

Laser stimulation of acupuncture point P6 reduces postoperative vomiting in children undergoing strabismus surgery

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Summary

We conducted a double-blind, randomized, placebo-controlled study to investigate the effectiveness of P6 acupuncture on postoperative vomiting in children undergoing strabismus surgery. Acupuncture was performed by laser stimulation with a low-level laser. Laser stimulation of P6 was administered 15 min before induction of anaesthesia and 15 min after arriving in the recovery room. In the laser stimulation group, the incidence of vomiting was significantly lower (25%) than that in the placebo group (85%). (*Br. J. Anaesth.* 1998; 81: 529–532).

Keywords: anaesthesia, paediatric; acupuncture; vomiting, incidence; vomiting, nausea, surgical factors; surgery, ophthalmological

Postoperative vomiting is one of the most frequent complications after strabismus surgery in children. The incidence of postoperative vomiting has been reported as 40–88%.^{1–6} Several pharmacological studies have been performed to reduce this high incidence.^{1,2,5,7–11}

A non-pharmacological method for the prevention of postoperative vomiting is stimulation of an acupuncture point called Pericard 6 (P6, Neiguan). Numerous studies have shown that stimulation of P6 with acupuncture reduces postoperative vomiting.^{12–16} However, needle acupuncture and acupressure of P6 appear ineffective in the reduction of postoperative vomiting in children.^{17–20}

In this study, we used laser acupuncture to stimulate P6.^{21–23} A laser beam generated by a low-level laser diode stimulates the acupuncture point. This form of acupuncture is painless and especially suitable in awake children. Our aim was to evaluate the antiemetic effect of laser stimulation of P6 in children undergoing strabismus surgery compared with placebo.

Patients and methods

The study was approved by the Ethics Committee of the University of Innsbruck, Austria and written, informed consent was obtained from the parents of the children. We studied 40 children, ASA I or II, aged 3–12 yr, undergoing strabismus surgery. We excluded those with gastric or intestinal diseases, emesis and vomiting in the previous week, and those who received any medical therapy immediately before surgery.

In this double-blind, prospective study, each child

was allocated randomly to one of two groups. Acupuncture was performed on acupuncture point Pericard 6 (P6). P6 is located at the wrist between the tendons of the palmaris longus and flexor carpi radialis, 2 Cun proximal from the distal palmar crease. One Cun is equivalent to the width of the patient's thumb across the interphalangeal joint. Patients in group A underwent laser stimulation of P6. We used a low-level laser with the following characteristics: diode laser with continuous laser beam; power output 10 mW; wavelength 670 nm laser (Minilaser 2010F, Helbo-Medizintechnik, Gallsbach, Austria). Laser stimulation was performed on each P6 bilaterally over 30 s, 15 min before induction of anaesthesia and 15 min after arriving in the recovery room. In group B, the same low-level laser was held on P6, but the laser beam was not activated. Neither the children nor their parents were able to tell if the laser was active. Both laser and placebo acupuncture were performed by the same investigator.

All patients were allowed solid food or clear fluids up to 6 h before anaesthesia. Oral premedication with midazolam 0.4 mg kg⁻¹ and atropine 0.02 mg kg⁻¹ was given 1 h before transfer to the operating room. For painless placement of an i.v. cannula, each child received 5% EMLA cream (Astra, Austria) on a vein in the left cubita or on the back of the left hand.

Strabismus repair was performed under general anaesthesia. Thiopental 5 mg kg⁻¹, rocuronium 0.6 mg kg⁻¹ and fentanyl 2 µg kg⁻¹ were administered i.v. for induction of anaesthesia. After intubation, anaesthesia was maintained with 2–3% sevoflurane and 66.6% nitrous oxide in oxygen with controlled ventilation. Fluid deficit was replaced by an i.v. mixture of three parts Ringer's lactate solution and two parts 5% dextrose. Residual neuromuscular block was antagonized with prostigmine 0.05 mg kg⁻¹ and atropine 0.025 mg kg⁻¹. Immediately after arrival in the recovery room, all patients received paracetamol suppositories 10 mg kg⁻¹ for postoperative analgesia. The second laser stimulation was performed 15 min after arrival in the recovery room. After the children were awake and had stable vital functions, they were transferred to their rooms. Dimenhydrinate suppositories 50 mg were given as rescue antiemetic.

The incidence of vomiting was recorded by the nursing staff in the recovery room and on the ward over 24 h.

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Table 1 Patient characteristics (mean (SD) or number) in the two groups

	Laser acupuncture (n=20)	Placebo acupuncture (n=20)
Age (yr)	5.9 (1.8)	6.3 (1.9)
Sex (M/F)	9/11	10/10
Weight (kg)	21.5 (8.46)	24.1 (7.5)
Anaesthesia duration (min)	72.6 (18.2)	66.42 (18.0)
Surgery duration (min)	54.15 (17.3)	46.7 (12.9)
No. of muscles repaired, right side	1.82 (0.52)	1.92 (0.73)
No. of muscles repaired, left side	1.78 (0.58)	1.53 (0.51)

Table 2 Incidence of postoperative vomiting (number (%)) in the two groups. $P=0.0001$ between groups

Group	Vomiting	Non-Vomiting
Laser acupuncture (n=20)	5 (25%)	15 (75%)
Placebo acupuncture (n=20)	17 (85%)	3 (15%)

Table 3 Appearance of first episode of vomiting after surgery (number (%)) in the two groups

Group	0–2 h	0–6 h	0–12 h	12–24 h
Laser acupuncture (n=20)	0 (0%)	3 (15%)	4 (20%)	1 (5%)
Placebo acupuncture (n=20)	6 (30%)	13 (65%)	14 (70%)	3 (15%)

The number of patients required was determined by power analysis. We assumed that the incidence of vomiting would be 70% in the control group and 30% in the acupuncture group. $P<0.05$ was regarded as statistically significant. Statistical analysis was performed using SPSS 6.1 (SPSS Inc.). Fisher's exact test was used to determine the incidence of vomiting, and the unpaired t test to analyse patient data.

