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Original Article

Desflurane Inhalation Provide Cardiovascular Stability During Intubation but Prevention of Rocuronium Injection Pain

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Background: Desflurane has very short induction time because its physical characteristics. But its pungent odor and tendency to irritate the upper airway make it unsuitable for induction of anesthesia. This study was performed to determine what time is prefer to start the desflurane inhalation.
Methods: Forty adults (17-45 years) were enrolled in a randomized, double-blind study. Twenty start desflurane inhalation just after loss of consciousness, and the others received desflurane after intubation. We monitored vital signs, BIS, desflurane concentration, rocuronium injection pain response, and airway irritation signs.
Results: The demographic data were not different two groups. Early inhalation group showed more stable cardiovascular response than that of late inhalation group. But rocuronium injection pain response and airway irritation sings were not different between two groups.
Conclusions: Early inhalation of desflurane (6 vol%) just after loss of consciousness attenuates cardiovascular responses during intubation.

Key Words: Airway irritation, Cardiovascular stability, Desflurane inhalation, Rocuronium injection pain

INTRODUCTION

Desflurane is an inhalational agent with low blood gas and blood tissue solubility [1]. Inhalation induction with desflurane alone causes adverse airway events, such as coughing, bronchospasm, laryngospasm, and copious secretion of varying severity [2,3]. However, these adverse airway responses seem to be related to acute administration at high concentrations [4] and inadequate doses or drugs as adjunctive medication [2,5]. Many anesthesiologists feel that its pungent odor and tendency to irritate the upper airway make it improper for maintenance, and more specifically, for induction of anesthesia. Therefore they have a general tendency to start desflurane inhalation after tracheal intubation. But several studies [6-9] have demonstrated that desflurane can be used in inhalation induction. We hypothesized that early inhalation of desflurane would be good for cardiovascular stability during intubation and also rocuronium injection pain.

METHODS

The hospital ethics committee approved the study protocol and written informed consent was obtained from all participants. The participants were 40 adult patients (American Society of Anesthesiologists [ASA] physical status I-II, age 17-45 years) who were scheduled to undergo elective surgical procedures under general anesthesia. Patients with a history of gastroesophageal reflux, reactive airway diseases, or upper respiratory infection within the previous 2 weeks were excluded,

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as well as those using medications that may have interfered with the study (e.g., anxiolytics or hypnotics). The patients were assigned to two groups of 20 to receive either early (E group) or late (L group) inhalation of desflurane by a computer generated randomization program.

All patients were given premedication with glycopyrrolate (0.004 mg/kg). Electrocardiogram (ECG), pulse oximetry, noninvasive blood pressure, end-tidal CO2, and inspired and expired desflurane concentrations (M1026B, Philips, Germany) were monitored. Baseline blood pressure and heart rate were measured before induction of anesthesia, and both values were also measured at pre- and post-intubation. The bispectral index score (BIS) was monitored at same time point. The patients were given fentanyl (1.5 μg/kg) and preoxygenation for 3 min, followed by propofol, 2 mg/kg, for induction. After loss of consciousness a face mask was firmly applied to the patient's face. We used a semiclosed breathing system, keeping the adjustable pressure-limiting valve open until no response occurred in the eyelid test. At this point, E group was received 6% desflurane with oxygen 4 L/min and air 2 L/min but L group was given no inhalational agent until BIS score was under 50. Then rocuronium bromide (0.8 mg/kg) was injected and nasotracheal intubation was performed after 90 second. Airway irritation sign was evaluated by cough. Rocuronium injection pain was assessed by patient's withdrawal movement.

The results are given as means ± standard deviations (SD) or the number (percentage) of patients, as appropriate. For categorical variables, the Chi-square test was used, and the results are given as a number (percentage) of patients. Multiple testing was performed using the Mann-Whitney U test or the Pearson Chi-square test, as appropriate. For all analyses, two-tailed $P < 0.05$ was considered statistically significant.

RESULTS

The age, height, weight and sex were similar in the two groups (Table 1).

Mean arterial blood pressure (MBP) and heart rate (HR) were lower in E group at post-intubation period (Table 2). But there was no significant cardiovascular fluctuation between each time points (within 30% of baseline). The BIS was lower in E group than in L group at pre- and post-intubation period (Table 3).

