

# Effects of Electroacupuncture on Intraoperative and Postoperative Analgesic Requirement

Chin-Keng Sim, Pei-Chang Xu, Hwee-Leng Pua, Guojing Zhang, Tat-Leang Lee

Chin-Keng Sim  
anaesthetist

Pei-Chang Xu  
acupuncturist

Hwee-Leng Pua  
anaesthetist

Guojing Zhang  
research fellow

Tat-Leang Lee  
professor  
Department of  
Anaesthesia,  
National University  
Hospital  
Singapore

Correspondence:  
Tat-Leang Lee

analeetl@nus.edu.sg

## Summary

Acupuncture has been shown to be effective in experimental and clinical acute pain settings. This study aims to evaluate the effect of preoperative electroacupuncture (EA) on intraoperative and postoperative analgesic (alfentanil and morphine) requirement in patients scheduled for gynaecologic lower abdominal surgery. Ninety patients were randomly assigned to one of three groups: Group I (control group) – received placebo EA for 45 minutes before induction of general anaesthesia (GA); Group II – preoperative EA instituted 45 minutes before induction of GA; Group III – 45 minutes of postoperative EA. The Bispectral Index monitor was used intraoperatively to monitor the hypnotic effect of anaesthetic drugs, and alfentanil was titrated to maintain the blood pressure and pulse rate within  $\pm 15\%$  of basal values. Postoperative pain was managed by intravenous morphine via a patient-controlled analgesia (PCA) device. Patients in Group II ( $0.44 \pm 0.15 \mu\text{g}/\text{kg}/\text{min}$ ) received less alfentanil than those in Group III ( $0.58 \pm 0.22 \mu\text{g}/\text{kg}/\text{min}$ ) ( $p=0.024$ ), but not significantly less than those in Group I ( $0.51 \pm 0.21 \mu\text{g}/\text{kg}/\text{min}$ ) ( $p=0.472$ ). Postoperative morphine consumption was numerically lower in Group II compared with the other groups; however, the difference was statistically significant only during the period of 6-12 hours between Group II [ $0.03$  ( $0.05$ )  $\text{mg}/\text{kg}$ ] and Group I [ $0.10$  ( $0.11$ )  $\text{mg}/\text{kg}$ ] ( $p=0.015$ ), and Group II and Group III [ $0.08$  ( $0.10$ )  $\text{mg}/\text{kg}$ ] ( $p=0.010$ ). The 24-hour cumulative morphine consumption for Group II ( $0.52 \pm 0.19 \text{mg}/\text{kg}$ ) was less than that for either Group I ( $0.68 \pm 0.38 \text{mg}/\text{kg}$ ) or Group III ( $0.58 \pm 0.27 \text{mg}/\text{kg}$ ), but the difference did not reach significance. In conclusion, preoperative EA leads to a reduced intraoperative alfentanil consumption, though this effect may not be specific, and has a morphine sparing effect during the early postoperative period.

## Keywords

*Electroacupuncture, abdominal surgery, opioid usage, Bispectral Index Monitor, postoperative pain.*

## Introduction

Acupuncture is a component of the health care system of China that can be traced back for at least 2500 years. It has been widely used to provide analgesia during surgery in China since the 1950s. However, when used alone, acupuncture often does not suppress acute surgical pain completely. In addition, acupuncture does not provide adequate skeletal muscle relaxation and is also unable to suppress the autonomic reflexes elicited by traction on the intraabdominal viscera, thus making the technique unsuitable for intraabdominal surgical procedures. A Consensus Development Conference held by the United States National Institutes of Health in November 1997 concluded that there is good evidence that

acupuncture treatment is effective for acute dental pain and postoperative nausea and vomiting,<sup>1</sup> therefore acupuncture may be a useful adjunct to conventional balanced general anaesthesia techniques. This study was designed to evaluate the effect of preoperative electroacupuncture (EA) on intraoperative and postoperative analgesic requirement in patients scheduled for total abdominal hysterectomy with or without bilateral salpingo-oophorectomy.

