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Acupuncture anesthesia for open heart surgery in contemporary China ☆

Jia Zhou [a], Hao Chi [a], Tsung O. Cheng [b,*], Tong-yu Chen [a], Yao-yao Wu [a], Wen-xiong Zhou [a], Wei-dong Shen [a], Lan Yuan [a]

[a] Department of Cardiothoracic Surgery, Shu Guang Hospital affiliated with the Shanghai Traditional Medicine University, Shanghai, China
[b] Department of Medicine, George Washington University Medical Center, 2150 Pennsylvania Avenue, N.W., Washington, D.C., USA

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ABSTRACT

Background: Although the use of acupuncture anesthesia for open heart surgery, which was introduced in China four decades ago, has declined in recent years, there is a renewed interest in it in contemporary China due to the escalating medical costs associated with open heart surgery. This study was aimed to determine whether a combined acupuncture–medicine anesthesia (CAMA) strategy reduces early postoperative morbidity and medical costs in patients undergoing open heart operation under cardiopulmonary bypass.
Methods: From July 2006 to October 2010, CAMA was applied in 100 patients undergoing open heart surgery in comparison with another 100 patients under the conventional general anesthesia (GA). For all the CAMA patients, an abdominal breathing training program was practiced for the 3 consecutive days prior to operation. About 15 to 20 min prior to surgical incision, acupuncture needles were inserted into the bilateral points ZhongFu, LieQue, and XiMen. During operation, patients were kept on spontaneous breathing. Endotracheal intubation was not employed but only prepared as a standby. The narcotic drugs, fentanyl and midazolam, were intravenously injected but in very low doses as compared to GA. Open heart procedures were performed routinely in both groups.
Results: Compared with the GA patients, the CAMA patients had a less usage of narcotic drugs ($p<0.001$), less postoperative pulmonary infection ($p<0.05$), shorter stay in intensive care unit ($p<0.05$), and a lower medical cost ($P<0.05$).
Conclusions: A combined acupuncture–medicine anesthesia strategy reduces the postoperative morbidity and medical costs in patients undergoing open heart surgery under cardiopulmonary bypass.

1. Introduction

Open heart surgery performed under acupuncture anesthesia or acupuncture anesthesia combined with narcotic drugs has been reported several decades ago [1–3]. The advantages of acupuncture anesthesia are its simplicity in application and reduction in early postoperative complications as a result of the avoidance of general anesthesia and endotracheal intubation during open heart surgery. On the other hand, due to its obvious disadvantages and limitations such as a sophisticated preoperative preparation and lack of adequate muscle relaxation, it did not gain a widespread acceptance by both the patients and the operating surgeons. However, there is currently a renewed interest of performing open heart surgery under acupuncture anesthesia in contemporary China owing to the great concerns about the escalating medical costs associated with open heart surgery, particularly with the use of expensive anesthetic drugs and respiratory assisted devices and eventful postoperative complications including infections that necessitate the use of expensive antibiotics.

In this observational study, we sought to examine whether a strategy of combined acupuncture anesthesia with narcotic medicines reduces early postoperative morbidity and medical costs in patients undergoing open heart operation under cardiopulmonary bypass (CPB).

2. Patients and methods

Between July 2006 and October 2010, open heart surgery was performed in 100 patients under combined acupuncture–medicine anesthesia (CAMA) while another 100 patients underwent open heart surgery under conventional general anesthesia (GA) during the same period of time. All patients in the CAMA group were aware of the process of combined acupuncture–medicine anesthesia, and they all signed the informed consent. The patients' ages ranged from 14 to 74 years. They had no prior heart operations, no severe mental disorder, and New York Heart Association Functional Class I–III. The estimated aortic clamping time should be less than 150 min during the operation. Patients' demographic information as related to their

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* Corresponding author. Tel.: +1 202 741 2426; fax: +1 202 741 2324.
E-mail address: tcheng@mfa.gwu.edu (T.O. Cheng).

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age, gender, pre-operative conditions and the types of operation are summarized in Table 1.

2.1. Abdominal breathing training before surgery

Abdominal breathing training was performed in all CAMA patients for the 3 consecutive days prior to operation in the in-patient department or at home. A 3–5 kg sandbag was put on the chest of the patient to encourage breathing with their abdominal muscles (Fig. 1). This training was repeated 3 times per day with 30 min each time. The training result was considered ideal if the patient fell asleep with the sandbag on the chest.

