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The Analgesic Effect of Electroacupuncture and Pethedine Hydrochloride on Postoperative Pain: A Double Blind Study

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Abstract

The results of this study showed that electroacupuncture has a good effect on postoperative pain relief after lower abdominal operations in females. The pethidine requirements in patients who were electroacupuncture treated were 55.8% of that required by non electroacupuncture treated patients in the first two postoperative hours. In the next six postoperative hours the electroacupuncture treated patietns consumed 86.4% pethidine that consumed by the non electroacupuncture treated pateints. The electroacupuncture treated patients required 71.8% pethidine required by non electroacupuncture treated patients in the whole early eight postoperative hours. Electroacupuncture reduces the pain score postoperatively and reduces the dose of opioids needed to control the postoperative pain.

Introduction

POSTOPERATIVE pain relief had attracted the attention of surgeons and anaesthestists. Inadequate analgesia postoperatively may affect the whole postoperative period as it may cause an unplanned hospital admission that erodes the intended benefits of economy and convenience in day case surgery.

The scope for improvement in postoperative pain relief includes not only those approaches that increase the effectiveness whilst reducing the risk to life, but also those that increase the patients acceptance of the treatment by not eroding their sense of well-being [1].

Opioids are the traditional treatment for major postoperative pain. Whatever the route of administration of opioids, they carry a risk dangering life and the time of risk is markedly different. Many trials were made to avoid these risks of opioids by controlling the dose of opioids or reducing it by using adjuvants for analgesia [2].

Transcutaneous electrical nerve stimulation (TENS) and electroacupuncture (EA) are non-pharmacological approaches directed for analgesia to treat acute and chronic pain. Electroacupuncture analgesia is a method for pain relief developed on

the basis of body needing. It combines Chinese tradition and Western medicine. It has been re-evaluated in recent years following renewed political contract with china [3].

This study is a trial to evaluate the effect of electroacupuncture on postoperative pain relief. It is designed to eliminate the need for a placebo control. Patient controlled analgesia is used for objective assessment of pain.

Patients and Methods

The material of this study was 30 female patients. They were divided into two equal groups. The total number of patients was 30 female patients, with age ranging from 20 to 60 years old and they were ASA class I or II. Patients were admitted to hospital for abdominal hysterectomy, tubal surgery or elective caesarean section. All patients were investigated pre-operatively for blood chemistry, haemoglobin level, blood pressure, heart rate and ventilatory frequency. Non educated patients or non co-operative patients were excluded from this study. Also patients under psychotropic drugs were excluded.

A stadnard technique of anaesthesia was used for both groups. Diazepam 5 mg, by mouth was given two hours before operation. A venous cannula was inserted in the anticubital vein for each patient and a Ringer's solution was given in ml kg^{-1} hours basis. Induction for both groups was done by intravenus sodium thiopentone 2.5% (4-7 mg kg^{-1}) as a sleeping dose. Endotracheal intubation was facilitated by suxamethoinium (1 mg kg^{-1} body weight) and an oral cuffed endotracheal tube was inserted under vision, then the cuff was inflated. Anaesthesia was maintained with halothane 1% vaporised in 33% oxygen and 67% nitrous oxide. Atracurium (0.5 mg kg^{-1} body weight) was used for muscle relaxation. Increments of atracurium (10 mg) were given when needed guided by the use of peripheral nerve stimulator.

Fentanyl was given intra-operatively in a dose of 1.5 to 3 μg $kg^{-1}$to provide intra-operative analgesia. At the end of operation halothane was switched off and patient was maintained on oxygen 33% and nitrous oxide 67% till the end of electroacupuncture. Reversal of muscle relaxation was given at the end of electroacupuncture by neostigmine (0.05 mg kg^{-1}) and atropine (0.02 mg kg^{-1}).

Electroacupuncture:

The loci were selected from standardised acupuncture formulae for anaesthesia in hysterectomy [4,5]. After bandage placement on the surgical wound, the patients were placed on their side, while still anaesthetised after completion of surgery. Sterile transparent dressings 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 patient was returned to the supine position. Electroacupuncture was given with the following variables: pulse width 320us, approximately 12V, chain frequencies of 10 and 100 Hz [6].

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 [1].

The Acupuncture Loci Are:

The loci were selected from standardized acupuncture formulae for anaesthesia in hysterectomy [4,5].