General anaesthesia is the state in which, as a result of drug-induced narcosis, the patient neither perceives nor recalls noxious stimuli. Analgesia, muscle relaxation, and suppression of autonomic activity are important components and desirable supplements to the state of anaesthesia. As all

patients received a non-depolarising muscle relaxant as part of the balanced general anaesthesia technique, in order to assess the 'analgesic' effect of acupuncture while the patient was under general anaesthesia, a reliable monitor is required to indicate whether the patient is receiving adequate anaesthesia and/or analgesia.

The Bispectral index (BIS) (ASPECT medical system, A-1050, Natick, USA) is a processed parameter derived from multiple features generated by bispectral analysis of the EEG. Through clinical trials, features of the bispectral analysis that were predictive of response to stimuli under the effects of a variety of anaesthetic agents were identified. These features were combined to a multivariate index using discriminant analysis.<sup>2</sup> The BIS index measures the hypnotic component of the anaesthetic and is a useful adjunct to predict loss of consciousness and lack of recall during surgery. It is a dimensionless number that varies from 0 to 100. The monitor assigns the BIS number based on a database of prior recordings and the expert opinion of the anaesthesiologist during those recordings regarding the anaesthetic depth of the patient. In the awake state, the BIS is close to 100 and the number decreases with increasing sedation and hypnosis. A BIS value of <60 is often regarded as the criterion for adequate anaesthesia, whereas a value of more than 70 is frequently seen during awakening.<sup>3</sup>

### Methods

After obtaining Ethics Committee's approval and written informed consent, 90 female patients were recruited, American Society of Anaesthesiologists physical status (ASA) I or II, who underwent the above-mentioned elective surgery under balanced general anaesthesia that lasted for more than one hour. Exclusion criteria included: previous history of acupuncture, ASA physical status > II, patients below 18 years or above 75 years, having a body mass index greater than 30, and those patients who were on  $\beta$ -blockers, had a psychiatric history or who had received opioids in the preceding month.

The patients were randomised by the use of a table of random numbers to one of three groups.

Group I – Control group – received placebo EA for 45 minutes before induction of general anaesthesia (GA)

Group II – Preoperative EA (45 minutes of EA before induction of GA)

Group III – Postoperative EA (45 minutes of EA on arrival to the recovery area, patient extubated and awake).

Patients in Group I and II were blinded to the types of acupuncture administered. All patients received a standard balanced GA technique with endotracheal intubation. All patients received midazolam 7.5 mg an hour before arrival at the anaesthesia induction room. Thiopentone sodium 4-5mg/kg was used for induction; atracurium infusion was used to provide adequate muscle relaxation; alfentanil infusion was used to provide intraoperative analgesia, additional boluses of alfentanil were administered intermittently to suppress hypertension and tachycardia initiated by noxious surgical stimuli. Isoflurane was titrated to achieve an adequate level of anaesthesia (BIS index=45-55). All patients received intravenous morphine for postoperative pain management via a patient-controlled analgesia device (Graseby 9300, Watford, UK).

### Protocol for Alfentanil Administration

All patients received an intravenous dose of alfentanil (10 $\mu$ g/kg) one minute before endotracheal intubation, following which a continuous infusion of alfentanil was started at a rate of 10 $\mu$ g/kg/hr and continued till closure of the muscle layer of the abdomen. Additional intermittent doses of alfentanil (2 $\mu$ g/kg) were administered if the systolic blood pressure (SBP) and/or heart rate (HR) had increased by more than 15% above baseline reading. If the SBP and/or HR remained elevated (i.e. more than 15% above baseline) in spite of two consecutive boluses of alfentanil (2 $\mu$ g/kg), the baseline infusion of alfentanil was increased at an increment of 5 $\mu$ g/kg/hr. The above-mentioned regime was repeated till the SBP and HR returned to basal value  $\pm$  15%. Conversely, the infusion rate was reduced by 5 $\mu$ g/kg/hr each time the SBP and/or HR decreased by 15% less than the basal values. The average SBP and HR recorded at 10 minutes interval over 30 minutes, while waiting in the anaesthetic induction room before acupuncture or surgery, were taken as the baseline readings.

