

Acupressure and prevention of nausea and vomiting during and after spinal anaesthesia for Caesarean section

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The efficacy of acupressure at the P6 point in the prevention of nausea and vomiting during and after Caesarean section was studied. A double-blind, randomized controlled study of acupressure vs placebo was designed. Ninety-four patients scheduled for Caesarean section were included. The anaesthetic technique and postoperative analgesia were standardized. The use of acupressure reduced the incidence of nausea or vomiting from 53% to 23% compared with placebo (95% confidence interval (CI) 0.34–0.25; $P=0.002$) during the operation and from 66% to 36% compared with placebo (95% CI 0.34–0.19; $P=0.003$) after the operation. Other variables were similar between the groups.

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Most mothers request and receive regional anaesthesia for Caesarean section. Nausea and vomiting are important side effects both during and after Caesarean section under spinal anaesthesia. They may distress the patient and decrease overall satisfaction with pain relief. Rowbotham, in his review of the management of postoperative nausea and vomiting (PONV), concluded that the efficacy of currently available anti-emetics remains poor.¹ Routine use of anti-emetic drugs in patients during Caesarean section is not recommended by many because of adverse effects.

Many factors influence nausea and vomiting both during and after Caesarean section, and these must be carefully controlled when studying PONV.² The aetiology of emetic symptoms during and after operations tends to differ. Caesarean section under spinal anaesthesia is associated with maternal nausea in up to 80% of patients not pre-medicated with a pharmacological anti-emetic.³ There is also a high incidence (56%) of postoperative nausea and vomiting in this setting.⁴

Acupressure, a non-invasive variation of acupuncture, has been reported as a potential non-pharmacological method of preventing nausea and vomiting. In acupressure, manual stimulation is applied, whereas in acupuncture the skin is pierced with a needle. Studies have shown that acupressure can decrease the nausea due to morning sickness,⁵ general anaesthesia,⁶ chemotherapy⁷ and motion sickness.⁸ Other studies of this technique which had unfavourable results include those by Yentis and Bissonnette⁹ and Lewis and colleagues.¹⁰

Acupressure has been shown to be effective in the prevention of nausea and vomiting during spinal anaesthesia for Caesarean section, including intrathecal fentanyl.¹¹ This study, by Stein and colleagues, is limited, as nausea and vomiting were recorded only during operations. Efficacy after spinal anaesthesia was not studied. Factors predisposing to nausea and vomiting during spinal anaesthesia for Caesarean section differ from those after operation.

Intrathecal fentanyl for postoperative analgesia is limited by its short duration of action with single bolus administration.¹² Spinal anaesthesia including intrathecal morphine provides prolonged and effective analgesia after operations.¹³ We therefore investigated the effect of acupressure on nausea and vomiting during and after operations in patients undergoing Caesarean section under bupivacaine/morphine spinal anaesthesia.

Methods

A prospective, randomized, double-blind study was designed and approval was obtained from the hospital's ethics and research committee. Written informed consent was obtained from all patients. The study was designed with a power of 0.9, to detect a 30% difference in the incidence of nausea and vomiting, with a significance level of 0.05. This required the recruitment of 94 patients.

Patients, ASA I, aged between 18 and 40 yr scheduled for elective Caesarean section were recruited. Those with a previous history of PONV or nausea and vomiting in the

preceding 24 h, obesity (BMI >35), diabetes mellitus or previous experience of acupuncture or acupressure were excluded from this study. Minor side-effects such as swelling and discomfort¹⁴ have been reported with the use of acupressure bands. We used pulse oximetry¹¹ to demonstrate digital blood flow before the study. A single size elasticated acupressure band was used. To prevent minor complications, BMI >35 was used as an exclusion criterion. Patients with type 1 or type 2 diabetes mellitus are predisposed to delayed gastric emptying.¹⁵ There is no evidence that gestational diabetes with good glycaemic control is associated with delayed gastric emptying and this group of mothers was considered for inclusion.

