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ELECTROACUPUNCTURE AND POSTOPERATIVE PAIN

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SUMMARY

We studied 20 otherwise healthy women undergoing lower abdominal surgery. Immediately after wound closure, while still anaesthetized, they received either electroacupuncture (EA) or no further treatment. They were allowed pethidine for postoperative analgesia by patient-controlled infusion pump. Signs of postoperative distress (pain, nausea, drowsiness) were evaluated after 2 and 6 h by visual analogue scale scores. The group receiving EA consumed half the quantity of pethidine as that used used by the no treatment group. Two patients in the EA group had no postoperative analgesia in the first 2 h. There was no difference in the assessments of postoperative distress between groups. No patient was aware of having received EA or not.

Since Melzack and Wall introduced the gate control theory in 1965, interest in different forms of electroanalgesia (acupuncture and transcutaneous nerve stimulation) has been considerable. However, there are few clinical research studies to demonstrate any efficacy of these techniques [1,2]. As a result, the British Medical Association stressed, in the *Report of the Board of Science and Education on Alternative Therapy* in 1986, the need for controlled studies of alternative therapies.

Martelete and Fiori showed that patients treated after operation in the recovery room with electroacupuncture (EA) needed half the quantity of opioid to control pain as a group not receiving EA [2]. However, this study possessed two major flaws: lack of placebo control and absence of objective assessment of pain [3].

The present study was designed to eliminate the need for a placebo control. Patient controlled analgesia was used for objective assessment of pain.

PATIENTS AND METHODS

We studied 20 otherwise healthy women (median age 41.5 yr (range 22–52)) admitted to hospital for elective hysterectomy, salpingo-oophorectomy or operation for tubal infertility. The investigation was carried out as a patient-blinded randomized study with the performing nurse-anaesthetist blinded as well. The study was approved by the local Human Investigation Committee, and informed consent was obtained from all patients.

On the day before operation, weight, arterial pressure, heart rate and ventilatory frequency were recorded. The patient-controlled analgesia device (Prominject, Pharmacia) was demonstrated [4–6].

The Prominject is a microprocessor-controlled programmable infusion pump for parenteral administration of drugs. It possesses a dose–time memory and built-in printer. It is possible to program the infusion pump to inject defined doses when the patient presses a hand-held button. The size of the dose, and the duration of the smallest interval allowed between doses, is set in advance by the physician.

All patients were premedicated with apozepam 0.2 mg kg^{-1} by mouth 2 h before surgery. When the patient arrived in the theatre holding area, standard monitoring devices were applied. The acupuncture loci were identified and marked in all patients. An i.v. infusion of 0.9 % sodium chloride was begun. Following administration of pethidine 1 mg kg^{-1} i.v., sleep was induced with thiopentone

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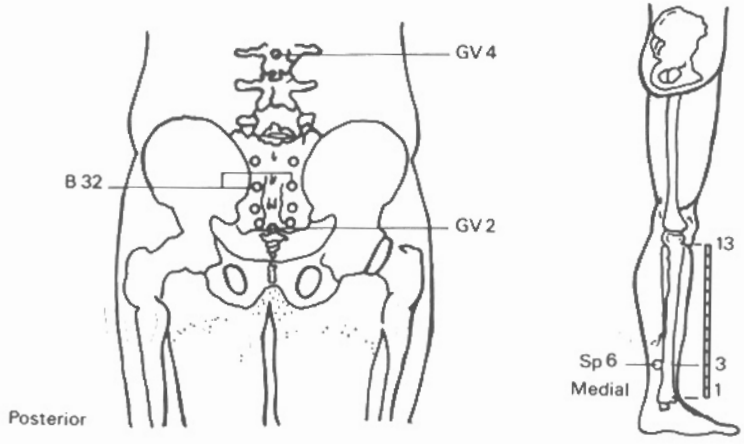

FIG. 1. Acupuncture loci. Meridian number, Chinese name and anatomical localization. GV 2 = Govenor vessel 2, *Jao-Iu*, in the dosal midline between the coccyx and sacrum; GV 4 = Govenor vessel 4, *Ming-Men*, in the dorsal midline below the spinal process of the 2nd lumbar vertebra: B 32 = Bladder 32, *Ciliao*, bilaterally in the second sacral foramen: Sp 6 = Spleen 6, *Sanjiniao*, bilaterally on the medial edge of the tibia, four fingerwidths above the tip of the internal malleolus.

4–6 mg kg^{-1} and tracheal intubation was facilitated by administration of atracurium. Ventilation was controlled manually and anaesthesia was maintained with 70% nitrous oxide in oxygen supplemented with increments of pethidine and thiopentone at the discretion of the nurse-anaesthetist.