2.2. Anesthesia during operation

2.2.1. CAMA group

About 15–20 min before surgical incision, acupuncture needles were inserted into the following acupuncture points bilaterally: ZhongFu (LU 1), LieQue (LU 7) and XiMen (PC 4) (Figs. 2 and 3). After the patients attained Qi (气) from the twisting of the acupuncture needles, the proximal ends of the needles were connected to an electrical stimulator apparatus (Shanghai High-Tech Medical Equipment Company, Shanghai, China). This apparatus could export an instant electrical vibrating stimulation (frequency 200 times/min, magnitude 3–4 Hz) and the output intensity was adjustable according to the tolerance of the patient. The induction time was around 20–30 min. The acupuncture stimulation was suspended when cardiopulmonary bypass (CPB) was started, and restarted as the CPB pump flow was down to 1.5 L/min. On sternal closure, the frequency and intensity of electrical stimulation were again increased to avoid any patient discomfort. The acupuncture needles were removed when the operation was completed. All the patients received intramuscular injections of morphine (1 mg/kg) at the beginning of anesthesia induction. Before skin incision, fentanyl 0.1 mg and midazolam 2 mg were injected intravenously. In addition, local subcutaneous anesthesia with lidocaine 20–30 ml of 0.25% was used immediately before median sternotomy. During the operation, additional doses of fentanyl and midazolam were given whenever necessary especially during sternal closure. All patients were kept in a condition of painless, light sleep and spontaneous respiration.

Table 1
Patients' demographic information and the types of operations.

	CAMA group (n = 100)	GA group (n = 100)	P value
Gender			
Male	63	57	NS
Female	37	43	NS
Age (average, years)	51.3	53.8	NS
Pre-operative conditions			
Smoking	34	41	NS
Diabetes	27	25	NS
Hypertension	35	37	NS
Chronic heart failure	57	55	NS
Cerebrovascular accident	3	7	NS
Chronic obstructive lung disease	5	7	NS
Heart function (NYHA)			
I	8	3	NS
II	67	60	NS
III	25	37	P<0.05
Pre-operative findings			
Atrial fibrillation (case)	54	49	NS
Ejection fraction (average) %	53.6	52.3	NS
Estimated mean pulmonary pressure (mmHg)	28.4	31.2	NS
Surgical procedures			
Congenital diseases corrective operations (case)*	19	4	P<0.05
Mitral valve valvuloplasty (case)**	2	8	NS
Heart valve replacement (case)***	79	88	NS

* Including atrial septal defect, ventricular septal defect, pulmonary valvular stenosis, tetralogy of Fallot.

** Including annuloplasty ring implant.

*** Including mechanical or bioprosthetic mitral valve, aortic valve or double valve replacement with or without tricuspid valvuloplasty, including radio-frequency ablation when necessary.

2.3. Respiration management

All patients were ideally kept on spontaneous breathing without endotracheal intubation. Facial or larynx mask was used sometimes whenever necessary. During the entire surgical procedure, endotracheal intubation was prepared as a standby. In case of necessity, conventional general anesthesia could be applied within a couple of minutes.

2.3.1. GA group

Narcotic drug usage in this group of patients included a routine intramuscular morphine injection (1 mg/kg) for premedication. Anesthesia was induced by fentanyl (10–20 μg/kg) and midazolam (0.1–0.4 mg/kg) intravenously. Then endotracheal intubation was facilitated by vecuronium (0.1–0.15 mg/kg) intravenous injection. Another dose of fentanyl (2–5 μg/kg) was injected during skin incision and sternotomy. When CPB began, midazolam (0.1–0.4 mg/kg) and vecuronium (0.02–0.1 mg/kg) were given. These drugs were given every 1–2 h. When the rewarming started, midazolam (0.1–0.4 mg/kg) and vecuronium (0.05–0.1 mg/kg) were given. The, vecuronium (0.05–0.1 mg/kg) was given continuously every 0.5–1 h till the end of the operation and fentanyl was used according to the blood pressure and heart rate responses. Mechanical ventilation (Datex-Ohmeda, Bromma, Sweden) was used in all patients in this group. Tracheal tubing was pulled out in the operation room or in the ICU in accordance with the patient's recovery status.

2.4. Operation and CPB management

2.4.1. CAMA group

All patients were operated with a median sternotomy. To avoid the rupture of pleura, a tunnel beneath the sternum was made before sawing the sternal bone by blunt dissection and putting a gauze through the tunnel to push the pleura away from both sides. After sawing, the sternal bone was retracted slowly to prevent patient from any respiratory instability. Cardiopulmonary bypass was started gradually with a roller pump (Stockert, Munich, Germany) and a membrane oxygenator (Dideco, Mirandola, Italy). The body temperature was cooled down gradually to 32 °F. When CPB was started, patient's respiration slowed down gradually to a suspended or shallow state, and it ceased as CPB reached full flow. Before release of the aortic cross-clamp, facial mask ventilation was performed routinely by the anesthesiologist as spontaneous respiration would appear as the pump rate slowed down. CPB was terminated as respiration returned to normal. If respiration was not stable after CPB, facial mask ventilation was continued. If patient's breathing was difficult to restore and the pulse oxygen saturation remained below 95% for 1 min, a laryngeal mask or even endotracheal intubation was employed.

2.4.2. GA group

All patients were operated with a median sternotomy, and the CPB was instituted in a routine manner.

2.5. Statistical analysis

Statistical analysis was performed using the SPSS 11.0 statistic package (SPSS Inc., Chicago, IL USA). The continuous data were compared using the unpaired Student's t-test. The Chi-square test was