Patients were randomly allocated to one of two groups to receive either acupressure or control. Anaesthesia was administered by different anaesthetists using a standardized technique. All patients received ranitidine 150 mg p.o. 12 h and 2 h before the operation. Patients were given 0.3 M sodium citrate 30 ml orally in theatre. Five minutes before administration of spinal anaesthesia, acupressure bands (Sea band UK Ltd, Leicestershire, UK) were placed, in both groups, on the right forearm¹⁷ by an anaesthetist not directly involved in patient care. This type of acupressure band has a flexible strap with a spherical plastic bead attached to it. In the acupressure group, wrist bands were placed with the plastic bead at the P6 point. The treatment point P6 ('Nei-Guan') is the number 6 meridian point in the pericardium channel; it is located on the anterior surface of the forearm between the tendons of flexor carpi radialis and palmaris longus, 2 'cun' (a cun is a Chinese measurement equal to the width of the interphalangeal joint of the thumb) from the distal wrist crease.¹⁶ In the control group, a point on the dorsal side of the right forearm, 2 'cun' proximal to the distal wrist crease, was used for placebo stimulation. Bands were not visible to the assessing anaesthetist during operations, as patients' arms were covered with surgical drapes. Before assessment, 6 h after discharge to the ward, bands were removed by nursing staff.

After placement of standard monitors (automated arterial pressure, electrocardiogram and pulse oximetry), patients received oxygen by face mask 5 litres min⁻¹. One litre of lactated Ringer's solution was administered i.v., to which 30 mg of ephedrine hydrochloride was added to prevent maternal hypotension.¹⁸ Thereafter, ephedrine-free lactated Ringer's solution was used. Subarachnoid puncture was performed with a 25 gauge Whitacre needle, with patients in the sitting position. A midline approach at the L2–3 or L3–4 interspace was used. Patients received 2.4 or 2.6 ml of 0.5% hyperbaric bupivacaine depending on their height (2.4 ml for those <152 cm and 2.6 ml for those >152 cm). Preservative-free morphine 0.2 mg was added to the bupivacaine. Patients were then placed in the supine position with left uterine displacement.

Non-invasive arterial pressure measurements were taken every 3 min until the patient left the theatre. A decrease in systolic arterial pressure (>20% from baseline or

<100 mm Hg) was treated with i.v. ephedrine 3–6 mg increments. After delivery, oxytocin 10 IU i.v. and augmentin 1.2 g i.v. were administered. Estimated fluid deficit and maintenance were replaced with crystalloid solution. The criterion for supplemental analgesia was pain associated with surgical manipulation.¹³ Fentanyl i.v. 1 µg kg⁻¹ was given as required.

Patients were questioned every 5 min concerning nausea. On a visual analogue scale of 0–10 a score of >2 was considered to indicate nausea. Anti-emetic (ondansetron 4 mg i.v. during operations¹⁹ or cyclizine 50 mg i.m. 8 hourly after operations) was given if nausea or vomiting was intolerable.

The postoperative analgesia regimen was standardized. Rectal diclofenac 100 mg was given with prior consent at the end of the surgery. Morphine sulphate 0.1 mg kg⁻¹ i.m. 4 hourly after 12 h was prescribed, as were diclofenac 100 mg 18 hourly p.r. and codeine 30 mg/paracetamol 500 mg 6 hourly. Chlorpheniramine 4 mg orally was available for symptomatic pruritis.

After 6 and 24 h, an anaesthetist blinded to the therapy noted whether nausea, retching or vomiting had occurred. The results were scored in a manner similar to that of Allen and colleagues²⁰ as (i) none, (ii) nausea or (iii) retching, vomiting or both. If a patient experienced both nausea and vomiting, they were listed as having vomited. Bands were removed 6 h after discharge to the ward, to avoid any possible local discomfort. Patients' charts were assessed at the end of 24 h for anti-emetic and analgesic requirements.

The physical characteristics of the two groups were assessed using the unpaired Student *t*-test. The groups were compared for overall nausea, retching and vomiting and then separately for nausea and vomiting during and after operations. Initially, Pearson's chi-squared test was used to investigate the association between nausea and vomiting in the acupressure and control groups. Then the odds ratio for acupressure and control of nausea and vomiting was estimated using a logistic regression model controlled for hypotension and age >33 yr during operations and in the 0–6 h and 6–24 h after operations. Non-parametric data were assessed using the rank sum sign test.

Results

Ninety-four patients participated in the study (47 in each group). Four patients were excluded because their BMI was >35 and two because of previous acupressure experience. The groups were comparable with respect to age, weight, height and bupivacaine dose (Table 1). The patients' obstetric and anaesthetic histories are shown in Table 2.

