Original Article

Tracheal intubation in children after induction of anesthesia with propofol and remifentanil without a muscle relaxant

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ABSTRACT

Objectives

To determine the suitable and ideal doses of remifentanil which provide acceptable tracheal intubating conditions in children given propofol.

Methods

This prospective double blind trial was performed on 60 ASA 1 and 2 children aged between 3 and 12 years at Nikokari University Hospital, Tabriz, Iran from June 2007 to April 2008. The patients were randomly allocated to one of four groups. Patients in groups 1, 2, 3, and 4 received 1, 2, 3µg/kg remifentanil; and 0.5mg/kg atracurium, respectively. Then, all patients were injected 3 mg/kg of propofol, and underwent tracheal intubation. The intubating conditions were evaluated and recorded according to the Helbo-Hansen scoring system.

Results

Tracheal intubation was successful in 58 of 60 patients. Intubation failed only in two patients of group 1, but was performed after injection of additional drug. The difference of total conditions of tracheal intubation between groups 1 and 4 was significant (33% vs. 80%); the difference of total conditions between groups 3 and 4 was not significant (P=0.427); but the difference of total conditions between 4 groups was significant (P=0.043).

Conclusion

Intubating conditions in children following administration of remifentanil 3 µg/kg were more suitable who were given propofol. (Rawal Med J 2010;35: ).

Keywords

Propofol, remifentanil, tracheal intubation, pediatric.

INTRODUCTION
Tracheal intubation can be achieved by direct laryngoscopy following deep inhalational anesthesia or an intravenous anesthetic and a muscle relaxant. The use of Neuromuscular blocking drugs, particularly suxamethonium, for laryngoscopy and tracheal intubation remains the mainstay of day to day anesthetic practice, however, it is associated with significant side effects. The use of non-depolarizing relaxants decrease the speed of anesthesia establishment and achievement of acceptable facility for tracheal intubation require higher doses of these drugs, which may not be compatible with short surgical procedures. Atracurium is a nondepolarizing neuromuscular blocking drugs that produces an onset of action of 3 to 5 minutes and a duration of 20 to 35 minutes.

The usage of combined Propofol and alfentanil reliably facilitates intubation without the use of neuromuscular blocking agents. Remifentanil hydrochloride, an ultra short acting opioid, undergoes rapid metabolism by tissue and plasma esterases. The speed of the onset of effect is rapid (1-2 min) and similar to that of alfentanil and the elimination half time is 0.17-0.33 hr. Thus, remifentanil is the ideal opioid to facilitate tracheal intubation and allows a rapid return of spontaneous respiration and airway reflexes. However, there is controversy on acceptable doses of remifentanil needed for tracheal intubation. The aim of this study was to determine the suitable and ideal dose of remifentanil which provides acceptable tracheal intubating conditions in children with propofol - induced anesthesia.

**PATIENTS AND METHODS**

Following Ethical Committee approval and written parental, informed consent, we included 60 ASA 1 and 2 patients, aged between 3 and 12 years presenting for elective ophthalmic surgery, who required tracheal intubation, in this prospective, randomized and double blinded trial. The study was carried out at Nikokari University Hospital, Tabriz, Iran from June 2007 to April 2008. Children with a history of reactive airway disease; suspected difficult airway and musculoskeletal disease were excluded. Patients were randomly divided in 4 groups with 15 patients in each. They were not premeditated. Upon their arrival to the anesthetic room, baseline heart rate, oxygen saturation and non-invasive blood pressure were measured. Intravenous access was secured using a 22-G cannula on the dorsum of a hand.

Patients in 4 groups received following infusions: group 1, 1µg/kg remifentanil; group 2, 2µg/kg remifentanil; group 3, 3µg/kg remifentanil; and group 4, 0.5mg/kg atracurium. The drugs used were diluted up to 5ml, and were labeled by numbers, so that, the anesthesiologist performing intubation was not aware of the type of the injected drug. All intubations were performed by one specialist. The drug was injected over 30 seconds, after which propofol 3 mg/kg was given as a rapid i.v. bolus over 10 seconds. Sixty seconds after injection of propofol, the patients were intubated, and the intubating conditions were evaluated according to the Helbo-Hansen scoring system (table 1) and were recorded.
If the patient received score 1 or 2 from each items of Helbo-Hansen table, we considered intubating condition as acceptable, and if the patient received score 3 or 4, intubating condition was non-acceptable. In non-acceptable conditions, intubation was performed after an increase in anesthetic drug. The groups were compared regarding age and gender. The time between intubation and return of spontaneous respiration, and the duration of surgery was recorded. Intubation time less than 30 seconds was considered acceptable. The collected data were analyzed using SPSS 13 statistical software. Chi-square test was used for intubation condition score. A P value of <0.05 was considered statistically significant.

