Endotracheal intubation without muscle relaxants in children using remifentanil and propofol: Comparative study

Freshteh Naziri,
Hakimeh Alereza Amiri,
Mozaffar Rabiee,
Nadia Banihashem,
Farhad Mohammad Nejad,
Ziba Shirkhani,
Sedigheh Solimanian

Department of Anesthesiology, Babol University of Medical Sciences, Babol, Mazandaran, Iran

Address for correspondence:
Dr. Hakimeh Alereza Amiri, Department of Anesthesiology, Ayatollah Rouhani Hospital, Babol University of Medical Sciences, Babol, Mazandaran, Iran.
E-mail: halereza@yahoo.com

ABSTRACT

Introduction: Endotracheal intubation is essential during general anesthesia and muscle relaxant drugs provide ideal conditions for this purpose. The objective of this study was to evaluate the intubating condition of remifentanil combined with propofol without muscle relaxant. **Materials and Methods:** In this prospective randomized study, 60 children aged 3-12 years, American Society of Anesthesiologists physical status I and II were included. All the children were premedicated with 0.05 mg/kg midazolam and 1.5 mg/kg lidocaine 5 min before the induction of anesthesia with 3 mg/kg propofol. Then, they were allocated randomly to receive either 2 μg/kg remifentanil (group R) or 1.5 mg/kg succinylcholine (group S). Tracheal intubation was attempted 90 s after the administration of propofol. The quality of intubation was assessed by using Copenhagen score based on jaw relaxation, ease of laryngoscopy, position of vocal cord, coughing and limb movement. Heart rate and blood pressure were recorded before and after induction, and 1, 3, 5 min after intubation. **Results:** There was no significant difference in intubating condition between the two groups (P = 0.11). Intubation condition was excellent in 26 of 30 (86.7%) patients in the group R compared with 30 (100%) patients in the group S. We observed significant difference in heart rate and systolic blood pressure over time between two groups (P = 0.02, P = 0.03 respectively). After intubation, we had higher heart rate and systolic blood pressure with a significant difference in group S compared with group R (P = 0.006, P = 0.018). None of the children had a chest rigidity, laryngospasm, and hypoxia. **Conclusions:** In premedicated children, propofol-remifentanil combination provides adequate conditions for tracheal intubation that is comparable with succinylcholine. Hemodynamic response to laryngoscopy and tracheal intubation was controlled better in group R.

Key words: *Endotracheal intubation condition, propofol, remifentanil, succinylcholine*

INTRODUCTION

Neuromuscular relaxants provide optimal conditions for laryngoscopy and tracheal intubation after induction of general anesthesia. Due to rapid onset and short duration of succinylcholine, it is an appropriate muscle relaxant that is currently available. However, due to the risk of some complications, such as rhabdomyolysis and hyperkalemia as well as the risk for masseter spasm and malignant hyperthermia, it is suggested that succinylcholine should not be used routinely in children.[1] For short surgical procedures, that tracheal intubation is necessary to protect the airway, residual weakness due to the use of muscle relaxant could interfere with timely recovery. Recent studies have shown that tracheal intubation can be done successfully in a patient with normal anatomy of the airway with hypnotics and short-acting opioids such as alfentanil or remifentanil without the need for muscle relaxants.[2,3] High doses of alfentanil (25-50 μg/kg intravenous [IV] weaken hemodynamic response to laryngoscopy and intubation, but lead to delay in spontaneous breathing and recovery in a short time surgical procedures. Remifentanil has similar onset effect as alfentanil (1-2 min). Remifentanil is not dose-dependent because hydrolysis by blood esterase and has a short half-life and rapid recovery.[4] In the study

Access this article online

Quick Response Code:

Website: www.saudija.org

DOI: 10.4103/1658-354X.159465

performed by Bouvet *et al*., it was revealed that the effective dose of remifentanil, ED50 and ED90, for intubation was 1.8 μg/kg, 4.0 μg/kg respectively. However, the higher dose was associated with a maximum decrease in heart rate and mean arterial pressure.[5] Studies also showed that propofol compared with thiopental or etomidate provides better condition for tracheal intubation.[6] We hypothesized that, the combination of 3 mg/kg propofol and 2 μg/kg remifentanil may provide good condition for laryngoscopy and tracheal intubation. Hence, this study was scheduled based on a comparison with succinylcholine as standard muscle relaxant that achieves optimal conditions for intubation. Hemodynamic response to laryngoscopy and intubation were assessed as secondary objectives of this study.