*Postoperative Analgesia*

Intravenous morphine (0.1mg/kg) was given as a bolus dose to all patients immediately after the termination of alfentanil infusion, followed by i.v. 4mg of ondansetron. Patients' pain was managed in the recovery room by intermittent i.v. morphine 1-2mg every 5 minutes until the pain intensity became tolerable (i.e. VAS  $\leq 3$ ), after which the patients used the PCA device to titrate the morphine administration to meet individual analgesic needs. The device was programmed to deliver 1 mg of morphine i.v. with a lock out time of five minutes.

*Electroacupuncture (EA)*

The acupuncture points selected were adopted from Chinese acupuncture literatures and the recommendations of an acupuncturist with 18 years of clinical and research experience (Xu PC), who also administered the acupuncture and placebo acupuncture procedure. Disposable acupuncture needles (0.25 mm diameter) were inserted by tapping through a plastic needle tube at acupoints ST36 and PC6 bilaterally and subcutaneously along the skin incision. The needles were inserted to a depth of 3-4cm and 0.5-1cm at acupoints ST36 and PC6 respectively. Electrical stimulation was delivered via a battery-operated stimulator (model WQ1002K, AERON optoelectronic technology corp., Beijing, PRC). The frequencies employed were 2Hz at ST36 and PC6, and 100Hz at the skin incision.

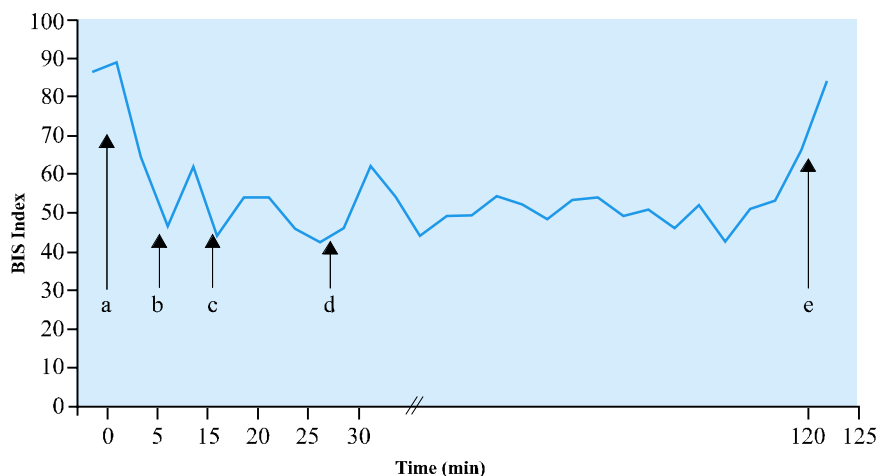
*Placebo Acupuncture*

The placebo acupuncture was carried out as described by Lao and colleagues<sup>4</sup> with slight modification. The patients were shown the acupuncture needle with a plastic needle tube before the procedure. It was carried out by tapping a plastic needle tube on the bony area next to each of the acupuncture points to produce some discernible sensation. The acupuncture needle was then taped to the skin (without skin penetration) with non-transparent adhesive tape. The patients were lying supine and were instructed to close their eyes and concentrate on their breathing during the procedure. Electrodes from a mock electrical stimulator were attached to the needles. The indicator light on the mock unit blinked but no electrical current was applied. The patients were told that they may or may not feel electrical current because of its very high frequency.

*Bispectral Index (BIS) and isoflurane*

Isoflurane was titrated to attain a BIS value of 45-55 for all patients, any increase in autonomic responses (i.e. hypertension and/or tachycardia) will be considered as indication of inadequate analgesia. Boluses of alfentanil (in addition to a background infusion of alfentanil) will be used to suppress the autonomic responses to noxious stimuli. A representative tracing of changes of the BIS index over time during surgery and anaesthesia is shown in figure 1.

**Figure 1 This graph shows the changes of BIS index over time in one patient.**



The time points correspond to:

a – induction of general anaesthesia, b – laryngoscopy and intubation,  
c – skin incision, d – application of abdominal retractor, e – reversal of anaesthesia.

Table 1 Demographic and perioperative data.

