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Acupuncture and anaesthesia

Anna Lee* MPH, PhD

Associate Professor

Simon Chan MBBS, FANZCA, FHKCA

Consultant Anaesthetist

Department of Anaesthesia and Intensive Care, The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, NT, Hong Kong, China

Acupuncture and related techniques are increasingly practised in anaesthesia. This paper reviews the current evidence and applicability of acupuncture and related techniques for anaesthetic procedures and postoperative nausea and vomiting. Recent evidence suggests that manual acupuncture is effective for reducing preoperative anxiety and for postoperative pain relief. Current available data do not support the use of acupuncture as an adjunct to the general anaesthetic in the intraoperative setting. There are extensive and good quality data to support the use of P6 acupoint stimulation techniques for preventing postoperative nausea and vomiting in combination with or as an alternative to conventional anti-emetics. The use of acupuncture for labour pain management appears promising but requires further research. Patient selection, acupoint selection, needling techniques, and mode of acupuncture need to be considered when applying acupuncture and related techniques in the perioperative setting. There are guidelines for the conduct and reporting of acupuncture research, and these should be followed to improve the quality of studies.

Key words: evidence-based medicine; acupuncture; perioperative care; postoperative nausea and vomiting; pain.

Acupuncture is an integral part of an ancient Chinese system of medicine that has been used for more than 2500 years to treat diseases and relieve pain.¹ The process of acupuncture involves the use of small needles placed at specific points along the energy meridians in the body to regulate the flow of *qi* (vital energy) along these pathways to help restore the patient to health. Non-invasive techniques of acupuncture include manual acupressure, acupressure wristbands, transcutaneous electrical stimulation, moxibustion, and laser stimulation. Compared to invasive manual acupuncture,

* Corresponding author. Tel.: +852 2732 2735; fax: +852 2637 2422.
E-mail address: annalee@cuhk.edu.hk (A. Lee).

non-invasive stimulation techniques require less practitioner time spent directly with the patient and facilitates standardization of acupoint stimulation.

Official reviews conducted in the United States, United Kingdom, Europe and Canada suggest that acupuncture appears to be effective for postoperative dental pain, postoperative nausea and vomiting (PONV), and chemotherapy-related nausea and vomiting.² For chronic pain and neck pain, the evidence is considered inconclusive and difficult to interpret.² In the last decade, there has been growing interest in the use of acupuncture and related techniques in anaesthesia. Although there is increasing evidence that acupuncture evokes changes via the nervous system¹, there is much scepticism among anaesthetists about its effectiveness.

This paper reviews the current evidence and applicability of acupuncture and related techniques for anaesthetic procedures and PONV using an evidence-based approach. For detailed background, theory, mechanism of action of acupuncture, and perioperative studies of acupuncture published to the end of 2003, the reader is referred to a review by Chernyak and Sessler.¹

IS THERE GOOD EVIDENCE?

Methodological quality of primary acupuncture and related technique studies

One of the arguments for not supporting the use of acupuncture in anaesthetic practice is that the methodological rigour of clinical trials of acupuncture and related techniques is generally poor.² Some of the methodological flaws in clinical trials of acupuncture and related techniques are similar to randomised controlled trials in conventional medicine: inadequate allocation concealment, no blinding, and loss to follow-up. In addition to these flaws, specific problems unique to acupuncture randomised controlled trials are treatment effects³, matching sham control, and heterogeneity of acupoints. These issues are discussed in more detail below.

Treatment effects of complex non-pharmacological interventions

In a conventional drug trial, diagnosis determines the eligibility for the trial and occurs before the drug intervention. Talking and listening to the patient are separate from the drug intervention. In comparison, treatment factors that are characteristic of acupuncture include, in addition to the needling, the diagnostic process and aspects of talking and listening to the patient (which may be different at each acupuncture session).³ Therefore, it has been suggested that the use of placebo- or sham-controlled trial designs for acupuncture interventions may lead to false-negative results.³

Matching sham control

There is considerable controversy as to the appropriate placebo as a control intervention in acupuncture studies. 'Sham acupuncture' (acupuncture at random points on the body surface that are thought to be inactive and are not located in the meridian) is often used. A recent functional magnetic resonance imaging showed

that acupuncture at Hegu LI4, a major analgesia acupoint, evoked specific activation in the middle temporal gyrus and cerebellum, along with deactivation areas in the middle frontal gyrus and inferior parietal lobule, compared with the effects of sham acupuncture.⁴ These findings suggest that real acupuncture induces specific patterns of brain activity different to sham acupuncture, which may explain the therapeutic effects of real acupuncture.

