Journal of Clinical Anesthesia (2015) **27**, 504–507

Journal of Clinical Anesthesia

Original Contribution

The effect of remifentanil on the minimum alveolar concentration of isoflurane in children☆,☆☆

Ben-zhen Chen MD [a,b], Qin-jun Chu MD [c], Jing-rui Yu MD [d], Yu-sheng Yao MD [e], Ling Tan [a,*]

[a]*Department of Anesthesiology, West China Hospital, Sichuan University, Chengdu, Sichuan, China*
[b]*Department of Anesthesiology, Sichuan Provincial Hospital for Women and Children, Chengdu, Sichuan, China*
[c]*Department of Anesthesiology, The First Affiliated Hospital of Zhengzhou University, Zhengzhou, Henan, China*
[d]*Sichuan Provincial Hospital for Women and Children, Chengdu, Sichuan, China*
[e]*Department of Anesthesiology, Fujian Provincial Hospital, Fuzhou, Fujian, China*

Received 1 November 2013; revised 4 February 2015; accepted 26 March 2015

Keywords:
Remifentanil;
Isoflurane;
Minimum alveolar concentration;
Children

Abstract

Study objective: To evaluate the effect of remifentanil on the isoflurane end-tidal concentration required to eliminate movement reaction upon surgical incision in children.

Design: Prospective, double blinded, serial study.

Setting: Operating room of a university-affiliated hospital.

Patients: Patients of ASA status 1 or 2, aged 4 to 7 years, scheduled for either inguinal hernia repair or orchidopexy surgery with general anesthesia.

Interventions and measurements: After endotracheal intubation, 108 children serially received 1 of 6 dose (nil, 0.05, 0.10, 0.15, 0.20, or 0.25 μg kg^{-1} min^{-1}) of remifentanil. End-tidal isoflurane concentration was adjusted according to a Dixon's up-and-down approach. Twenty-five minutes after starting the remifentanil infusion, the surgical incision was performed. The response of patients was classified as either "response" or "no response." Response was defined as a purposeful response in response to skin incision.

Main Results: The MAC of isoflurane were 1.50 ± 0.16%, 1.33 ± 0.27%, 0.93 ± 0.13%, 0.73 ± 0.27%, 0.63 ± 0.19%, and 0.60 ± 0.15% for remifentanil infusion rates of nil, 0.05, 0.10, 0.15, 0.20, and 0.25 μg kg^{-1} min^{-1}, respectively.

Conclusion: The MAC of isoflurane decreased with increasing infusion rate of remifentanil, showing an initial step reduction followed by a ceiling effect.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

Anesthesiologists routinely combine different drugs to minimize their side effects and maximize their benefits. General anesthesia is often administered by using a combination of a volatile anesthetic and an opioid. The interaction

☆ Disclosure: This research is supported solely by department resources.
☆☆ Conflict of interest: None.

* Corresponding author. Department of Anesthesiology, West China Hospital, Sichuan University, No. 37, Guo Xue Xiang, Chengdu, Sichuan Province, 610041, China.
E-mail address: chenzhen19830320@163.com (L. Tan).

http://dx.doi.org/10.1016/j.jclinane.2015.03.026
0952-8180/© 2015 Elsevier Inc. All rights reserved.

between opioids and volatile anesthetics is complex. Defining this interaction provides a basis for more rational dosing schemes when such combinations are used for anesthesia and allows the anesthetic potency of remifentanil relative to other opioids to be determined. The minimum alveolar concentration (MAC) necessary to prevent movement in 50% of patients was defined originally by Eger and has become the standard measure of volatile anesthetic potency [1]. Opioids markedly reduce the concentrations of volatile anesthetic agents required to maintain anesthesia [2–4]. A rational intraoperative measure of opioid potency would be one directly related to the requirement for volatile anesthetic. This interaction may be studied in terms of a decrease of the MAC of a volatile anesthetic by differing doses of opioid [2,5]. Therefore, it is important to define the properties of the interaction between the different anesthetic drugs that may be used in combination.

Remifentanil is a novel synthetic opioid receptor agonist. An ester linkage makes this 4-anilidopiperidine derivative susceptible to rapid metabolism by esterases in plasma and tissues [6]. Its context-sensitive half time of approximately 3 to 5 minutes and rapid onset make it an easy drug to control for achieving the desired depth of anesthesia [7].

