, was unlikely to be a useful antiemetic for postoperative emesis. Dundee and Ghaly [22] have explained this failure to confirm their results in terms of the timing of acupuncture; to be effective as an antiemetic, acupuncture must be applied before the emetic stimulus.

The majority of studies investigating the effect of P6 stimulation on postoperative emesis have been conducted in women, undergoing minor gynaecological surgery. In this group of patients, both acupuncture and acupressure appear to be as effective as metoclopramide 10 mg and cyclizine 50 mg, but less effective than droperidol 2.5 mg. However, some of these antiemetics may be ineffective after a different surgical procedure or anaesthetic technique. In two separate studies, both acupuncture [21] and metoclopramide 10 mg [23] did not reduce the incidence of postoperative emesis in women undergoing elective laparoscopy. In the latter study, only droperidol 0.01 mg kg^{-1} significantly reduced postoperative emesis [23].

P6 stimulation (acupuncture and acupressure) appears to be a clinically useful, non-toxic antiemetic in certain groups of patients. The factors influencing its effectiveness have not been clearly defined, although gender, age, timing of P6 stimulation, type of surgery or emetic stimulus and anaesthetic technique may all be important. Several different emetic stimuli probably combine to produce a high incidence of postoperative vomiting in children undergoing outpatient surgery for correction of strabismus. In the present study we found P6 acupressure was ineffective as an antiemetic in this group of children.

ACKNOWLEDGEMENT

The authors wish to thank Dr M. A. Schork, Professor of Biostatistics, for statistical advice concerning the study design.

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