Results

There were no significant differences between the groups in age, sex distribution, ASA status, weight, height, duration of anaesthesia, duration of surgery or number of repaired muscles (table 1). Because of difficult placement of the i.v. cannula in two awake children, general anaesthesia was induced with sevoflurane administered by mask (one child in each group).

Compared with the placebo group, the incidence of vomiting was significantly lower in the acupuncture group ($P=0.0001$). In the first 24 h after surgery, vomiting occurred in five (25%; 95% confidence interval (CI) 8.56–49.10%) of 20 patients in the laser acupuncture group and in 17 (85%; 95% CI 62.11–96.79%) of 20 children in the placebo group (table 2).

In the laser acupuncture group, no patient vomited in the first 2 h after surgery. In the same interval, vomiting occurred in six children in the placebo group. Within the first 6 h, three (15%) children in the laser acupuncture group and 13 (65%) in the placebo group vomited. During 0–12 h after surgery, the incidence of vomiting in children who had received laser acupuncture (20%) differed from those who had placebo acupuncture (70%). In the acupuncture group one child, and in the placebo group three children, vomited for the first time 12–24 h after surgery (table 3).

Two children who received laser acupuncture and 14 children in the placebo group required antiemetic rescue therapy.

Discussion

Using laser stimulation of acupuncture point P6, we have demonstrated a significant reduction in postoperative vomiting in children undergoing strabismus surgery. These results do not correspond with previous studies in paediatric patients, in whom needle acupuncture, acupressure or transcutaneous electrical stimulation of P6 was performed to reduce postoperative vomiting.^{17–20}

Acupuncture of P6 in adult patients has been shown to reduce the incidence of postoperative vomiting.^{13 24–26} Most of these studies were conducted in gynaecological patients and in all, acupuncture was carried out before induction of anaesthesia. Timing of acupuncture seems to be important for the effectiveness of P6^{27 28}; it seems important that stimulation is performed before induction of anaesthesia. Dundee and Milligan²⁸ showed no antiemetic effect of P6 when opioids were administered before acupuncture. Weightman, Zacharias and Herbison were unable to demonstrate an antiemetic effect when acupuncture was performed during general anaesthesia²⁹.

Yentis and Bissonnette¹⁸ performed acupuncture over 5 min on P6 in anaesthetized children immediately before starting surgery. In this study, the investigators found no difference in the incidence of postoperative vomiting after droperidol (41%), acupuncture (43%) and acupuncture–droperidol (34%). Because there was no placebo group, Yentis and Bissonnette¹⁸ have shown only that acupuncture and the combination of acupuncture and droperidol did not decrease the incidence of postoperative vomiting compared with droperidol alone. This seems important because other investigations using droperidol showed a reduction in postoperative vomiting in children undergoing strabismus surgery.^{1 10 30}

Schwager, Baines and Meyer used transcutaneous electrical stimulation of P6 to prevent postoperative vomiting in children undergoing circumcision and orchidopexy surgery.¹⁹ This method is non-invasive, but they stimulated P6 in anaesthetized patients. The

reason why electrical stimulation did not prevent postoperative vomiting could be the same as in all other studies in which acupuncture of P6 was performed after induction of anaesthesia. Additionally, transcutaneous electrical stimulation is shorter acting and less effective than needle acupuncture.^{26 31}

Compared with needle acupuncture, acupressure allows painless stimulation of P6^{24 25 32 33} and is therefore useful in children. However, this method has failed in paediatric patients undergoing strabismus surgery.²⁰ It may be that stimulation of P6 with acupressure alone was insignificant to prevent postoperative vomiting in children after strabismus surgery.³⁴ Previous studies with acupressure in adult patients have also shown that acupressure reduced nausea but not vomiting.³²

If the prevention of postoperative vomiting by stimulation of P6 requires awake patients in order to be effective, needle acupuncture is unsuitable in paediatric patients. In contrast with invasive needling, laser stimulation of acupuncture points allows painless acupuncture. Our results showed that painless laser acupuncture reduced postoperative vomiting in paediatric patients undergoing strabismus surgery, primarily in the early postoperative period.

In contrast with previous studies, we performed laser stimulation of P6 before induction of anaesthesia and in the recovery room. Each acupuncture point was stimulated for 30 s. The first stimulation of P6 was conducted 15 min before induction of anaesthesia and the second 15 min after surgery. This may account for the good antiemetic effect. Most of the recent studies showed an antiemetic effect of P6 when acupuncture was performed only once, immediately before induction of anaesthesia.^{12 13 26} Ho and colleagues demonstrated a significant reduction in postoperative vomiting in adult patients when postoperative electroacupuncture was performed.³⁵ Yang and co-workers also found an antiemetic effect when a 50% glucose solution was injected after operation into P6.³⁶ Whether single laser stimulation of P6 is also sufficient to reduce postoperative vomiting after strabismus surgery in paediatric patients should be examined in further studies.

The antiemetic effects of P6 stimulation by a low-level laser were similar to those reported in studies which investigated the effects of antiemetic agents in children undergoing strabismus surgery.^{1 2 7 10 30 37–42} Therapy with drugs such as ondansetron, droperidol and metoclopramide, however, is often associated with side effects.^{43–46} In comparison, stimulation of P6 with a low-level laser has no known side effects. However, it must be remembered that direct laser irradiation of the retina should be avoided by laser-protection glasses and correct handling.

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