	Group I (n = 30)	Group II (n = 30)	Group III (n = 30)	p-value
Age (year)	47 ± 6	46 ± 5	45 ± 4	0.67
Weight (kg)	59 ± 9	60 ± 10	57 ± 9	0.58
Race (C : M : I)*	22:3:5	23:4:3	24:3:3	0.91
Types of incision : (Pfannenstiel : midline)	24:6	23:7	21:9	0.66
Expired concentration of isoflurane (%)	0.6 ± 0.1	0.6 ± 0.1	0.6 ± 0.2	0.12
Duration of surgery (minute)	111 ± 27	97 ± 26	102 ± 29	0.57
Duration of recovery room stay (minute)	86 ± 23	80 ± 36	83 ± 24	0.73

\*C: Chinese, M: Malay, I: Indian

### Outcomes

The total intraoperative usage of alfentanil was compared among the three groups to reflect the analgesic component contributed by acupuncture. The amounts of morphine used (PCA morphine consumption) and severity of pain at rest using a 0-10 (no pain – worse pain experienced) visual-analogue scale (VAS) were evaluated every six hours, up to twenty-four hours. Side effects such as nausea, vomiting, pruritus, and drowsiness over the first twenty-four hours were also noted.

The adequacy of placebo acupuncture was evaluated on the 2nd postoperative day by asking the patients in Group I and II which group they thought they were assigned to. Side effects pertaining to acupuncture such as bruising, persistent pain at needle insertion sites were also noted. Patients' satisfaction with the acupuncture procedure and willingness to undergo similar treatment was surveyed on the day prior to discharge from hospital.

### Data Analysis

An a priori sample size calculation determined that a 30% reduction in mean 24 hour postoperative morphine consumption between preoperative EA and placebo EA (mean ± SD = 0.59 ± 0.24mg/kg) would be detectable using a sample size of 30 patients per group for a two-tailed  $\alpha=0.05$  and a study power of 0.8.

Demographic data, VAS and postoperative side effects were analysed using ANOVA and Chi-square. Intra and post-operative analgesic consumption were analysed using ANOVA and

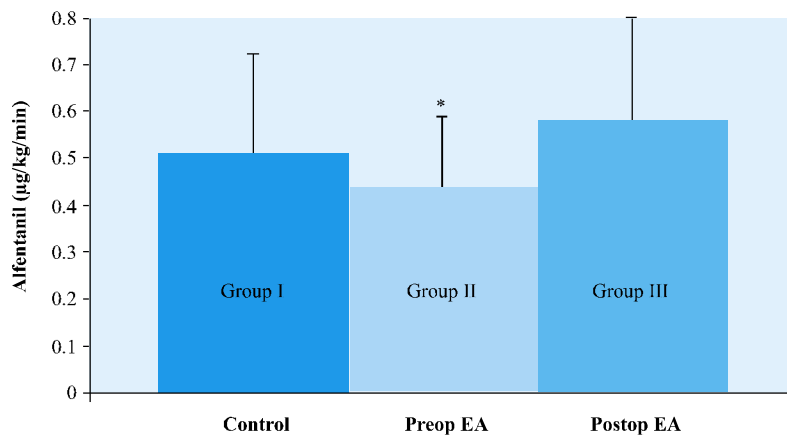
Dunnett's test for parametric data, Kruskal-Wallis test and Mann-Whitney test with Bonferroni adjustment for non-parametric data. The data were presented as mean ± SD or median (interquartile range). A p-value less than 0.05 was deemed statistically significant.

### Results

The demographic data of the patients is shown in table 1. The three groups were comparable with regard to age, body weight and duration of surgery. Patients in Group II ( $0.44 \pm 0.15\mu\text{g/kg/min}$ ) received significantly less alfentanil than those in Group III ( $0.58 \pm 0.22\mu\text{g/kg/min}$ ) ( $p=0.024$ ). Group II also received less alfentanil compared to Group I ( $0.51 \pm 0.21\mu\text{g/kg/min}$ ) but the difference was not statistically significant (figure 2).

