Since acupuncture provides analgesia it might be expected to reduce the need for conventional anaesthetic drugs during general anaesthesia. In this review we discuss four double blind, placebo controlled studies evaluating acupuncture’s ability to reduce analgesic or anesthetic requirement. Three studies (from Greif et al., Morioka et al. and Taguchi et al.) examined whether transcutaneous electrical stimulation of some acupuncture points reduces anaesthetic requirement. Kotani et al. tested the hypothesis that preoperative insertion of intradermal needles in the bladder meridian reduces postoperative pain and opioid requirement.

Conclusions: none of the first three studies showed that the stimulation of the acupoints produces clinically important reductions in anaesthetic requirement. In contrast, Kotani et al. showed that at least some acupuncture techniques provide substantial postoperative analgesia and significantly reduce opioid requirement.

Key words: Acupuncture - Anesthesia - Review.

Acupuncture has been used extensively since being developed in China 2500 years ago and remains widely used throughout Asia. Acupuncture is based on patterns of energy flow through the body, with disruptions of this flow being thought to cause disease. The scientific basis for acupuncture remains unclear since traditional acupuncture points do not correspond to western concepts of anatomy or neurology. Nonetheless, acupuncture releases neurochemical substrates, such as endorphins, serotonin, and norepinephrine.

Acupuncture has not received the kind of stringent evaluation required for new drugs or medical devices. The vast majority of studies on acupuncture in the biomedical literature consist of case reports, case series, or intervention studies with designs inadequate to assess efficacy. It is disconcerting that this increasingly popular pain treatment has yet to be adequately evaluated — especially given the substantial potential for bias.
and placebo effect in unblinded or partially blinded pain studies. Difficulty with blinding has proven one of the major impediments to adequate validation studies.

During general anesthesia is one time when it is possible to completely double-blind acupuncture treatments. To the extent that acupuncture provides analgesia, it might be expected to reduce the need for conventional anesthetic drugs. In this review, we discuss four double blind, placebo-controlled studies evaluating acupuncture’s ability to reduce analgesic or anesthetic requirement.

**Materials and methods**

In a randomized, double-blind study, Kotani et al. tested the hypothesis that preoperative insertion of tiny intradermal needles at acupuncture points 2.5 cm from the spinal vertebrae (bladder meridian, BL) reduces postoperative pain scores, opioid requirement, opioid-related side effects, and adrenal responses induced by surgical stress in patients undergoing upper or lower abdominal surgery. Before anesthesia, patients undergoing each type of surgery were randomly assigned to Acupuncture (n=50 and n=39, for upper and lower abdominal surgery, respectively) or untreated Control (n=48 and n=38, for upper and lower abdominal surgery, respectively). In the acupuncture group, intradermal needles were inserted to the left and right of BL18-24 for upper and BL20-26 for lower abdominal surgery before induction of anesthesia.

Postoperative analgesia was maintained with epidural morphine and bolus doses of intravenous morphine. Using a 4-point verbal rating scale, patients rated incisional pain at rest and during coughing and deep visceral pain during recovery and for four days thereafter. Consumption of intravenous morphine and time-dependent changes in plasma concentrations of cortisol and catecholamines were also evaluated.

In the three following volunteer studies, anesthetic requirement was determined by the "Dixon up-and-down method" and was defined by the average desflurane concentration required to prevent purposeful movement of the extremities in response to noxious electrical stimulation. These up-and-down sequences were continued until volunteers crossed from movement to no movement four times. The P50 of a logistic regression identified the MAC-equivalent for desflurane. In all studies an investigator blinded to treatment determined movement.

Greif et al., recently published a crossover, double-blind, placebo-controlled study examining whether transcutaneous electrical stimulation of one auricular-acupuncture point near the ear tragus reduces anesthetic requirement after acute noxious stimulation. Healthy volunteers were anesthetized with desflurane on two days with at least 48 hours between days. Electrical stimulation was used on one randomly assigned day and no electrical stimulation on the other study day. Treatment consisted of bilateral electrical stimulation of the Lateralization-Control Point, 3 cm anterior to the tragus. The 10-milliamperc current was set to 299 Hertz on the dominant side of the face and to 149 Hertz on the contralateral side. Data were compared on the control and acupuncture day in both men and women.

Morioka et al. tested the hypothesis that electro-acupuncture at the Zusanli, Yanglingquan, and Kunlun acupuncture points on the legs decreases anesthetic requirement. Fourteen young, healthy volunteers were anesthetized with desflurane on two separate days. Needle electrodes were positioned at these three acupuncture points that are thought to produce a generalized sedative and analgesic effect. Needles were placed percutaneously on treatment days; on control days, they were insulated and taped near the insertion points. The electrodes were stimulated on the treatment day only. Stimulation consisted of 2-Hz and 100-Hz currents alternated at 2-second intervals. When the end-tidal desflurane concentration of 5.5% was stable for 15 minutes, noxious electrical stimuli were administered via 25-G needles on both thighs (70 mA, 100 Hz, 10 sec).
Taguchi et al. tested the hypothesis that the combined stimulation of four ear acupoints with needles would significantly reduce anesthetic requirement. In this crossover study, 10 healthy volunteers were anesthetized with desflurane and randomly assigned to no treatment or acupuncture; the alternative treatment was given on the subsequent study day. Auricular acupuncture was performed with needles placed at the Shen Men, Thalamus, Tranquilizer, and Master Cerebral Points on the right ear.