The ability of fentanyl to decrease anesthetic requirements in children has been studied previously [5,8,9]. The advantage with remifentanil is that it can be used relatively high infusion rates and yet still maintain a rapid decrease in opiate concentration. The effect of remifentanil in reducing the MAC of isoflurane has been demonstrated in adults [3]. The effect of remifentanil on isoflurane MAC in children remains to be determined. In this study, we evaluated the effect of remifentanil on the isoflurane end-tidal concentration required to prevent a movement reaction upon surgical incisions in 50% of children undergoing painful procedures.

2. Materials and methods

The study was approved by the Hospital Research Ethics Committee, and written informed consent was obtained from all parents. Healthy patients, ASA status 1 or 2, aged 4 to 7 years, scheduled for either inguinal hernia repair or orchidopexy surgery with general anesthesia were recruited. Exclusion criteria included patients requiring premedication, patients for which propofol and succinylcholine were contraindicated, and patients taking medication known to affect anesthetic requirements such as antiepileptic agents; patients with symptomatic cardiovascular, respiratory, neurological disease, and morbid obesity were also excluded.

All children in this study were fasted and not premedicated. Upon arrival at the operating room, patients were monitored with electrocardiography, pulse oximetry, respiratory rate, and noninvasive arterial blood pressure. Anesthesia was induced with propofol 3.5 mg kg^{-1}; succinylcholine 1.5 mg kg^{-1} was administered to facilitate endotracheal intubation. After endotracheal intubation, the appropriate group-dependent infusion rate was started, and then anesthesia was maintained with the remifentanil infusion and isoflurane in oxygen 100%. Patients were connected to mechanical ventilation (Omeda 7100, GE, USA). Artificial ventilation was set with a tidal volume of 10 mL/kg, with fresh gas flows of 4 L/min, and respiratory rate was adjusted to maintain a partial pressure of end-tidal carbon dioxide between 35 and 45 mm Hg, and the inspired isoflurane concentration was adjusted to maintain the target end-tidal concentration. The end-tidal concentration of isoflurane was measured using a Datex multigas analyzer, calibrated before each case. Subjects were serially assigned to 1 of 6 test groups. The corresponding remifentanil infusion rates were as follows: nil, 0.05, 0.10, 0.15, 0.20, and 0.25 μg kg^{-1} min^{-1}. After steady-state isoflurane (at least 15 minutes before incision to obtain an equilibration) and commencement of the remifentanil infusion for at least 25 minutes, the surgical incision was performed. It was confirmed that patients could not respond to verbal command just before surgical incision.

The MAC of isoflurane for each remifentanil infusion rate was determined using the standard Dixon's up-and-down approach [10]. This rule tends to concentrate testing in the range of isoflurane concentrations, which gives a 50% probability of blocking response to incision. From the time of incision, the patient was observed for 1 minute by a rater (blinded to group assignment, doses of remifentanil, and concentrations of isoflurane) for any movement of the arms or legs. A positive response was defined as a purposeful response in response to skin incision. Grimacing and movement of the head, limbs, and trunk were accepted as positive response. The response to incision was yes or no response. Once the response was recorded, further administration of anesthetic and analgesic agents was at the attending anesthesiologist's discretion.

The staring concentrations of isoflurane for each of the remifentanil infusion rates were 1.8, 1.6, 1.4, 1.2, 1.0, and 0.8 vol%, respectively. For each succeeding patient in that test group, the end-tidal isoflurane concentration was adjusted depending on the previous patient's response to incision (0.2 vol% as a step size). If a movement response to incision was previously observed, the succeeding end-tidal isoflurane concentration was increased by 0.2 vol%. If a movement response to incision was not previously observed, the subsequent isoflurane concentration being administered was decreased by 0.2 vol%.

The sample size of 6 groups was based on an $\alpha = .05$ for two-sided χ^2 test for trends in proportions based on a logistic model of $\beta = 0.2$ to detect a difference in move–no move, using the statistical software package NQUERY ADVISOR (version 4.0; Janet D Elashoff, Los Angeles, Calif). Our sample size was determined by the number of patients required to observe a minimum of 6 crossovers for each dose of remifentanil [11]. Unless otherwise specified, data were reported as mean ± SD (SD). Minimum alveolar concentration values were calculated as the mean of independent

Download English Version:

https://daneshyari.com/en/article/2762228

Download Persian Version:

https://daneshyari.com/article/2762228

Daneshyari.com