Recent evidence suggests that the Streitberger needle is promising as a valid and convincing placebo needle for use in acupuncture trials.⁵ As the needle is pushed against the skin, it causes a pricking sensation, but as increased pressure is applied, the shaft of the needle disappears into the handle, giving the impression that the needle is actually entering the skin.⁵ Most patients were unable to discriminate between the real acupuncture needle and the Streitberger needle by penetration; however, only 60% found similarities between real acupuncture and placebo acupuncture.⁵ The authors concluded that further work on inter-tester reliability and standardization of technique is needed before the Streitberger needle is valid and reliable as a placebo needle.

Heterogeneity of acupoints

Many different acupoints can be stimulated to treat the same disease or syndrome. For example, for PONV the Neiguan P6 is the most common single acupoint studied, although there are more than 30 classic acupoints described as being effective for nausea and vomiting. Such simplification may not always be appropriate and may result in the treatment failure seen in many studies.¹ The selection of acupoints is discussed in more detail in the latter part of this chapter.

A recent guideline on design, implementation and reporting of clinical research on acupuncture and related techniques has been published and may improve the quality of trials conducted in the future.⁶ Several complementary medicine journals have now adapted the STRICTA guidelines to improve standards for reporting interventions in controlled trials of acupuncture.⁷ These guidelines may lead to greater ease in interpreting the results of trials and systematic review of acupuncture and related techniques.

METHODOLOGICAL QUALITY OF SYSTEMATIC REVIEWS OF ACUPUNCTURE AND RELATED TECHNIQUE STUDIES

Anaesthetists are increasingly using systematic reviews for patient management. Are systematic reviews of acupuncture and related techniques in the anaesthetic setting reliable? The answer is unclear as there are no data. However, a recent study showed that the quality of reporting complementary and alternative medicine systematic reviews (acupuncture, homeopathy, cognitive behaviour therapy) is at least as good as that found for conventional medicine, and is not affected by inclusion or exclusion of language other than English.⁸ Publication bias may be problematic in systematic review of acupuncture, as one study found that all primary trials originating in China, Japan, Hong Kong and Taiwan were all positive.⁹ The implication of this is that the efficacy of acupuncture may be over-estimated. As more systematic reviews of acupuncture and related techniques are published in anaesthesia, the quality of these systematic reviews and consideration of publication bias should be assessed.

FINDING THE EVIDENCE

In order to apply the evidence on acupuncture and related techniques, anaesthetists must know how to obtain this information efficiently. Good sources of information about acupuncture and related techniques include electronic searching of MEDLINE, EMBASE, the Cochrane Library and CISCOM database. The CISCOM database was developed by the United Kingdom Research Council for Complementary Medicine and contains articles on complementary and alternative medicine published in the medical literature.¹⁰ Apart from the mainstream anaesthetic journals, the following journals have published acupuncture and related techniques in the anaesthesia setting and may be useful sources of evidence to consider: *Acupuncture in Medicine*, *Journal of Alternative and Complementary Medicine* and *Evidence-based Complementary and Alternative Medicine*.

EVIDENCED-BASED INTERVENTIONS

Convincing evidence from randomised controlled trials and systematic reviews of perioperative applications of acupuncture and related techniques are available in anaesthesia. Below is a selection of current evidence published in the last 2 years (2004 to September 2005). For earlier studies, refer to the review by Chernyak and Sessler.¹