All patients received 1500–2000 ml crystalloid solution, and T4–5 block was achieved in all. The incidence of hypotension was similar in the two groups: 18 (38.3%) in the study group and 20 (42.5%) in the control group ($P=0.67$).

Eleven (23%) patients in the acupressure group and 25

Table 1 Patient characteristics and anaesthetic details (mean (SD or range)), using the unpaired *t*-test to calculate *P* values

	Acupressure (<i>n</i> = 47)	Control (<i>n</i> = 47)	<i>P</i> value
Age (yr)	30 (18–38)	32 (19–40)	0.25
Weight (kg)	78 (12)	77 (11)	0.33
Height (cm)	163 (6)	160 (7)	0.27
Bupivacaine dose (ml)	2.51 (0.1)	2.55 (0.09)	0.15
Time wearing band on ward (h)	6.1 (6.0–6.3)	6.1 (6.0–6.3)	0.29

Table 2 Obstetric and anaesthetic history of patients (data are presented as number of patients and percentage of study group (SD))

	Acupressure (<i>n</i> = 47)	Control (<i>n</i> = 47)
Primiparous	30 (64%)	32 (68%)
Multiparous	17 (36%)	15 (32%)
Weeks' gestation	38.6 (1.4)	38.9 (1.4)
Previous Caesarian section	6 (13%)	8 (17%)
General anaesthesia	2 (4.3%)	1 (2%)
Regional anaesthesia	4 (8.5%)	7 (15%)

Table 3 Incidence (%) of nausea and vomiting, nausea only or vomiting, during and after operations

Period	Acupressure (<i>n</i> = 47)	Control (<i>n</i> = 47)	<i>P</i> value
During operations	11 (23.4)	25 (53.2)	0.002
Nausea only	7 (14.9)	17 (36.2)	0.018
Vomiting	4 (8.5)	8 (17)	0.21
0–24 h after operations	17 (36.2)	31 (66)	0.003
Nausea only	4 (8.5)	6 (12.7)	0.50
Vomiting	13 (27.7)	25 (53.2)	0.011
0–6 h	16 (34)	29 (62)	0.007
6–24 h	3 (6)	10 (14)	0.03

Table 4 Opioid and anti-emetic requirements during and after operations; values are mean (range) (the rank sum sign test was used to assess statistical significance)

	Acupressure (<i>n</i> = 47)	Control (<i>n</i> = 47)	<i>P</i> value
During operations			
Fentanyl µg	12.7 (0–100)	10.8 (0–100)	0.87
Ondansetron mg	0.08 (0–4)	0.5 (0–4)	0.002
0–24 h after operation			
Morphine mg	0.85 (0–10)	1.0 (0–10)	0.86
Cyclizine mg	13.0 (0–50)	25.0 (0–100)	0.002

(53%) in the control group had nausea or vomiting during Caesarean section ($P=0.002$). Twenty-four hours after the operation 17 (36%) in the acupressure group and 31 (66%) in the control group had nausea or vomiting ($P=0.003$). There was a statistically significant reduction in nausea only ($P=0.018$) during operations in the acupressure group compared with control. After operations there was a statistically significant reduction in vomiting ($P=0.011$) in the acupressure group (Table 3).

Opioid requirements during and after operations were similar (Table 4). Twenty-three patients (50%) in the control group and 12 (25%) in the acupressure group required

Table 5 Odds ratio and 95% confidence interval of efficacy of acupressure in preventing nausea/vomiting (N/V) after adjustment for hypotension and age >33 yr; odds ratios were derived from a logistic regression model

Variable	Odds ratio	95% CI	<i>P</i> value
N/V during Caesarian section	0.3	0.09–0.9	0.03
Hypotension	7.7	2.3–28.2	0.001
Age >33 yr	2.8	0.8–10.1	0.08
N/V 1–6 h	0.3	0.11–0.74	0.01
Hypotension	0.9	0.33–2.84	0.97
Age >33 yr	0.9	0.35–2.38	0.88
N/V 6–24 h	0.1	0.02–0.53	0.007
Hypotension	1.2	0.06–2.10	0.31
Age >33 yr	0.6	0.13–2.29	0.47

rescue anti-emetic in the study period (one or more dose) ($P=0.01$). There was a statistically significant difference in anti-emetic requirement during and after operations (Table 4).