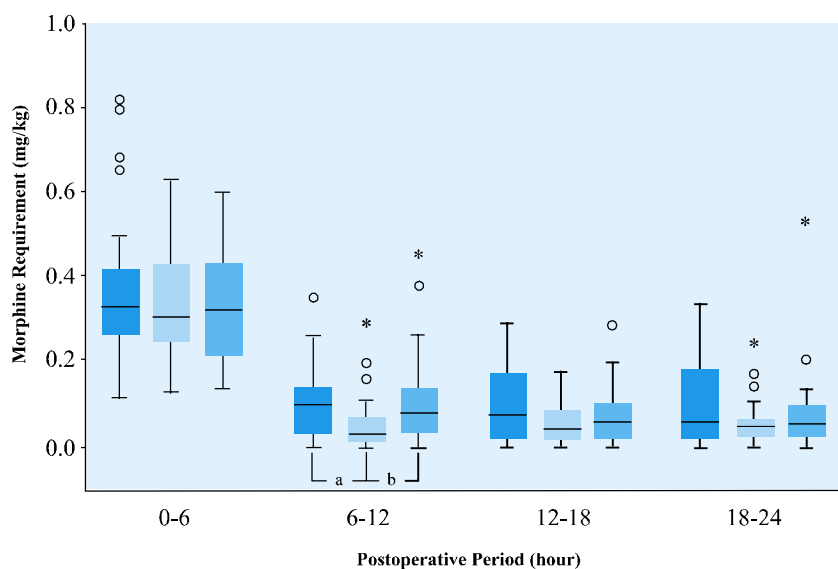
Postoperative morphine consumption via PCA among the three groups was assessed in four different time periods: 0-6 hours (include recovery room stay), 6-12 hours, 12-18 hours and 18-24 hours. Morphine consumption was numerically lower in Group II compared to other groups from the second time period onwards, the difference was statistically significant during the period of 6-12 hours between Group II [ $0.03$  ( $0.05$ ) mg/kg] and I [ $0.10$  ( $0.11$ ) mg/kg] ( $p=0.015$ ), and between Group II and Group III [ $0.08$  ( $0.10$ ) mg/kg] ( $p=0.010$ ). The total morphine consumption (0-24 hours) for Group II ( $0.52 \pm 0.19\text{mg/kg}$ ) was less compared to Group I ( $0.68 \pm 0.38\text{mg/kg}$ ) and Group III ( $0.58 \pm 0.27\text{mg/kg}$ ) (figure 4), however, the differences were not statistically significant.

Figure 2 Intraoperative alfentanil requirements in each treatment group.



\* p=0.024 (Group II vs Group III); p=0.472 (Group II vs Group I)

Figure 3 Postoperative morphine requirements in each treatment group.



Group I Group II Group III a p=0.015 b p=0.010

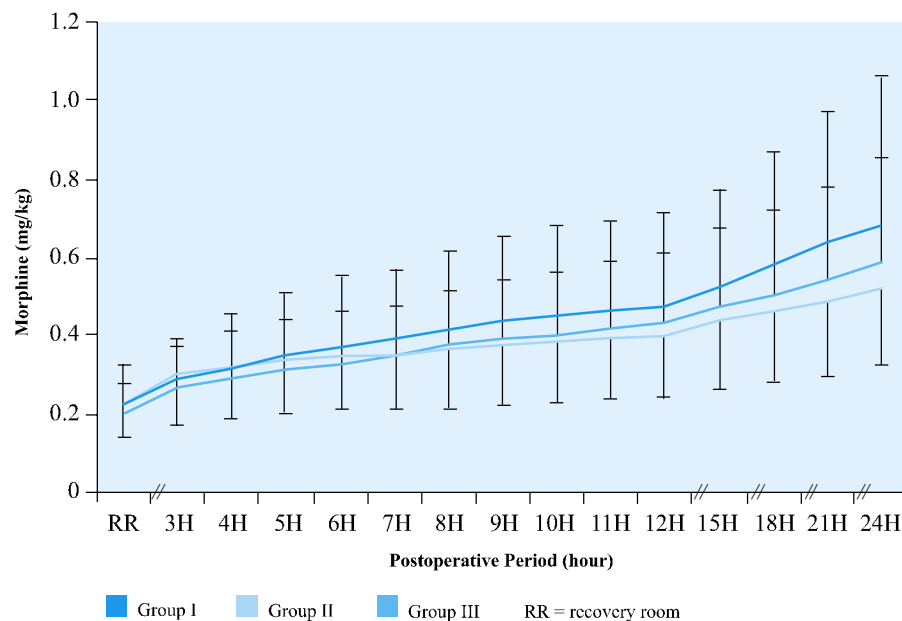
Circles and asterisks represent outliers and extreme outliers respectively

Table 2 VAS and side effects of PCA morphine.