GV2 = Govenor vessel (Tu Mo)2,

Fao-Iu, Yaoshu, in the dorsal midline between the coccyx and sacrum, in the middle of the sacral hiatus. Needling by slanting insertion slightly upwards, 1 tsun deep. GV4 + Governor vessel (Tu Mo)4, Ming Men, in the dorsal midline below the spinous process of the second vertebra. Needling by slanting insertion slightly upwards, 1 tsun deep. B 32 + Bladder 32, Ciliao, Tz Uliao, bilaterally on the second posterior sacral foremen and midway between the lower part of the posterior superior iliac spine and the median line. Needling by straight insertion, 1.53 tsun deep. SP 6 = Spleen 6, Sanjiniao, bilaterally on the medial edge of the tibia, four fingers widths above the tin of the medial malleolus. Needling by straight insertion 1.5-2 tsun.

The apparatus used for electroacupuncture was JS 2400 electronic point detector and our channel stimulator, made in England.

Post-operative Analgesia:

Pethidine was given to the patients postoperatively on their request. The study was a complete double blind study. The patients, the resident doctors and the nurses knew nothing about whom of the patients received electroacupuncture.

The pethidine dose given in the first 2 hours postoperatively was 20 mg pethidine and 10 mg in the last 6 hours. The smallest interval allowed between doses was 10 minutes. The pethidine was given intravenously and each dose given was recorded with its time of injection.

The blood pressure, pulse rate and respiratory rate were recorded every 30 minutes in the first 2 hours, then every hour in the last 6 hours. After 2 hours postoperatively the patient was asked to complete a 100 mm, vertical numerical analogue scale for pain, nausea and drowsiness (0 = no trouble to 100 = worst possible) [1]. After 6 hours the recordings were repeated.

Statistics:

Statistical analyses were performed using nonparametric tests: Wilcoxon Rank Sum test for paired differences and Mann-Whitney Rank Sum Test for unpaired differences. p value less than 0.05 was regarded as significant.

Results

The two groups of this study were similar regarding age, weight, duration and type of operation. All patients were aroused easily upon arrival in the recovery room. Blood loss did not exceed 500 ml in any patient and blood transfusion was not needed for any patient.

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

Pethidine Requirements (Tables 1,2 and Figs. 2,3):

According to the patient demands, the pethidine were recorded and grouped into two periods: during the first 2 hours of postoperative period.

In non-electroacupuncture group (NEA), the pethidine requirement in the first 2 hours postoperatively was (90.67±21.2 mg) and the range was from 60 to 120 mg and the pethidine requirements in the following 6 hours (98.67±3.02) and the range were from 80 to 130 mg and the total pethidine requirement in the whole 8 postoperative hours was (189.3±28.1) and the range was from 140 to 230 mg.

In electroacupuncture group (EA), the pethidine requirement in the first 2 postop-

erative hours was (50.67±31.05) ranging from 0 to 100 mg. Two patients of this group received no pethidine in the first two postoperative hours. The mean pethidine requirement of this group was 55.8% of that same period of NEA group. The difference was statistically highly significant ($p < 001$). In the next six hours the pethidine requirement was (85.3±17.3) ranging from 20 to 120 mg. This was 86.4% of that required for non electroacupuncture group. The difference between the two groups was significant ($p < 0.05$).

The total pethidine received in the first 8 hours postoperatively was (136.0±40.3) ranging from 60 to 180 mg which was 71.8% of that of non electroacupuncture group. The difference was statistically significant ($p < 0.005$).

Visual Analogue Scale Scores (VAS):

Visual analogue scale scoring was done at 2 hours and 8 hours postoperatively for pain, drowsiness and nausea.

VAS for pain was statistically of significant difference between the two groups with high pain score in the non electroacupuncture group ($p < 0.05$) but the difference in the next 6 hours was statistically insignificant ($p > 0.05$) (Fig. 4).

VAS for drowsiness was more in the electroacupuncture group in the whole eight hours postoperatively but the difference was statistically insignificant ($p > 0.05$) (Fig. 5).

VAS for nausea which was more in non electroacupuncture group in the first two hours postoperatively but nausea was more in the next 6 hours in the electroacupuncture group. The difference between the two groups of study was statistically insignificant ($p > 0.05$) (Fig. 8).

Table (1): Patients Data, Median Values (Range).