If patients who received an anti-emetic intra-operatively were excluded, the protective effect of acupressure remained. The use of acupressure reduced the incidence of nausea and vomiting from 87% (35/40) to 50% (23/46) compared with placebo (95% CI 0.37–0.18, $P=0.0002$). With this analysis, the use of acupressure reduced anti-emetic requirement from 47% (19/40) to 26% (12/46) compared with placebo (95% CI 0.21–0.20, $P=0.03$).

The multiple variable analysis of data is presented in Table 5. Hypotension and age >33 yr was associated with increased risk of nausea or vomiting during Caesarean section but not at 6 and 24 h after operations. The odds ratio of nausea or vomiting during Caesarean section was about 30% in the acupressure group compared with control (adjusted for hypotension and age). This reduction was also evident during the 0–6 and 6–24 h periods.

Discussion

The mechanism of action of acupressure is still not known. Peripheral nerve stimulation must be an integral part of the mechanism as acupressure is not clinically effective if the nerve supply is disrupted.²¹ Acupuncture has been shown to enhance gastric motility.²² Treatment of vection-induced motion sickness by reducing gastric tachyarrhythmia has been demonstrated.²³

Most published studies indicate the efficacy of acupressure or acupuncture at the P6 meridian. Belloumini and colleagues,⁵ Fan and colleagues⁶ and Dundee and colleagues⁷ found this technique to be effective. In studies that have not had favourable results,^{9,10} the technique was applied after the induction of anaesthesia. Acupuncture has been shown to be effective by Al-Sadi and colleagues²⁴ after induction of anaesthesia but before opioid administration.²⁴

Difficulties in acupuncture and acupressure research have been highlighted.^{25–27} The question of what is an optimal control for acupuncture or acupressure has not been resolved. Acupuncture techniques raise expectations and

involve a sensation; to facilitate blinding, control acupuncture should be indistinguishable from real acupuncture. It has been agreed that control acupuncture itself may have a specific effect.²⁸ This is particularly true with respect to analgesia research where location of the point is less important than in studies of nausea and vomiting studies.²⁹ Lewith and Vincent³⁰ have described sham acupuncture as a valid control in nausea and vomiting studies.

The incidence of nausea and vomiting in the control group during Caesarean section (53%) agrees with that reported elsewhere.¹³ The incidence of nausea and vomiting in the control group in the first 24 h after operations (66%) differs from that of Abouleish and colleagues,¹³ probably reflecting the small number of patients in their study. Our results do agree with results by Milner and colleagues,⁴ with a higher incidence (66% vs 56%) resulting in part from our active questioning of patients' emetic symptoms and more frequent assessment.

We have demonstrated the effectiveness of P6 acupressure in reducing nausea and vomiting. The use of acupressure reduced the incidence of nausea and vomiting from 53% to 23% compared with placebo (95% CI 0.34–0.25; $P=0.002$) during operations and from 66% to 36% compared with placebo (95% CI 0.34–0.19; $P=0.003$) after operations. Significantly less anti-emetic was required by those in the treatment group ($P=0.01$).

Bands were removed 6 h after discharge to ward, but their effectiveness persisted in the 6–24 h interval, at a reduced level (odds ratio 0.1). There was a statistically significant reduction in the acupressure group, compared with controls, in nausea only ($P=0.018$) during operations and in vomiting ($P=0.011$) after operations. Nausea alone was the predominant symptom during operations and vomiting after operations.

From previous studies we know that nausea and vomiting follow a particular pattern in this setting, with nausea occurring early and vomiting later.³¹ It is thought that this results from widespread dispersion of morphine throughout the subarachnoid and ventricular cerebrospinal fluid.

Routine use of anti-emetic drugs in patients during Caesarean section is not recommended by many because of adverse effects. Metoclopramide, which has been shown to have no deleterious effects on the neonate,³ is most commonly used, but it is associated with extrapyramidal symptoms³² and peripartum supraventricular tachycardias.³³ In our study, the only side effect of acupressure bands was some localized discomfort in a small number of women.

In conclusion, the non-pharmacological technique of acupressure at the P6 point is effective in preventing nausea and vomiting both during and after Caesarean section under spinal anaesthesia. Acupressure has no major side effects and is easy to apply and economical. Efficacy of acupressure before anaesthesia in combination with prophylactic anti-emetic drugs given after delivery is currently being examined.

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