At the time of wound closure, the patients were allocated to two groups by means of the Giegy random number table. Group ACP+ received acupuncture as described below, and group ACP− no further treatment.

All operations utilized lower abdominal incisions and all patients received sodium chloride 1–2 litre; blood loss exceeding 500 ml was replaced with whole blood.

Electroacupuncture

The loci were selected from standardized acupuncture formulae for anaesthesia in hysterectomy (fig. 1) [7–9]. The four loci on the back were localized after needle insertion. The two loci on the leg were identified finally by use of the Multiple Electronic Acupunctoscope, WC-10 R, using a hand-held probe [10]. After bandage placement the patients were placed on their side, while still anaesthetized after completion of surgery. Sterile transparent dressings (Tegaderm) were placed over each locus. The needles were inserted to the prescribed depth for each locus, then bent back against the plastic and taped in place. A constant current source was connected and the patients were returned to the supine position. Electroacupuncture was given with the following variables: pulse width 320 μs, approximately 12 V, chain frequencies of 10 and 100 Hz [11]. The acupuncture needles were 10 cm long, 30-gauge, sterilized solid stainless steel needles. They were removed after treatment. During the period of acupuncture, anaesthesia was maintained with 70% nitrous oxide in oxygen.

Upon their arrival in the recovery room, the programmed infusion pump was connected to all patients via the existing infusion of 5% glucose. Recordings of arterial pressure, heart rate and ventilatory frequency were made every 30 min for the first 2 h and thereafter at hourly intervals. Inspired oxygen concentration was increased by the use of nasal catheters with a flow of oxygen 3 litre min^{-1}.

The infusion pump was programmed to deliver 20 mg of pethidine in the first 2 h and 10 mg in the last 4 h, when the patient activated the hand-held press button. The smallest interval allowed between doses was set at 5 min. Each self-administered dose was registered on a time recorder. The nurses in the recovery room were not aware of the group to which the patients had been allocated. After 2 h the patient was asked to complete a 100-mm, vertical visual analogue scale for pain, nausea

TABLE I. *Patient data. Median values (range)*

	Age (yr)	Weight (kg)	Duration of operation (min)	Thiopentone requirement (mg)
Group ACP+ ($n = 10$) (Electroacupuncture)	41.5 (22–52)	68 (48.5–85)	142.5 (110–170)	625 (469–780)
Group ACP− ($n = 10$) (No treatment)	41.5 (27–50)	65.5 (55–69.5)	140 (105–165)	575 (432–719)

and drowsiness (0 = no trouble to 100 = worst possible). The pump was then reprogrammed to deliver pethidine 10 mg per dose.

After 6 h the recordings were repeated, the infusion pump was disconnected, and the patient was discharged to the ward.

Statistics

Statistical analyses were performed using non-parametric tests: Wilcoxon Rank Sum Test for paired differences, and Mann–Whitney Rank Sum Test for unpaired differences. $P < 0.05$ was regarded as significant.

RESULTS

The two groups were similar with regard to age, weight, duration and type of operation, and thiopentone requirement (table I). All patients were aroused easily upon arrival in the recovery room. Blood loss did not exceed 500 ml in any patient.

No problems were encountered in identifying the acupuncture loci or placing the needles.

Pethidine requirements

The pethidine requirements of each patient were recorded and grouped into three periods: during operation, during the first 2 h and during the next 4 h in the recovery room.

Median requirements of pethidine during operation were similar in both groups: 197 mg (range 130–230 mg) in group ACP+ and 195 mg (range 130–290 mg) in ACP−. One patient in group ACP+ had no need of analgesia in the recovery room and another in the same group required no analgesia during the first 2 h. Both were awake immediately after operation; one had undergone salpingo-oophorectomy and the other total hysterectomy.

Group ACP+ had a significantly smaller median opioid requirement during the first 2 h compared with group ACP− ($P = 0.007$): 60 mg (range 0–100 mg) and 100 mg (60–140), respectively (fig. 2). There was no significant difference in opioid consumption between the two groups over the subsequent 4 h ($P = 0.058$), but there was a tendency towards smaller requirements in group ACP+.