PREOPERATIVE INTERVENTIONS

Several randomised controlled trials of auricular acupuncture at 'master cerebral point', 'tranquilizer point' and 'relaxation' suggest that it is effective for treatment of preoperative anxiety in surgical patients.¹ More recently, auricular acupuncture has been extended to parents of children undergoing surgery.¹¹ Mothers of children undergoing general anaesthesia for outpatient surgery were randomised to auricular acupuncture or sham acupuncture (auricular press needles at the shoulder, wrist and extraneous auricular point). After induction, maternal anxiety in the acupuncture group, as measured by the State Trait Anxiety Inventory, was slightly lower than that in the sham group (42.9 ± 10 versus 49.5 ± 11 , respectively; $P=0.014$). An important outcome of the study was that children whose mothers received the acupuncture intervention were significantly less anxious on entry to the operating room and during introduction of the anaesthesia mask. No side-effects were reported in the study.¹¹

More recently, the same group of investigators examined the effect of acupressure on the Yintang point (midpoint between the two eyebrows) on preoperative parental anxiety.¹² Parents were randomised to an acupressure bead with occlusive tape covering at the Yintang point or sham acupressure above the lateral border of the left eyebrow (same dermatomal distribution as the Yintang point) for 20 minutes in the preoperative holding area. Parents in the acupressure group had significantly less anxiety at 20 minutes post-intervention compared with parents in the sham group (37 ± 10 versus 45 ± 13 , respectively, $P=0.03$). The main advantage of acupressure over auricular acupuncture at the Yintang point for preoperative anxiety was that there was less discomfort.¹²

In contrast, there was no difference in the reduction of preoperative anxiety levels in a randomised controlled trial of acupuncture versus sham acupuncture at the Yintang point in patients undergoing minor or moderate surgery.¹³ The differences in results

between these studies^{11–13} may be due to different techniques and the way in which anxiety was measured (State Trait Anxiety Inventory^{11,12} and verbal score scale¹³). In general, the results appear to be favourable for the use of acupuncture and related techniques for preoperative anxiety.

INTRAOPERATIVE ACUPUNCTURE-ASSISTED ANAESTHESIA

Interest in the role of acupuncture for anaesthesia grew following the reports of surgery being performed with only acupuncture as an anaesthetic in China by Western physicians more than 30 years ago.¹⁴ However, it became clear from subsequent research that acupuncture does not provide true anaesthesia or unconsciousness but rather provides analgesia and sedation.¹ Nevertheless, on the basis of the involvement of endogenous opioid peptides along the pain pathway proposed by Pomeranz and Chiu¹⁵, focus has shifted towards the role of acupuncture in reducing intraoperative anaesthetic and opioid requirements.

In a recent review, Chernyak and Sessler¹ concluded that although acupuncture may reduce the anaesthetic requirement in some volunteer studies, the reduction was not clinically important. In addition, intraoperative acupuncture stimulation did not alter the analgesic requirement.¹ This has been supported by the findings of another recent systematic review¹⁶ where real acupuncture was not significantly different from placebo acupuncture as an adjunctive analgesic during surgery. This conclusion was later supported by a recent well-designed randomised controlled trial by Usichenko et al.¹⁷ Although the German group had demonstrated a significant reduction in postoperative analgesic requirement and pain score in patients after total hip arthroplasty with auricular acupuncture, the intraoperative fentanyl requirement and duration of general anaesthesia were similar in both acupuncture and control groups.¹⁷ Hence, the currently available data do not support the use of acupuncture as an adjunct to the general anaesthetic in the intraoperative setting.

POSTOPERATIVE INTERVENTION

Postoperative pain control

Recent evidence¹ suggests that acupuncture may be effective for postoperative pain relief, but it probably requires a high level of expertise and training of the practitioner. In a recent randomised controlled trial¹⁷ patients in the acupuncture group received press steel needles at several points (hip joint, shenmen, lung and thalamus of the ipsilateral ear) compared to the control group receiving sham needles on the non-acupuncture points of the helix, fixed with flesh-coloured adhesive tape. Compared with the control group, the acupuncture group required significantly less analgesia (32%) during the first 36 hours after surgery and had a longer time to first request for analgesia.¹⁷ Also patients in the acupuncture group had a significantly lower pain score at all time intervals compared with sham controls.¹⁷ The success of blinding was confirmed in this study as more than 80% of patients from both acupuncture and control groups believed that they had received true acupuncture.¹⁷

Postoperative nausea and vomiting (PONV)