	Age (yr)	Weight (kg)	Duration of opertion (min)
Group I No EA (n = 15)	42.5 (27-50)	69.5 (55-76)	145 (105-165)
Group II EA (n = 15)	41.5 (22-52)	74.5 (52-85)	142.5 (110-160)

Table (2): Pethidine Requirements Post-Operatively by Electroacupuncture Patients and Non Electroacupuncture Patients (Mean ± S.D.) (mg).

	Non EA patients	EA patients	Significance
0-2h	90.67 ± 21.20	50.67 ± 31.05	Sign. **
2-8h	98.67 ± 13.02	85.3 ± 17.3	Sign. **
Total pethidine at 8h	189.3 ± 28.1	136.0 ± 40.3	Sign. **

EA = Electroacupuncture ** = Significant

Table (3): Pain Score, Drowsiness Score and Nausea Score at 2 Hours and 8 Hours Post-Operatively (Mean ± S.D.).

	Non EA patients	EA patients	Significance
Pain score			
2h	50.33 ± 17.16	33.33 ± 20.24	Sig. **
8h	38.67 ± 14.57	33.67 ± 20.22	N.S
Drowiseness score			
2h	50.33 ± 25.18	55.33 ± 19.86	N.S
8h	36.67 ± 18.39	38.33 ± 19.06	N.S
Nausea score			
2h	16.67 ± 22.49	13.33 ± 20.85	N.S
8h	20.00 ± 23.53	30.00 ± 27.06	N.S

EA = Electroacupuncture ** = Significant N.S = Non significant

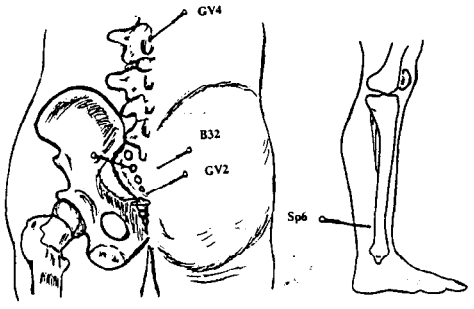
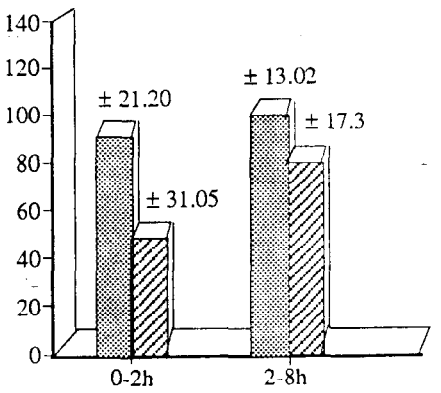


Fig. (1): Acupuncture loci. GV 2 = Govenor vessel 2, in the dorsal midline between the coccyx and sacrum; GV4 = Govenor vessel 4, in the dorsal midline below the spinal process of the 2nd lumbar vertebra; B32 = Bladder 32, bilaterally in the second sacral foramen; Sp6 = Spleen 6, bilaterlly on the medial edge of the tibia, four fingerwidths above the tip of the internal malleolus.



Non EA = Non electroacupuncture patients.
EA = Electroacupuncture patients.

Fig. (2): Pethidine repuirements (mg.) post-operatively by electroacupuncture patienets and non electroacupuncture patients (mean ± S.D.)

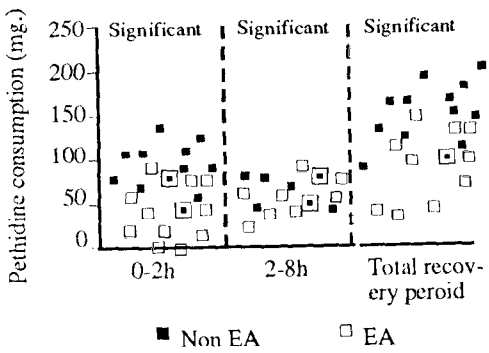
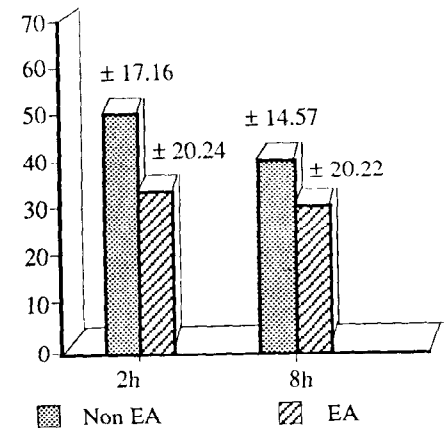
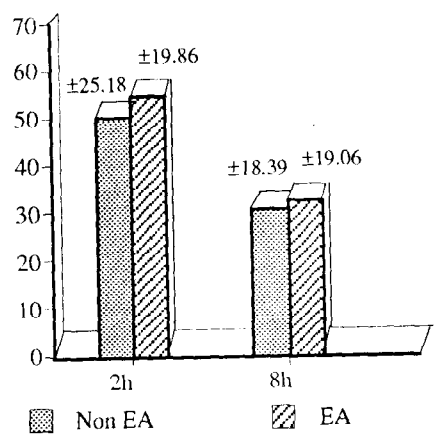