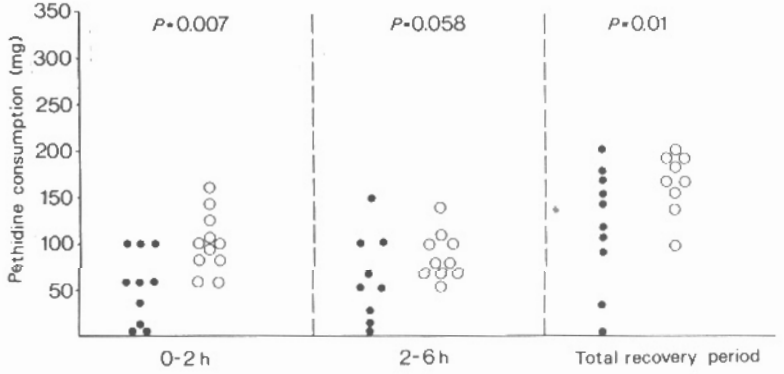

FIG. 2. Pethidine requirements of patients in group ACP+ (●) (electroacupuncture treated; $n = 10$) and group ACP− (○) (no treatment; $n = 10$) after the first 2 h, the subsequent 4 h and during the total recovery room period. P values for difference between groups are shown.

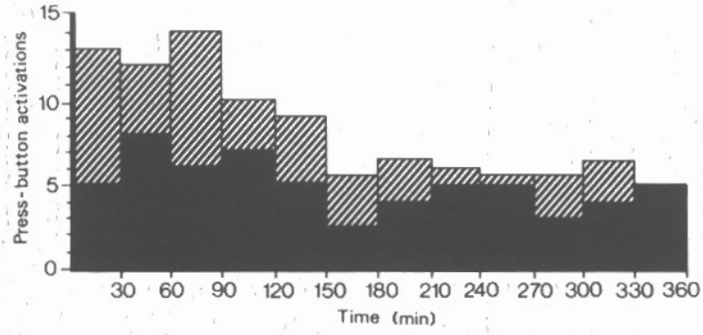

FIG. 3. Prominject press-button activations, each giving pethidine 20 mg in each group during 30-min periods in the recovery room. Black columns = group ACP+ (electroacupuncture treated; $n = 10$) cross-hatched columns = group ACP− (no treatment; $n = 10$). Two patients in group ACP+ required no analgesia for 2 and 6 h after operation.

TABLE II. *Median (range) of visual analogue scale scores for pain, drowsiness and nausea. Scale from 0 = no distress to 100 = worst possible. Both groups had the same amount of postoperative distress after 2 h and 6 h in the recovery room* (P = 0.05)

	Pain		Drowsiness		Nausea	
	2 h	6 h	2 h	6 h	2 h	6 h
Group ACP+ ($n = 10$) (Electroacupuncture)	48.5 (18–75)	30 (0–76)	64.5 (20–96)	41 (6–80)	0 (0–28)	13 (0–51)
Group ACP− ($n = 10$) (No treatment)	62 (42–97)	54.5 (14–74)	90.5 (33–100)	50 (0–72)	16 (0–87)	18.5 (0–60)

During the total recovery room period of 6 h, the median pethidine requirement of group ACP+ (135 mg (range 0–210 mg)), was significantly smaller than that of the group not receiving electroacupuncture (175 mg (100–300 mg)) ($P = 0.01$) (fig. 2).

The total numbers of Prominject press-button activations, each delivering 20 mg of pethidine, during 30-min periods are shown for the two groups in figure 3. It is clear that the patients in group ACP− had a greater opioid requirement during the first 2 h than during the last 4 h. This was not found in group ACP+.

VAS scores

Visual analogue scoring revealed a similar degree of postoperative pain, nausea and drowsiness, at both 2 and 6 h ($P > 0.05$) (table II). There was a tendency towards less nausea in group ACP+, with only two patients having mild nausea, compared with six patients in group ACP−.

DISCUSSION

The results of the present study indicate an effect of electroacupuncture (EA) on postoperative pain relief after lower abdominal operations in women. There was a significant difference between the treated group (ACP+) and the control group (ACP−) during the first 2 h after operation in terms of pethidine requirements. Two patients in group ACP+ did not self-administer any pethidine during the course of the study.

The groups were comparable for subjective assessment of postoperative distress, suggesting equal compliance in use of the patient-controlled demand infusion pump system. The patients in group ACP+ received nitrous oxide for an extra 20 min after wound closure, but there is no reason to believe that this should account for better postoperative analgesia.

It is noteworthy that, in another controlled trial in which patients were treated with EA, transcutaneous nerve stimulation (TNS) or pethidine after operation, the use of EA and TNS during

recovery was associated with better pain relief than pethidine alone. Furthermore, analgesia lasted longer and it increased with repeated treatment [2].

Our data suggest that the effect of EA lasted only approximately 2 h as indicated by opioid requirements. This is consistent with other studies of acupuncture and pain.

The patient-controlled demand pump was found to be satisfactory by all patients. The rate of consumption of pethidine in the ACP– group during the last 4 h was similar to that noted by Tamsen and colleagues [4] after abdominal operations.

In conclusion, the present study has demonstrated that electroacupuncture given immediately after lower abdominal surgical procedures significantly reduced opioid requirements in the first 2 h.

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