The overall incidence of PONV is reported to be about 38% and may reach 79% in high-risk patients.¹⁸ The current consensus strategy is to identify high-risk patients, avoid emetogenic stimuli, and use multimodal therapy.¹⁹ Acupuncture and related techniques were identified as important non-pharmacological interventions to consider.¹⁹

Several reviews have confirmed the effectiveness of acupuncture and related techniques in preventing PONV at the P6 acupoint.^{1,20–23} Although the earlier review suggested that acupuncture is ineffective for PONV in children²², it became clear in a subsequent review²³ that acupuncture for PONV is as effective in children as in adults. A plausible explanation is that acupuncture was administered after induction of anaesthesia which failed to elicit the anti-emetic effect of acupuncture.¹ The effectiveness of acupuncture-related techniques for the prevention of PONV in children has been reaffirmed by recent studies.^{24,25} Two acupuncture-related techniques were recently compared with anti-emetics in paediatric patients: laser acupuncture versus metoclopramide versus sham laser²⁴ at P6 acupoint, and acustimulation with capsicum plaster versus ondansetron versus sham plaster at P6 acupoint.²⁵ In these randomised placebo-controlled trials, it was found that these acupuncture-related techniques significantly reduced the incidence of PONV and were as effective as the anti-emetics.^{24,25} In a separate randomised controlled trial of transcutaneous electrical acupoint stimulation versus ondansetron versus control (no treatment), acupoint stimulation was effective for prevention of PONV.²⁶ Moreover, its effect is comparable to ondansetron.²⁶ The application of these acupuncture-related techniques was initiated prior to induction of anaesthesia in all three paediatric studies, and there were very few side-effects.

However, there is a recent conflicting report on the timing of acupuncture stimulation in relation to the induction of anaesthesia. In a randomised placebo-controlled patient- and observer-blinded trial, Streitberger et al.²⁷ showed no difference between applying acupuncture before or after induction of anaesthesia. The main finding was that acupuncture significantly reduced the incidence of postoperative vomiting, but not nausea, in patients undergoing gynaecological or breast surgery. One plausible explanation for this conflicting result is that, as the authors also suggested, Neiguan P6 is hardly the only point to prevent PONV, and that other acupuncture points may be required to supplement the P6 effect.²⁷

In a study to evaluate the efficacy of transcutaneous electrical acupoint stimulation in combination with ondansetron, the device was most effective for reducing PONV when applied after plastic surgery rather than before surgery.²⁸ Unlike many previous studies of acupuncture and related techniques for prevention of PONV, patient satisfaction was measured. Patients receiving peri- or postoperative acustimulation therapy had significantly higher satisfaction with the quality of recovery and anti-emetic management than patients receiving preoperative acustimulation.²⁸ As there is a paucity of well-designed studies with direct comparisons of the timing of acupoint stimulation^{27,28}, the question of when to apply acupoint stimulation remains unclear.

Other postoperative complications

The use of acupuncture for postoperative laryngospasm and cardiovascular resuscitation has been reviewed, and the evidence does not support its use in these settings due to conflicting results or insufficient data.¹

In a randomised double-blind sham-controlled study, Park et al.²⁹ showed that capsicum plaster on the Korean hand acupuncture point K-A20 significantly reduced the incidence of postoperative sore throat compared with sham and placebo control groups (0 versus 16 and 19%, respectively). Although further evaluation is required, this early result appears to be promising and may be considered in patients with a high risk of developing postoperative sore throat, such as in patients with anticipated difficult airway intubation.

LABOUR PAIN MANAGEMENT

A systematic review of three randomised controlled trials of women in labour³⁰ suggests that acupuncture alleviates pain and reduces analgesic consumption compared with control groups (relative risk 0.36, 95% confidence interval 0.24–0.54). Common acupoints used during labour in all three trials included in the systematic review were: Baihui GV20 (tension), Taichong LV3 (cervix rigidity), Kunlun UB60 (back pain in early labour), Ciliao UB32 (back pain later in labour) and Hegu LI4 and Sanyinjiao SP6 (strong pain during contractions). No adverse events were reported in any of the trials included in the review.³⁰ The authors concluded that the effectiveness of acupuncture for labour pain is promising but uncertain, mainly due to paucity of primary trials in the area.³⁰