Table 1. Patients characteristics.

	E group (n = 20)	L group (n = 20)
Age (years)	28.3 ± 15.7	26.4 ± 15.4
Gender (M/F)	10/10	9/11
Weight (kg)	62.8 ± 8.5	61.3 ± 12.6
Height (cm)	163.3 ± 8.3	165.2 ± 9.2
ASA (I/II)	15/5	16/4

Values are mean ± SD or number of patients. No significant differences between two groups.

Table 3. BIS value at baseline, pre- and post-intubation

	Baseline	Pre-intubation	Post-intubation
Group E	96.6 ± 2.9	40.2 ± 10.8	43.6 ± 10.7
Group L	95.9 ± 3.0	52.6 ± 13.9*	55.2 ± 14.4*

Values are mean ± SD.
* $P < 0.05$ vs. group E.

Table 2. Mean arterial blood pressure (MBP) and heart rate (HR) at baseline, pre- and post-intubation.

		Baseline	Pre-intubation	Post-intubation
Group E	MBP (mmHg)	92.7 ± 12.4	95.4 ± 10.2	102.3 ± 15.9
	HR (beat/min)	69.5 ± 12.9	75.2 ± 13.7	72.7 ± 8.3
Group L	MBP (mmHg)	94.3 ± 14.2	82.2 ± 16.5	117.2 ± 17.2*
	HR (beat/min)	70.1 ± 13.0	69.3 ± 10.7	92 ± 16.2*

Values are mean ± SD.
* $P < 0.05$ vs. group E. MBP and HR at pre- and post-intubation period were within ± 30% of baseline.

Table 4. The incidence of airway irritation and rocuronium-induced pain withdrawal movement at baseline, pre- and post-intubation

	Withdrawal movement	Cough
Group E	14 (70)	1 (5)
Group L	13 (65)	0 (0)

Values are numbers of patients (% incidence).
No different between two groups.

The incidence of airway irritation and rocuronium-induced pain withdrawal movement was not different between two groups (Table 4). There were no airway complications such as laryngospasm and bronchospasm.

DISCUSSION

Early inhalation of desflurane attenuated cardiovascular responses during nasotracheal intubation, and there was no airway irritation sign at concentration of 6 vol%. Many studies [8,9] used desflurane as induction agent showed a stepwise increase in desflurane for example desflurane was gradually increased by 1% every six breaths until the expiratory desflurane concentration reached 10% or desflurane was increased by 1% every 1 min, to a maximum of 6%. But we used desflurane vaporizer (D-vapor, Drager, Germany) was starting at 6%. Preliminary study (n = 20) showed that expired desflurane concentration was 4.2 ± 1.1 when vaporizer was set at 6%, and there were no airway irritation signs such as cough, bucking and excessive secretion (Data were not showed). In fact, upper airway irritation is one of the major drawbacks when desflurane is used as the sole induction agent. Various methods have been used to reduce adverse airway responses (coughing, breathholding, or laryngospasm), including increasing airway humidity using an artificial nose [10], applying a low [4,6] or gradual increase of inspired concentration [6], or premedication with fentanyl [7,11]. Therefore, we used an appropriate dose of fentanyl to prevent adverse airway events.

In adults, increasing desflurane concentration can induce sympathetic activation, tachycardia and hypertension [12]. Although we used 6% desflurane, MBP and HR were maintained within 30% of baseline. The reason of stable vital signs was fentanyl. Kong and colleague [7] suggested that intravenous opioids reduce airway irritation during induction of anesthesia with desflurane in adults. And also rocuronium-induced pain withdrawal movement was not different between two groups because of fentanyl. The expired desflurane concentration at time of rocuronium injection was 2.4 ± 1.8. This concentration of desflurane couldn't reduce pain withdrawal, the effects of desflurane on rocuronium-induced pain needs to be studied further.

This study has several limitations. The main limitation is the adjunctive use of fentanyl may have influenced the hemodynamic parameters, airway irritation response and pain withdrawal. However, all patients were taken same dosage of fentanyl so fentanyl premedication have little effect on the comparison between each groups.

In conclusion, we found that early inhalation of desflurane (6%) to the patient pretreated with fentanyl attenuates adverse hemodynamic responses to nasotracheal intubation without airway irritation but has no effect on rocuronium-induced pain.

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