MATERIALS AND METHODS

In a clinical trial, after the approval by our Institution's Ethics Committee and obtaining written informed consent of the parents' patient, 60 children aged 3-12 years according to American Society of Anesthesiologists physical status I and II who were candidates for elective surgery requiring oral tracheal intubation were enrolled. Children with a history of colds, cardiopulmonary disease, neuromuscular diseases and other underlying systemic diseases were excluded. Patient's airway was evaluated based on Mallampati test.[7] Children with difficult intubation were excluded. After entering the operating room, monitoring of blood pressure, electrocardiogram and pulse oximetry were started. After the start of infusion fluids (10 ml/kg/h), 0.05 mg/kg midazolam, 1.5 mg/kg lidocaine were administered to both groups of patients. 5 min after premedication, induction of anesthesia was applied with 3 mg/kg Propofol in both groups. The patients were randomly allocated into two groups; group R received 2 μg/kg remifentanil and group S received 1.5 mg/kg succinylcholine. 90 s after administration of propofol, laryngoscopy with Miller blade and intubation was performed using a proper cuffed tracheal tube. The patient's lung was ventilated before intubation via face mask with nitrous oxide 50% in oxygen 50%. The quality of intubation were assessed by using Copenhagen score based on jaw relaxation, ease of laryngoscopy, position of vocal cord, coughing and limb movement [Table 1].[8] Finally, intubating conditions were graded as excellent, all responses are excellent; good, all responses are excellent or good; poor, the presence of one or more poor response. Excellent and good intubation conditions are considered as clinically acceptable intubation condition. Blood pressure and heart rate were measured and recorded before the induction of anesthesia as a baseline, after induction and at 1, 3 and 5 min after intubation.

Statistical analysis

The sample size was determined 30 patients according to Batra *et al*., study with alpha 0.05 and power of 80%.[9] *T*-test and Chi-square were used for analysis of the patients' characteristics. Chi-square and Fisher's exact test was used to compare intubation conditions. *T*-test and repeated measures was used for analysis of hemodynamic data. $P < 0.05$ was considered as statistically significant. In this research, data analysis software SPSS 18 was used.

RESULTS

Sixty children were enrolled in total (30 children in each group). Average weight, age and gender were similar between two groups [Table 2]. Mask ventilation was carried out with ease in children. None of the children had a chest rigidity, laryngospasm and hypoxia. Tracheal intubation was made in both groups at the first attempt without any intervention. The intubating conditions were excellent in 86.7% in group R as compared to 100% of the patients in group S. However, not considering the reaction to endotracheal intubation, the quality of intubation in group R was 100% and it was great. Jaw was relaxed, and laryngoscopy was done easily in all of the patients in group R and vocal cord was open during laryngoscopy. Only 4 patients had coughing and mild limb movement after intubation. There were significant difference in systolic blood pressure and heart rate over time between two groups ($P = 0.03$, $P = 0.02$, respectively) [Figures 1 and 2]. In group R, values of heart rate and systolic blood pressure showed a significant decrease after administration of induction drugs compared to baseline values ($P = 0.012$, $P = 0.000$, respectively). After intubation, we had higher heart rate with significant difference in group S compared to group R ($P = 0.04$). There was no intervention because of changes in heart rate and blood pressure in both groups.

Table 1: Intubating scoring system

Score	Excellent	Good	Poor
Jaw relation	Relaxed	↑tone	Rigid
Laryngoscopy	Easy	Slightly resistance	Impossible
Vocal cords	Open	Moving	Closed
Coughing	None	One to two cough	More than two cough
Limb movement	None	Slight	Severe

Table 2: Patient characteristics, Values are mean (SD), number

Study group	Group R, 2 μg.kg (*n* = 30)	Group S, 1.5 mg.kg (*n* = 30)	*P* value
Weight; Kg	19.76±7.59	19.43±5.78	0.85
Age; years	5.88±2.65	6.76±2.13	0.17
Gender, M/F (*n*)	20/10	13/17	0.06

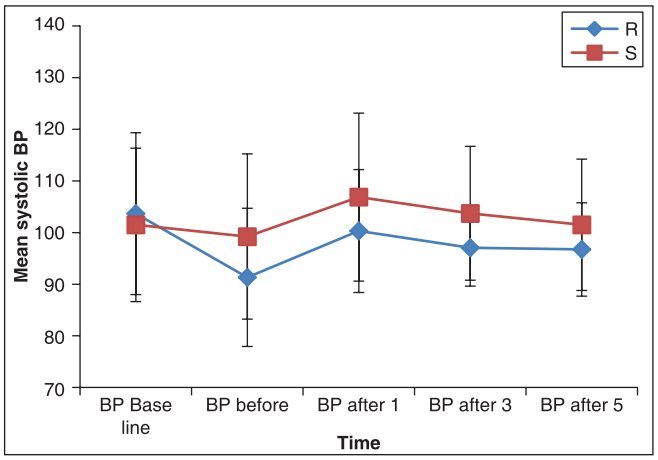

Figure 1: Mean systolic blood pressure; baseline value, before intubation, after intubation 1 min, 3 min, 5 min