Following the publication of the systematic review³⁰, acupressure at the SP6 acupoint for 30 minutes was effective for decreasing labour pain for up to 60 minutes after the acupressure intervention—mean pain score in acupressure group versus sham (SP6 touch) group were 7.7 ± 1.5 versus 8.9 ± 1.7 , respectively—but there was no difference in the use of analgesia ($P=0.20$).³¹ The total labour time (3 cm cervical dilatation to full dilatation) was significantly shorter ($P<0.01$) in the Sanyinjiao SP6 acupressure group (108 ± 52 minutes) than in the sham group (146 ± 61 minutes).³¹ Based on these findings^{30,31}, acupuncture and related techniques are promising interventions to consider for labour pain management.

GENERAL PRINCIPLES OF APPLYING ACUPUNCTURE AND RELATED TECHNIQUES

Although a thorough understanding of the theory of traditional Chinese medicine is advisable, there are several factors which should be considered when applying acupuncture in the perioperative setting, including patient selection, acupoint selection, needling techniques, and mode of acupuncture.

Patient selection

Chernyak and Sessler¹ have summarized some of the important aspects of patient selection for perioperative acupuncture and related techniques. Acupuncture in young adults is generally more effective than in elderly patients, with the exception of small children who would normally be uncooperative with needling.¹ Furthermore, a better result is expected from patients with a good attitude towards and faith in acupuncture, and acupuncture is less effective in severely ill patients. Moreover, approximately 10% of population are 'non-responders' in whom typical physiological responses cannot be

elicited with acupuncture stimulation, and hence test needling prior to treatment is recommended.

Acupuncture point selection

The detailed prescription of acupoint selection based on traditional Chinese medicine is beyond the scope of this article. Nevertheless, the point selection in patients presenting for anaesthesia would depend on the purpose of the acupuncture (such as analgesia or PONV), the patient's overall condition, and the type of operation.

Yintang point^{12,13} and auricular Shenmen³² are common points used for preoperative anxiolysis. For PONV, Neiguan P6 is commonly employed.^{1,20–28} However, one should note that due to the variation in patients' conditions, different aetiologies for the same symptoms, and other factors, it would be inappropriate to assume that one single or specific set of acupoints for the treatment of a disease condition will always be effective. For example, PONV may be drug-induced or surgery-related, and would have a different management approach, as in the case of strabismus surgery. Neiguan P6 acupressure prior to induction of anaesthesia was shown to be ineffective in children undergoing strabismus surgery.³³ However, the incidence of PONV was significantly reduced after strabismus surgery in a randomised controlled trial using acupoints for meridians associated with the eyes.³⁴ These results suggested that PONV in strabismus surgery may be surgery-related rather than drug-induced.

The points chosen for acupuncture and related techniques can be considered at three levels³⁵: the local points, the distant points, and the points along the course of the affected meridian. Local points refer to the acupoints located near the affected area. Wushu GB27, Weidao GB28, Qixue KI13 and Siman KI14 (acupoints located at the lower abdomen and groin, respectively) have been used as acupuncture anaesthesia during inguinal hernia repair in a small study.³⁶ Some reactive acupoints, usually below the elbows and knees, are helpful for painful conditions at remote body regions.³⁵ For example, Hegu LI4 (located between the thumb and index finger) is traditionally used for facial and oral pain; Zusanli ST36 (near the proximal tibia) is used for abdominal pain; Lieque LU7 (near the wrist at the radial side) is used for head and neck discomfort; and Weizhong BL40 (situated at the popliteal fossa) is helpful for back pain.³⁵ Acupoints from the meridian that passes through the surgical area or the meridian strongly associated with the organ undergoing surgery (the 'organ phenomenon') can be selected for postoperative pain control.¹ Moreover, back shu points of the viscera are located bilaterally 1.5 cun (about 2.5–3 cm) lateral to the posterior midline (the bladder meridian) and may be useful for postoperative deep visceral pain.¹