**Results**

In Kotani et al.’s study, starting in the recovery room, patients with intradermal acupuncture had better pain relief than controls (p<0.05). Consumption of supplemental morphine was reduced 50% and the incidence of postoperative nausea was reduced 20-30% in acupuncture patients who had undergone either upper- or lower-abdominal surgery (p<0.01). Plasma cortisol and epinephrine concentrations were reduced 30-50% in the acupuncture group during recovery and on the first postoperative day (p<0.01).

In Greif et al.’s study, transcutaneous electrical stimulation applied to the Lateralization-Control Point reduced anesthetic requirement 11%, p<0.001. The reduction was similar in women (13%, 95% CI 9-17%, n=14) and men (9%, 95% CI 6-12%, n=10). The women required a greater desflurane concentration to prevent movement on the control day than the men: 5.5±1.0 versus 4.6±0.6 volume-percent, p=0.028 (means ± SDs).

In Morioka et al.’s study, four women and ten men completed the trial. Desflurane requirement on the acupuncture (4.6±0.6%) and the control (4.6±0.8%) days did not differ significantly (p=0.8).

In Taguchi et al.’s study, five subjects developed post-anesthetic nausea and/or vomiting (one after both study days, three after a control day, and one after an acupuncture day). The subjects required a greater desflurane concentration to prevent movement on the control day than on the acupuncture day: 4.9±0.7 versus 4.4±0.8 volume-percent, p=0.003. Acupuncture thus reduced anesthetic requirement by 8.5±7%.

**Discussion and conclusions**

The conventional measure of volatile anesthetic potency is the minimum alveolar concentration (MAC), which can most efficiently be determined by using the Dixon “up-and-down” method. MAC for a population is conventionally defined as the volatile anesthetic concentration preventing movement in response to surgical skin incision. An equivalent of MAC can be determined in individuals using repeated noxious electrical stimulation. The resulting partial pressures are uniformly lower than obtained with skin incision, but electrical stimulation nonetheless provides a reasonable measure of anesthetic need and has been used in numerous previous studies.

In all three crossover designed studies described, the investigators used this technique, because it has the advantage of allowing cross-over study designs that are especially sensitive for detecting treatment-induced changes in anesthetic requirement. In Greif et al.’s study, the investigators used electro-acupuncture of a single auricular acupoint and identified an 11% reduction in anesthetic requirement. In Taguchi et al.’s study, the investigators used dry needles at four auricular acupoints and identified an 8% reduction in anesthetic requirement. In Taguchi et al.’s study, the investigators stimulated three acupoints on the leg, failed to reduce anesthetic need.

An obvious conclusion from these three studies is that electrical stimulation of the Zusanli, Yanglingquan, and Kunlun points is less effective than electrical stimulation or dry needles at auricular points. However, a more important conclusion is that none of these techniques produced clinically important reductions in anesthetic requirement. It remains a possibility that other acupuncture...
techniques are more effective — although it has yet to be determined whether any produces clinically important reductions in anesthetic requirement. In contrast, in Kotani et al. showed that at least some acupuncture techniques provide substantial postoperative analgesia and significantly reduce opioid requirement.4

A benefit of the model used in all of these studies is that acupuncture needles are inserted after induction of anesthesia. This allows full blinding of the volunteers as well as the investigators evaluating the response to noxious stimulation. In Kotani et al.’s study, although the needles used were so thin and small that insertion might be insensible for the patient, there is still a small chance of getting a placebo effect from the patients who felt insertion. A disadvantage of the crossover method used in the latter three studies, though, is that the acupuncturist cannot elicit the typical “Qi” sensation that is associated with proper needle position and may even be critical for eliciting acupuncture. It is thus possible that the needles were sub-optimally positioned. Nonetheless, the points chosen were relatively broad so that exact needle positioning was less critical than at other sites. Needle positioning is also far less critical with electrical stimulation than “dry needles” because the current stimulates a relatively wide area. Another disadvantage of the model used in the latter three studies is that volatile anesthetics per se may interfere with effective acupuncture, especially when acupuncture is started after induction of anesthesia.13-14

Of these studies on acupuncture to support intra- and postoperative analgesia, only the one, which was done by intradermal tiny needles in the paravertebral bladder line, showed a clear benefit. In conclusion, acupuncture initiated after induction of anesthesia was found to have minimal to no benefit to support analgesia. Other than the intradermal technique, none of the acupuncture techniques used can be recommended to be used perioperatively.

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Riassunto

Agopuntura: un utile complemento dell’anestesia?

Dato che l’agopuntura ha effetti analgesici ci si potrebbe aspettare che riduca il bisogno dei farmaci normalmente utilizzati durante anestesia generale. In questa review discutiamo quattro studi, condotti in doppio cieco e controllati con gruppo placebo, che hanno valutato la capacità dell’agopuntura di ridurre il bisogno di farmaci anestetici o analgesici.

Tre studi (condotti da Greif et al.; Morioka et al. e Taguchi et al.) sono esaminati se la stimolazione elettrica transcutanea di alcuni punti di agopuntura possa ridurre il bisogno di anestetici. Lo studio condotto da Kotani et al. ha invece valutato l’ipotesi che l’infissione preoperatoria di aghi intradermici lungo il mendiano di vesica possa ridurre il dolore postoperatorio e la richiesta di oppioidi.

Conclusioni: in nessuno dei tre studi la stimolazione dei punti di agopuntura ha prodotto una riduzione rilevante dal punto di vista clinico nel bisogno di anestetici. Lo studio di Kotani et al. ha invece dimostrato che almeno alcune tecniche di agopuntura hanno consentito una sostanziale analgesia postoperatoria e ridotto la richiesta di oppioidi.

Parole chiave: Agopuntura - Anestesia - Review.

References