**RESULTS**

Mean age of children was 6.15±2.68 years. The mean age of all groups was not significantly different (P=0.523). The duration of surgery was 15 to 180 min, with the average time of 45 min.

| Table 1. Scoring system (Helbo-Hansen table) used for intubating conditions. |
|-----------------------------|-----|-----|------|------|
|                             | 1   | 2   | 3    | 4    |
| Laryngoscopy                | Easy| Fair| Difficult| Impossible |
| Vocal cords                 | Open| Moving| Closing| Closed |
| Coughing                    | None| Slight| Moderate| Severe |
| Jaw relaxation              | Complete| Slight| Stiff| Rigid |
| Limb movement               | None| Slight| Moderate| Severe |

The time of return of spontaneous respiration was not significantly different between the groups (P=0.115). This time was minimum 12.93 min (group 2) and maximum 21.67 min (group 4). The only non-acceptable condition in this study was belonging to group 1. The assessment of vocal cord in 4 studied groups showed that the vocal cord status was non-acceptable in 9 cases, of which 4 cases belonged to group 1, 4 belonged to group 2, and one case belonged to group 3.
As showed in table 2, the cough status of patients in 4 group following tracheal intubation was not significantly different between the groups (P=0.133). Jaw relaxation was not significantly different between the groups. However, the limb movement after laryngoscopy and tracheal intubation was significantly different between the groups (P=0.044). The most movement (66.66%) was seen in group 1, whereas the least movement
(20%) in group 4. Tracheal intubation in two patients of group 1 was impossible, but was performed after injection of additional drug.

DISCUSSION

The use of remifentanil has been reported in pediatric practice, though experience is still limited and it is necessary that various doses of this drug to be evaluated. Because of its very short elimination half-life, remifentanil is normally administered a continuous infusion during surgery. Many studies have used a combination of narcotics with propofol for induction tracheal intubation succesfully in adults without the use of a neuromuscular blocker. We performed such study on children with 3-12 years old.

A combination of remifentanil 4 µg /kg and propofol 2.5 mg/kg provided excellent or good intubating conditions without the use of neuromuscular blocking agents. We achieved such suitable intubating conditions with remifentanil 3 µg /kg. Morgan et al evaluated intubating conditions following propofol 4 mg/kg combined with either remifentanil 1.25 µg/kg (group R), or suxamethonium 1 mg/kg (group S) and concluded that intubation conditions were significantly more better in group S, and the mean apnea time was significantly more in group R. In our study, the duration of return of spontaneous respiration was not significantly different in various studied groups. The longest duration of apnea time was (21.67±9.484 min) in muscle relaxant group and the shortest duration of was (13.93±6.477 min) in group 2. The intubating conditions were better in muscle relaxant than other groups.

McNeil et al evaluated the intubating conditions after propofol 2 mg/kg combined with either a bolus of remifentanil 2 µg/kg or 4 µg/kg, or succinylcholine 1 mg/kg and concluded that the most suitable intubating conditions were achieved with remifentanil 4 µg/kg, and mean duration of apnea following induction was significantly more with remifentanil. In our study, the most apnea duration was seen in the group receiving muscle relaxant, but there was no significant difference between the study groups. Our findings are incompatible with the results of McNeil et al study, probably because of higher dose of remifentanil in their study which result in better intubating conditions and longer duration of apnea.

In a study by Batra et al, 40 children (5-10 years) were randomly allocated to one of two groups to receive remifentanil 2 µg/kg (Gp I) or 3 µg/kg (Gp II) before the induction of anesthesia with i.v. propofol 3 mg/kg. Tracheal intubation was successful in all patients without requiring neuromuscular blocking agent. Intubating conditions were clinically acceptable in 50% of patients in Gp I compared with 90% of patients in Gp II (P <0.05). Woods and Allam found that remifentanil 3 µg/kg with propofol 2 mg/kg without muscular relaxant, resulted in satisfactory intubating conditions in nearly all patients but remifentanil 2 µg/kg resulted in satisfactory intubating conditions in only 75% of patients, demonstrating better results than ours.
CONCLUSION

It is concluded from this study that using remifentanil 3 µg/kg with propofol 3 mg/kg without muscular relaxant provided satisfactory intubating conditions in children.

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Received: July 9, 2009 Accepted: December 24, 2009

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