	Group I (n=30)	Group II (n=30)	Group III (n=30)
*VAS (0-10)	4.5±2.1	4.7±1.8	3.9±1.6
PONV (%)	46.6	43.3	56.7
Drowsiness (%)	30.0	23.3	33.3
Pruritus (%)	16.7	13.3	16.7

\* Mean values over 24 hours  
PONV=Postoperative nausea vomiting

Figure 4 Cumulative morphine consumption for the first 24 hours postsurgery.



The VAS for pain assessed every 6 hours was not different among the three groups. The opioid related side effects experienced (nausea and vomiting, drowsiness and pruritis) were less in Group II compared to the other two groups (table 2), however, the differences were not statistically significant.

In both Group I and II, fifty-five to sixty-five percent of the patients was unable to guess to which group they had been assigned, 20-30% guessed acupuncture and the remaining patients thought they were in the control group. There were no complications related to the EA procedures. Sixty-five percent of patients who received EA stated, when asked, that they would not mind receiving EA for future surgery.

### Discussion

This study showed that preoperative EA, when used in conjunction with conventional GA technique, resulted in reduction of intraoperative and postoperative opioid consumption.

There is no data in the English literature to demonstrate the intraoperative analgesic component contributed by acupuncture when the patient is under GA. This is because without a reliable 'anaesthetic depth' monitor, it is very difficult to differentiate whether the patient is receiving inadequate anaesthesia or inadequate analgesia,

both can manifest intraoperatively as hypertension and/or tachycardia. Failure to recognize inadequate anaesthesia, especially when the patient is being paralysed due to the effect of muscle relaxant (to provide muscle relaxation during intra abdominal surgery), could result in the patient being aware (sensory and/or auditory) during surgery. Opioids can effectively blunt the hypertension and/or tachycardia elicited by noxious surgical stimulus (inadequate analgesia), but opioids alone are not able to ensure adequate anaesthesia to prevent awareness during anaesthesia and surgery.<sup>5</sup>

The recent introduction of the BIS monitor into clinical practice allows us to monitor the hypnotic component of the anaesthetic. It also enables us to assess the analgesic component contributed by EA by monitoring the haemodynamic response during surgery. The monitor has been validated for the anaesthetic drugs (sodium thiopentone, midazolam, isoflurane and nitrous oxide) and opioid (alfentanil) used in this study. The BIS index has been found to correlate closely with the hypnotic effect of the anaesthetic drugs, and is minimally affected by alfentanil.<sup>6-8</sup> In this study, the BIS index was maintained within the limits to ensure adequate anaesthesia (BIS index 45-55) using isoflurane (which has no analgesic effect) while alfentanil which is a short acting opioid, was used to provide analgesic cover to

suppress unwanted hyperdynamic response (hypertension and /or tachycardia) initiated by the surgical stimulus.

The results of this study showed that patients in Group II (preoperative EA) consumed less alfentanil intraoperatively as compared to the other two groups. However, the difference was only statistically significant between Group II and III (postop EA). The non-significant difference between Group I (control) and Group II (preoperative EA) could be due to a strong placebo effect in Group I, since patients in Group I were made to believe that they had received acupuncture, whereas patients in Group III were aware that they only received acupuncture treatment after the surgery. There is recent evidence to suggest that placebo analgesia may involve an endorphin mechanism.<sup>9</sup> Although it is still unclear what are the exact mechanisms underlying the action of acupuncture, it has been shown quite convincingly that endorphins play an important role in the acute pain setting.<sup>10</sup> Therefore, the sample size of thirty patients may not be able to detect a statistical difference, as both acupuncture and placebo treatments share a common pathway in mediating analgesia. Studies on EA for experimental pain in humans found that acupuncture was able to raise the pain threshold by about 20-30%.<sup>11-15</sup>