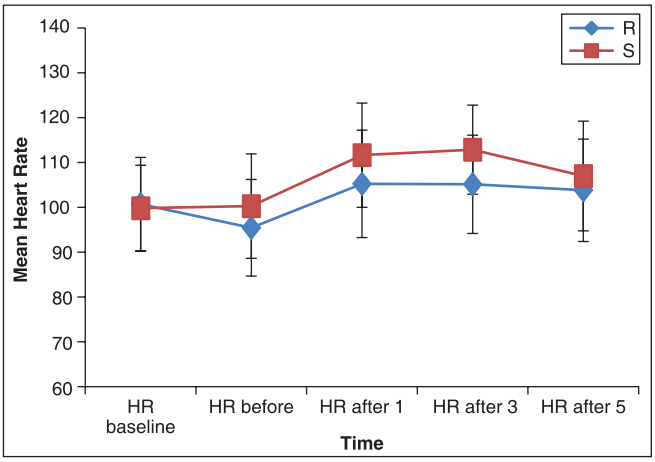

Figure 2: Heart rate baseline value, before intubation, after intubation 1 min, 3 min, 5 min

DISCUSSION

The results of our study showed that, the administration of 3 mg/kg propofol combined with 2 μg/kg remifentanil provided good and excellent intubation conditions compared with succinylcholine in healthy, premedicated children. Taha *et al*.,[10] showed that propofol is preferred over other IV anesthetic agents for tracheal intubations without muscle relaxant due to further weaker laryngeal reflexes and better jaw relaxation. Analogous to our study Gupta *et al*.,[11] reported that, 3 mg/kg propofol provides acceptable intubating conditions in 80% patients. They used combination of propofol and 3 μg/kg fentanyl. In the study by Batra *et al*.,[9] 2 μg/kg remifentanil and 3 mg/kg propofol provided acceptable intubating conditions in 50% patients. They had acceptable intubating conditions in 90% patient after increasing the dose of remifentanil to 3 μg/kg. It seems that, the difference in results between studies is due to the differences in premedication. In our study, we used midazolam and lidocaine as premedication. Lidocaine reduces the need for anesthetic drugs due to analgesic function (anti-nociceptive) and suppressing the cough reflex.[12,13] Gulhas *et al*.,[14] concluded that remifentanil without muscle relaxants provides similar intubating conditions as succinylcholine. Furthermore, they asserted that remifentanil is superior to succinylcholine with regard to hemodynamic stability and recovery duration. Morgan *et al*.,[15] showed that the administration of 1.25 μg/kg remifentanil combined with 4 mg/kg propofol provides good to excellent intubating conditions in 67% patients. Alexander *et al*.,[16] concluded that 2 μg/kg remifentanil after administration of 2 mg/kg propofol will not produce intubating conditions as good as those obtained with alfentanil 50 μg/kg or succinylcholine 1 mg/kg. The difference between the results of our study with theirs may be because of the different age groups (children vs. adults) and a lower dose of propofol (2 mg kg). In our study, in order to avoid bradycardia and hypotension we chose a dose of remifentanil equals to 2 μg/kg. The hemodynamic response to laryngoscopy and tracheal intubation was blunted in the remifentanil group compared with succinylcholine group. No patient was treated for bradycardia or hypotension in our study. Hanna *et al*.,[17] concluded that, the combination of propofol-remifentanil is able to control the hemodynamic stress response to laryngoscopy and intubation. In our study, the lungs of all patients were easily ventilated via mask. No patient exhibited signs of opioid-induced muscular rigidity such as stiff chest. The absence of muscular rigidity in our patients might be due to using relatively low dose of remifentanil and pretreatment with midazolam. Sub-anesthetic doses of midazolam prevent, attenuate, or successfully treat the rigidity.[4] We concluded that the combination of propofol and remifentanil can be used effectively in premedicated children for endotracheal intubation, when the use of muscle relaxants is not indicated.