Fig. (3): Pethidine repuirements of patietns in group EA (electroacupuncture treated; n = 15) and group Non EA (no treatment; n = 15) after the first 2h, the subsequent 6h and during the total recovery peroid.



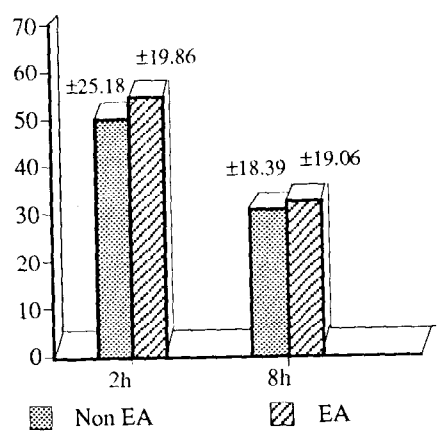
Non EA = Non electroacupuncture treated group
EA = Electroacupuncture treated group

Fig. (4): Pain score (0-100 mm) at 2 hours and 8 hours postoperatively (meas ± S.D.).



Non EA = Non electroacupuncture treated group
EA = Electroacupuncture treated group

Fig. (5): Drowsiness score (0-100 mm) at 2 hours and 8 hours postoperatively (mean ± S.D.)



Non EA = Non electroacupuncture treated group
EA = Electroacupuncture treated group

Fig. (6): Nausea score (0-100 mm) at 2 hours and 8 hours postoperatively (mean ± S.D.).

Discussion

Both surgeons and anaesthetists are now more prepared to exert pressure to allocate resources of the provision for acute postoperative pain, knowing that the therapeutic options now available should yield more effective returns for the price that needs to be paid.

The opioids are the traditional treatment for major pain, by actions thought to

be largely within the CNS; however, there are types of acute pain that are opioid sensitive and types that are less so [2].

Of the non-opioids, the prostaglandin synthetase inhibitors have traditionally played a supporting role for less severe pain, by actions perceived as being largely peripheral at the site of tissue injury and inlfammation.

Local anaesthetics have recognized usefulness in blocking the conduction between the peripheral and central processes, as well as in acting directly on the spinal cord after intratheacal injection [7].

Relative newcomers to the list are drugs for which analgesia has not so far been considered to be the prime action e.g. ketamine [8] the α -2 adrenergic blocker, clonidine [9] antidepressant drugs and cogeners such as clomipramine and flurandoline [10] and the channel blocker, nifedipine [11].

The scope for improvement in pain relief includes not only those approaches that increase the effectiveness whilst reducing the risk to life, but also those that increase the patients' acceptance of the treatment by not eroding their sense of well-being.

Transcutaneous electrical nerve stimulation (TENS) [12] and acupuncture [13] are non pharmacological approaches directed at altering the balance of naturally occurring substances in the CNS a well, perhaps, as exploiting the pyschological or placebo-effect that there must be with any proccdure.

Though electroanalgesia does have a place for particular problems, it has not yet proved sufficiently reliable to have established itself as one of the routine measures against routine postoperative pain.

The scope of this study is to reduce opioids administration for postoperative pain relief using electroacupuncture analgesia in a way to reduce the incidence of opioid administration complications.

In the present study, the results indicate a good effect of electroacupuncture (EA) on postoperative pain relief after lower abdominal operations in femails. For pethidine requirements, there was a significant difference between EA treated group and the non EA group.