In addition, the patient's comfort and convenience have to be taken into account when selecting the acupoints. Therefore, acupoints located at the limbs and auricular points are usually preferable to those at the trunk. Nevertheless, preoperative intradermal needle to the back shu points have been successfully used for postoperative analgesia as an adjunct to epidural morphine in patients undergoing abdominal surgery.³⁷

Needling technique

In order to achieve a good effect of acupuncture, it is crucial to obtain *De-qi* during needling. *De-qi* (which means arrival of *qi*) refers to a specific sensation of soreness, numbness, distension or heaviness around the acupoint after the needle is inserted to a

certain depth. At the same time, experienced acupuncturists may also feel tenseness and tightness around the needle.³⁵ If the *De-qi* sensation cannot be obtained at needle insertion, manual manipulation of the needle by twirling, rotating, lifting or thrusting is performed until it is achieved. The *De-qi* sensation experienced by healthy volunteers has been verified and is different from the pain sensation from needle pricking.^{38,39} Indeed, increased skin blood flow to Hegu LI4 and Quchi LI11 (near the elbow) is associated with *De-qi* sensation during acupuncture stimulation of Hegu LI4 in volunteers.⁴⁰

Mode of acupuncture

Acupuncture-related techniques include: acupressure, electroacupuncture, transcutaneous electrical acustimulation, laser acustimulation, and more recently, capsicum plaster acustimulation. Compared with manual acupuncture, these techniques have the following advantages: (1) they are less painful and hence are more acceptable to patients, especially small children; (2) they require less specialist training; (3) they are less labour-intensive; and (4) they provide better analgesia when electroacupuncture is used.¹ In a recent review, Rowbotham²¹ concluded that various acupuncture-related techniques are effective for the prevention of PONV, and as these techniques are not time-consuming and do not require specially trained personnel, he has advocated their widespread use.

The analgesic effect of electroacupuncture was reported to be different according to the frequency of stimulation used, suggesting that different neurotransmitters are involved.¹ High frequency (100 Hz) was reportedly to provide better postoperative pain control in patients undergoing abdominal surgery compared with low frequency (2 Hz).⁴¹ Acupressure and transcutaneous electrical acustimulation have a long history and a favourable safety profile. Laser acustimulation (with the precaution of eye protection) was advocated for use in paediatric patients for the prevention of PONV.⁴² Capsicum plaster developed in Korea was found to be effective in PONV when applied to the Korean hand acupoint⁴³ or at the Neiguan P6²⁵, and also for treatment of postoperative sore throat.²⁹ As capsicum plaster is not readily available, the widespread use of this simple technique has yet to be determined.

SUMMARY

Manual acupuncture requires specialist training and is labour-intensive and time-consuming, which limits its applicability in many units. However, recent evidence suggests that manual acupuncture is effective for reducing preoperative anxiety and for postoperative pain relief. Current available data do not support the use of acupuncture as an adjunct to the general anaesthetic in the intraoperative setting. The results from recent studies of non-invasive techniques and systematic reviews of acupoint stimulation techniques suggest that they are effective for preventing postoperative nausea and vomiting in combination with—or as an alternative to—conventional antiemetics. The use of acupuncture for labour pain management appears promising but requires further research. Patient selection, acupoint selection, needling techniques and mode of acupuncture are important factors to consider when applying acupuncture and related techniques in the perioperative setting.

Practice points

- guidelines to improve standards for reporting interventions in controlled trials of acupuncture and related techniques exist and should be followed in future studies
- current available data do not support the use of acupuncture as an adjunct to the general anaesthetic in the intraoperative setting
- there is extensive and good evidence to support the use of acupuncture and related techniques for the prevention of postoperative nausea and vomiting
- patient selection, acupoint selection, needling techniques, and mode of acupuncture need to be considered when applying acupuncture and related techniques in the perioperative setting

Research agenda

- the quality of systematic reviews of perioperative applications of acupuncture and related techniques is unknown
- further research is warranted to evaluate the optimal timing (preoperative, postoperative, perioperative) of acupuncture and related techniques
- the value of acupuncture and related techniques for treating postoperative complications needs to be determined
- the efficacy of capsicum plaster acustimulation appears favourable but requires further research
- the role of acupuncture for labour pain needs to be defined more clearly

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