Postoperative morphine consumption via PCA in Group II during the 6-12 hours postoperative period was significantly less than Group I ( $p=0.015$ ) and Group III ( $p=0.010$ ). The graph of 24 hours cumulative morphine consumption (figure 4) also showed that the curve for Group II started to deviate (less morphine consumption) from Group I and III after 7-8 hours postoperatively. In addition, there was no significant difference in the VAS among the three groups (i.e. patients in Group II had the same level of comfort compared to Group I and III, despite consuming less morphine). This study demonstrates that preoperative EA has a morphine sparing effect during the 6-12 hours postoperative period. Although the morphine consumption level remained lower in Group II from 12-24 hours postoperatively, the difference was not statistically significant. The 24-hour total morphine consumption was also not significantly different

among the three groups.

The reason why the morphine sparing effect of preoperative EA was not observed after the 6-12 hours period could be due to the diminishing effect of a single dose of EA therapy. There is not much information regarding how long the analgesic effect will last after a single session of acupuncture. Lao et al studied the duration of analgesic effect of acupuncture in 11 subjects after surgical third molar extractions;<sup>4</sup> they found that the mean time to reach moderate pain was 181 minutes (about 3 hours). Likewise, Christensen showed that the effect of a single session of EA lasted only approximately 2 hours as indicated by opioid requirement.<sup>16</sup> Current study showed that a single session of preoperative EA (with some EA continued till end of surgery) could result in a morphine sparing effect 6-12 hours postoperatively. EA at 2Hz and 100Hz have been shown to induce expression of preproenkephalin mRNA and preprodynorphin mRNA respectively, in different parts of the rat brain.<sup>17</sup> This suggests that EA may result in changes in the genetic expression of neurotransmitters and this would provide an explanation for the sustained effect of acupuncture observed clinically.

Clinical studies on the efficacy of acupuncture involve a number of difficulties. First of all it is almost impossible to design a double blind acupuncture study, since the acupuncturist and the anaesthetists involved in this study were aware of the group assignment. An independent observer blinded to the group assignments carried out the postoperative assessment in this study.

Some investigators blind the patients by carrying out acupuncture treatment only after the patients had been randomized under general anaesthesia but before surgery.<sup>16;18-20</sup> In addition, such a design may also help to minimize the strong placebo or the nonspecific effect of acupuncture instituted on awake patients. However, there is evidence to suggest that GA may in some way affect the nervous system rendering acupuncture ineffective. Indeed, two of the above mentioned studies did not demonstrate any difference in analgesic requirement compared to the control group (no acupuncture).<sup>18;19</sup> In Christensen's study,<sup>18</sup> EA was performed soon after induction of GA and continued till end of

surgery while the patient was still anaesthetized. Gupta et al,<sup>19</sup> on the other hand, performed manual (not EA) acupuncture for 15 minutes before surgery while the patient was anaesthetized. However, Christensen et al in an earlier study demonstrated a significant difference between the acupuncture group and the control group (without acupuncture) during the first 2 hours after operation in terms of pethidine requirements.<sup>16</sup> The acupuncture group received EA after the completion of surgery while the patients only received nitrous oxide and oxygen. As nitrous oxide is a very weak anaesthetic, it is possible that the patients were maintained at a very light plane of GA, which would allow the analgesic effect of acupuncture to manifest. Kho et al also demonstrated a significant reduction in intraoperative fentanyl usage between the EA group and control group (no EA).<sup>20</sup> Although the EA was instituted under anaesthesia, the GA was only maintained with fentanyl and nitrous oxide without the use of other potent inhalational agent or intravenous anaesthetic, not surprisingly, their study had a high incident of intraoperative recall/awareness under anaesthesia. As Kho et al did not employ any monitor to assess the hypnotic component during the anaesthesia;<sup>20</sup> it is difficult to determine how they had titrated the analgesic requirement. While acupuncture has been shown to be effective for postoperative nausea and vomiting,<sup>1</sup> there is some evidence to show that for acupuncture to be effective, it should not be performed under GA.<sup>21,22</sup> Acupuncture stimulation was administered before GA and surgery in this study, although the preoperative EA group had some EA continued under GA till end of surgery, it is unclear whether the intraoperative stimulation gave rise to any further beneficial effect.