The significant differences were found in the first 2 postoperative hours, the next 6 postoperative hours and in the whole first 8 postoperative hours. The pethidine requirement in the first 2 postoperative hours was 55.8% in the EA group in relation to non EA group. In the next 6 hours pethidine requirement by EA group was 85.3% of that non EA group the total pethidine requirement by EA group in the 8 postoperative hours was 71.8% of that of non EA group. Two patients of EA group received no analgesia in the first 2 postoperative hours.

All these are proves for analgesic effect of electroacupuncture on postoperative pain. Christensen, et al. [1] found nearly the same results in their study on the effect of electroacupuncture on postoperative pain relief.

Martelete and Fiori [14] showed that patients treated after operation in the recovery room with electroacupuncture needed half the quantity of opioid to control pain as group not receiving electroacupuncture.

The patients of the present study in the electroacupuncture treated group received nitrous oxide for an extra 20 minutes after wound closure, but there is no reason to believe that this should account for better

postoperative analgesia.

The rate of consumption of pethidine in the non electroacupuncture treated group during the early postoperative period was similar to what noted by Tamsen and his colleagues [12] in pateints after abdominal operations.

Electroacupuncture has a sedating effect beside its analgesic effect in the early postoperative period. Pain score was significantly lower in the electroacupuncture treated in the whole 8 postoperative hours which was reflected on pethidine requirements by those patients.

In conclusion, the present study has demonstrated that electroacupuncture when given immediately after lower abdominal surgical procedures significantly reduced opioid requirements in the first 8 hours postoperatively.

Electroacupuncture analgesia was not accompanied by any side effects or complications. It is an easy, cheap and effective technique for postoperative relief of pain.

References

1- CHRISTENSEN P.A., NOEENG M., ANDERSEN P.E. and NIELSEN J.W.: Electroacupuncture and postoperative pain. Br. J. Anaesth., 62: 258-262, 1989.

2- MCLINTOCK TTC., AIKEN H. and KENNY GNC: Postoperative analgesic requirements in patients exposed to positive intraoperative suggestions. Br. Med. J., 301: 788-790, 1990.

3- LEWITH G.T. and MACHIN D.: On the evaluation of clinical effects of acupuncture. Pain, 16-111, 1983.

4- CHAITOWL: The acupuncture treatment of pain, North Hamptonshire, england: Thorsons publishers Ltd, 1976.

5- BISCJ J.: An introduction to accupuncture. Germany, Haug Verlag. 120-165, 1978.

6- ERIKSSON M.B. and SJOLUND B.H.: Long-term results of peripheral conditioning stimulation as an analgesic measure in chronic pain. 6: 335-347, 1979.

7- WILDSMITH JAW: Developments in local anaesthetic drugs and techniques for pain relief. Brit. J. Anaes., 63: 159-164, 1989.

8- BRISTOW A. and ORLIKOWSKI: Subcutaneous ketamine analgesia: Postoperative analgesia using subcutaneous infusions of ketamine or morphine. Annals of the Royal College of Surgeons of England. 71: 64-66, 1989.

9- BONNET F., BOICO O., ROSTAING S., LORIFESNE J.F. and SANDA M.: Clonidine-induced analgesia in postoperative pateitns: epidural versus intramuscular adminstration. Anaesthesiology, 72: 423-427, 1990.

10- HILL R.G.: New analgesics - a status report. Current opinion in Anaesthesthiology, 1: 367-371, 1988.

11- CART F., BIANCHI M., ARGENTON S., CERVI D., MARALLO G., et al.: Effect of nifedipine on morphine-induced analgesia. Anaesthesia and Analgesia, 70: 493-498, 1990.

12- MERRIL D.C.: Clinical evaluation of fast TENS, an inexpensive, disposable transcutaneous electrical nerve stimulator designed specifically for postoperative electroanalgesia. Urology, 33: 27-30, 1989.

13- BOWSHER D.: The physiology of acupuncture. Journal of the Intractable Pain Society, 5: 15-18, 1989.

14- MARTILITE M. and FIORI A.M.: Compar-

ative study of the analgesic effect of transcutaneous nerve stimulation (TNS), electroacupuncture (EA) and meperidine in the treatement of postoperative pain. Acupunct. Electrother. Res. 10: 183-193, 1985.

15- TAMSEN A., HORTWING P., FAGERLUND C., DAHLSTROM B. & BONDESSON V.: Patient controlled analgesia therapy: Clinical experience. Acta Anaesthesiologica Scandinavica (Suppl), 74: 157, 1982.