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Original Contribution

Effects of stellate ganglion block on cardiovascular reaction and heart rate variability in elderly patients during anesthesia induction and endotracheal intubation

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Abstract

Study Objective: To investigate the effects of stellate ganglion block (SGB) on cardiovascular response and heart rate (HR) variability in elderly patients during anesthesia induction and endotracheal intubation.

Design: A randomized, double-blinded, and placebo-controlled study.

Setting: University-affiliated teaching hospital.

Participants: Eighty elderly patients (American Society of Anesthesiologists grades I and II) receiving elective surgery during general anesthesia.

Interventions: Right stellate ganglion injection (SGB) was performed in all patients using 10 mL of 1% lidocaine or normal saline.

Measurements: Systolic blood pressure (BP), diastolic BP, HR, and calculated rate pressure product. HR variability at the following time points: conscious status before induction (T_0); immediately before intubation (T_1); immediately after intubation (T_2); and 1, 3, and 5 minutes postintubation (T_3, T_4, and T_5).

Main Results: No significant differences in BP and HR were observed between the 2 groups. Rate pressure product values significantly increased in the control group compared with baseline and SGB group values. Low-frequency power (LF) and LF/high-frequency power (HF) significantly increased, and HF and normalized units of HF significantly decreased in the control group compared with baseline values. LF, normalized units of LF, and LF/HF in the SGB group significantly decreased compared with those of the control group.

Conclusion: SGB protects the myocardium and effectively suppresses stress responses during anesthesia induction and tracheal intubation in elderly patients.

1. Introduction

As elderly patients exhibit decreased, poor reserve, and compensatory capability of organs as well as increased sensitivity of the cardiovascular system to anesthetic drugs,

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anesthesia induction and endotracheal intubation may lead to hemodynamic instability, which increases the risk during anesthesia and surgery [1,2]. Maintaining hemodynamic stability, especially during induction and endotracheal intubation, is important [3,4]. Several approaches are used clinically to reduce cardiovascular responses during anesthesia induction and endotracheal intubation. Medicines that regulate the function of the cardiovascular system, such as esmolol, labetalol, nitroglycerin, and clonidine, for example, are widely applied [5-8]. The use of lidocaine as topical anesthesia for pars laryngeal pharynges has been reported [9], and increasing the dosage of anesthetic medicines to inhibit reactions of the cardiovascular system is a common practice [10]. The results of these techniques, however, are not always satisfactory.

Stellate ganglia are formed from the fusion or adjoining of the inferior cervical ganglion and the first thoracic ganglion. The postganglionic fibers are widely distributed in the blood vessels; smooth muscles; and glands of the head, neck, face, upper limbs, lungs, trachea, and heart [11]. Stellate ganglion block (SGB) has been used to manage pain [12,13] and treat various diseases caused by sympathetic overexcitation through increased blood flow; improved hemodynamics; and regulation of the central nervous, immune, and endocrine systems [14,15]. The effects of SGB on the cardiovascular system remain controversial. Blockade of the right stellate ganglion has been believed to be beneficial to the cardiovascular function by regulating cardiac sympathetic nervous functions without affecting hemodynamics [16,17].

This study investigates the effects of SGB on organ stress responses in elderly patients during anesthesia induction and endotracheal intubation. Patients were anesthetized with SGB (SGB group) or without SGB (control group), and various parameters of cardiovascular reaction and heart rate (HR) variability (HRV) were monitored and analyzed.

2. Materials and methods

2.1. General data

This study had a randomized, double-blind, and placebo-controlled design. Approval was obtained from the Ethics Committee of the Affiliated Hospital of Wannan Medical College, and written informed consent was obtained from each participant. Eighty patients older than 65 years (American Society of Anesthesiologists [ASA] grades I and II) who had been scheduled for elective upper abdomen surgery during general anesthesia were enrolled in this study. Patients with ischemic heart disease, hypertension, kidney dysfunction, or diabetes mellitus were excluded.

2.2. Anesthesia procedure

Thirty minutes before anesthesia, 0.1 g of phenobarbital sodium (Mindong Lijiexun, Fujian, China) and 0.3 mg of scopolamine (Hefeng, Shanghai, China) were injected intramuscularly. After entering the operation room, the patients were given inhaled oxygen and conventional fluid infusion and connected to a Huaxiang HXD-I monitor (Huaxiang, Heilongjiang, China) to monitor electrocardiogram, blood pressure (BP), and pulse oxygen saturation. In the SGB group (n = 40), right SGB was performed via C7 access using 10 mL of 1% lidocaine (Jinyao Amino Acid, Tianjin, China) 15 minutes before anesthesia induction. After 5 minutes, blocking effects were evaluated, and successful SGB was determined by Horner sign, which includes symptoms of narrowed ipsilateral palpebral fissure, enophthalmos, miosis, facial anhidrosis, flushing, and constriction of the ipsilateral pupil by over one-third of the contralateral one. Patients in the control group (n = 40) received the same volume of normal saline injected over the same period.

Patients were stabilized for 10 minutes (baseline point) and slowly induced with 0.08 mg/kg midazolam (Enhua, Jiangsu, China), 2 mg/kg propofol (Astra Zeneca, Italy), 4 μg/kg fentanyl (Renfu, Hubei, China), and 0.6 mg/kg Rocuronium (O.V. Organon, OSS) sequentially. Ninety seconds after induction, endotracheal intubation was performed by anesthesiologists with over 5 years of experience. Mechanical ventilation was provided after endotracheal intubation at a tidal volume of 8-10 mL/kg, respiratory rate of 10 breaths/minute, and end-tidal carbon dioxide partial pressure of 35-45 mm Hg. Patients with airway management difficulty (Mallampati III and IV) as well as those not exhibiting Horner syndrome were excluded.

2.3. Parameter measurement

An anesthesiologist blinded to the intervention evaluated cardiovascular responses during anesthesia induction and endotracheal intubation. Systolic BP (SBP), diastolic BP (DBP), and HR were measured, and rate pressure product (RPP) were calculated as RPP = HR × SBP. The parameters used to evaluate HRV, including total power (TP), low-frequency power (LF), high-frequency power (HF), and LF/HF, were recorded at the following time points: baseline (T_0); immediately before intubation (T_1); immediately after intubation (T_2); and at 1, 3, and 5 minutes postintubation (T_3, T_4, and T_5). Normalized units of LF and HF (LFnu and HFnu) were calculated according to the following formulas: LFnu = LF/TP × 100% and HFnu = HF/TP × 100%.

2.4. Statistical analysis

Data are shown as mean ± SD. Intragroup comparisons were performed using repeated analysis of variance, whereas intergroup comparisons were performed using single-factor analysis of variance. $P < .05$ was considered statistically significant.