The failure to achieve significance in acupuncture studies could be due to inadequate acupuncture treatment. None of the studies mentioned previously made any reference to the experience or background training of the acupuncturist, with the exception of Gupta's study which very briefly mentioned 'one of the authors with experience in acupuncture techniques'. It is important to enlist an experienced acupuncturist to help design and carry out the proper techniques.

A variety of acupuncture points and

stimulating techniques (range from manual stimulation to electrical stimulation employing different stimulating frequencies) were used in different studies. This study employed EA of low frequency (2Hz) and high frequency (100Hz) to provoke the release of different types of endorphins (beta-endorphin, met-enkephalin and dynorphin) to combat pain.<sup>23</sup> Acupuncture points chosen were based on traditional points (ST36 and PC6) as recommended by our experienced acupuncturist and skin stimulation corresponding to the same dermatomes as the skin incision. Chen and co-workers studied the postoperative opioid analgesic requirement in female patients scheduled for elective abdominal hysterectomy or myomectomy (type of surgery similar to our study).<sup>24</sup> They found that transcutaneous electrical nerve stimulation (TENS) applied at the dermatomal level of the skin incision is as effective as ST36 acupoint stimulation, and both were more effective than stimulation at a non acupoint location. The type of TENS used by Chen et al<sup>24</sup> has been shown by Han and colleagues<sup>25</sup> to have an effect similar to EA.

Many studies on the efficacy of acupuncture have compared an acupuncture group with a placebo control group to evaluate the specific effect (i.e. the effect beyond placebo) of acupuncture. However, there is difficulty in designing an appropriate control procedure, and a bewildering variety of control procedures have been used in acupuncture trials.<sup>26</sup> In the most commonly used control treatment, needling is carried out at incorrect, theoretically irrelevant sites. Usually this simply means carrying out a procedure similar to the real treatment at nearby, non-classical locations. Depth of insertion and stimulation are the same, only location differs. This procedure, which is termed 'sham' or 'mock' acupuncture, has been used as placebo in many studies. Sham acupuncture was initially assumed to be ineffective by most investigators, and therefore ideal as a placebo. However, Lewith and Machin showed that sham acupuncture appeared to have an analgesic effect in 40% to 50% of patients compared with 60%-75% for real acupuncture and 30% to 35% for placebo (control).<sup>27</sup> There is evidence that acupuncture at non-classical locations may have analgesic

effects.<sup>28</sup> It is also very likely that such effects could be endorphin mediated, therefore requiring a very large sample size to detect a difference between 'real' acupuncture and 'sham' acupuncture. In any case, a sham acupuncture control condition really only offers information about the most effective sites of needling, not about the specific effect of acupuncture. Therefore, sham acupuncture was not used as control in this study.

The results also indicate that Group II has lower postoperative opioid related side effects such as nausea and vomiting and drowsiness. The incidence of postoperative nausea and vomiting (PONV) reported in this study was unexpectedly high (45-55%) in the first 24 hours; despite the prophylactic use of an antiemetic (ondansetron) at the end of surgery and acupuncture at PC6, which has been shown to be effective for PONV.<sup>1</sup> The reasons could be due to the short-term antiemetic effect (not more than six hours) of a single session of acupuncture;<sup>21</sup> female gender and gynaecological operations are known to be associated with a higher incidence of PONV;<sup>29</sup> and the use of morphine via PCA is also a continued emetic stimulus.<sup>30</sup>

In summary, our results indicate that preoperative EA has a short-term morphine sparing effect postoperatively, lasting not beyond 12 hours postoperatively. The procedure was well tolerated and was generally well received by the patients. In addition, with the help of the BIS monitor, this study also demonstrates that preoperative EA can achieve a reduction of intraoperative alfentanil consumption. The role of preoperative EA deserves further clinical investigations.

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