REFERENCES

1. Coté CJ. Pediatric anesthesia. In: Miller R, editor. Miller's Anesthesia. 7th ed. Philadelphia: Churchill Livingstone Co.; 2010. p. 2559-97.
2. Klemola UM, Mennander S, Saarnivaara L. Tracheal intubation without the use of muscle relaxants: Remifentanil or alfentanil in combination with propofol. Acta Anaesthesiol Scand 2000;44:465-9.
3. Jabbour-Khoury SI, Dabbous AS, Rizk LB, Abou Jalad NM, Bartelmaos TE, El-Khatib MF, *et al*. A combination of alfentanil-lidocaine-propofol provides better intubating conditions than fentanyl-lidocaine-propofol in the absence of muscle relaxants. Can J Anesth 2003;50:116-20.
4. Fukuda K. Opioids. In: Miller R, editor. Miller's Anesthesia. 7th ed. Philadelphia: Churchill Livingstone Co.; 2010. p. 769-824.
5. Bouvet L, Stoian A, Rimmele T, Allaouchiche B, Chassard D, Boselli E. Optimal remifentanil dosage for providing excellent intubating conditions when co-administered with a single standard dose of propofol. Anesthesia 2009;64:719-26.

6. Erhan E, Ugur G, Gunusen I, Alper I, Ozyar B. Propofol — not thiopental or etomidate — with remifentanil provides adequate intubating conditions in the absence of neuromuscular blockade. Can J Anaesth 2003;50:108-15.
7. Adamus M, Fritscherova S, Hrabalek L, Gabrhelik T, Zapletalova J, Janout V. Mallampati test as a predictor of laryngoscopic view. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 2010;154:339-44.
8. Viby-Mogensen J1, Engbaek J, Eriksson LI, Gramstad L, Jensen E, Jensen FS, *et al*. Good clinical research practice (GCRP) in pharmacodynamic studies of neuromuscular blocking agents. Acta Anaesthesiol Scand 1996;40:59-74.
9. Batra YK, Al Qattan AR, Ali SS, Qureshi MI, Kuriakose D, Migahed A. Assessment of tracheal intubating conditions in children using remifentanil and propofol without muscle relaxant. Paediatr Anaesth 2004;14:452-6.
10. Taha S, Siddik-Sayyid S, Alameddine M, Wakim C, Dahabra C, Moussa A, *et al.* Propofol is superior to thiopental for intubation without muscle relaxants. Can J Anaesth 2005;52:249-53.
11. Gupta A, Kaur R, Malhotra R, Kale S. Comparative evaluation of different doses of propofol preceded by fentanyl on intubating conditions and pressor response during tracheal intubation without muscle relaxants. Paediatr Anaesth 2006;16:399-405.
12. Hans GA, Lauwick SM, Kaba A, Bonhomme V, Struys MM, Hans PC, *et al*. Intravenous lidocaine infusion reduces bispectral index-guided requirements of propofol only during surgical stimulation. Br J Anaesth 2010;105:471-9.
13. Altermatt FR, Bugedo DA, Delfino AE, Solari S, Guerra I, Muñoz HR, *et al*. Evaluation of the effect of intravenous lidocaine on propofol requirements during total intravenous Anesthesia as measured by bispectral index. Br J Anaesth 2012;108:979-83.
14. Gulhas N, Topal S, Erdogan Kayhan G, Yucel A, Begec Z, Yologlu S, *et al.* Remifentanil without muscle relaxants for intubation in microlaryngoscopy: A double blind randomised clinical trial. Eur Rev Med Pharmacol Sci 2013;17:1967-73.
15. Morgan JM, Barker I, Peacock JE, Eissa A. A comparison of intubating conditions in children following induction of Anesthesia with propofol and suxamethonium or propofol and remifentanil. Anesthesia 2007;62:135-9.
16. Alexander R, Booth J, Olufolabi AJ, El-Moalem HE, Glass PS. Comparison of remifentanil with alfentanil or suxamethonium following propofol Anesthesia for tracheal intubation. Anesthesia 1999;54:1032-6.
17. Hanna SF, Ahmad F, Pappas AL, Mikat-Stevens M, Jellish WS, Kleinman B, *et al.* The effect of propofol/remifentanil rapid-induction technique without muscle relaxants on intraocular pressure. J Clin Anesth 2010;22:437-42.

How to cite this article: Naziri F, Amiri HA, Rabiee M, Banihashem N, Nejad FM, Shirkhani Z, *et al*. Endotracheal intubation without muscle relaxants in children using remifentanil and propofol: Comparative study. Saudi J Anaesth 2015;9:409-12.
Source of Support: Nil, **Conflict of Interest:** None declared.