# USE OF PROPOFOL AS INTUBATION AID FOR CHILDREN ANESTHETIZED WITH SEVOFLURANE

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Submitted: 6/10/2019; Accepted: 13/9/2020; Published: 21/9/2020

## ABSTRACT

### *Background*

Use of muscle relaxants for tracheal intubation in pediatric patients been associated with significant side effects and complications during general anesthesia. Many anesthetic drug combinations have been used to facilitate intubation without the use of relaxants.

### *Objectives*

To compare the efficacy of three different doses of Propofol to obtain optimum intubating conditions.

### *Patients and Methods*

One hundred and four pediatric patients enrolled in our study after ethical committee approval and written parental consent. Patients were belonging to the American Society of Anesthesiologist physical status classes (I and II), aged from 18 months to 5 years, and were scheduled for tonsillectomy and/or adenoidectomy. Patients were pre-medicated with midazolam 0.2 mg/kg and ketamine 3 mg/kg 15-30 minutes before induction orally. Patients were randomly divided into 4 groups: Group I (control group) did not receive Propofol, while Group II, Group III, and Group IV received (1, 2 and 3 mg/kg of intravenous Propofol respectively). Cough, movement of the limb, tachycardia and smooth intubation condition had been recorded during intubation.

### *Results*

Cough, movement of the limbs, tachycardia were mostly reported among the control group (100%, 74%, 43%) respectively. While smooth intubation condition was mostly among the group IV. 1mg/kg Propofol abolished cough response. 2mg/kg Propofol abolished movement of the limbs. 3 mg/kg Propofol was superior to 2 mg/kg Propofol in decreasing tachycardia response and smooth intubation condition.

### *Conclusion*

Propofol in a dose of 3 mg/Kg I.V. is an excellent adjuvant drug for smooth intubation in children anesthetized with Sevoflurane.

**Keywords:** *Sevoflurane, Propofol, Tracheal Intubation, Pediatric Anesthesia.*

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https://doi.org/10.17656/jsmc.10263

## INTRODUCTION

The safe anesthetic technique in paediatrics depends on understanding the physiological, anatomical and pharmacological characteristics of the paediatric age group [1]. The pediatric trachea is a conical shape. The narrowest part is at the level of the cricoid ring; the only part of the airway that is surrounded by a cartilage. If the tracheal tube is too large, it will compress the tracheal epithelium at this level, leading to ischemia with consequent scarring and risk of subglottic stenosis [2] . The ring forms a natural cuff around the tube, thereby eliminating the need for a cuff. Generally, cuffed tubes are used only in children above the age of 8 years [3].

The intubation technique has to be modified in children because of anatomical differences. The child has a large head and a short neck relative to the size of the body. Instead of placing a pillow under the head, it is usually necessary to place a small pad or pillow under the shoulders. The larynx of a child under the age of 2 years tends to sit higher in the neck opposite the vertebral bodies of C3–4, whereas in the older child it is opposite C5–6. This results in the larynx being more anterior during laryngoscopy. The epiglottis of the child is relatively large and tends to be floppy because the cartilaginous support is not fully developed. It is usually difficult to elevate the epiglottis sufficiently to see the vocal cords if a curved blade is used. For this, the anesthetist has to use a straight blade and place it on the posterior surface of the epiglottis whilst lifting. Sometimes, gentle cricoid pressure helps to align the three axes. This may be performed with the little finger of the left hand [3].

Propofol is a potent short-acting intravenous anesthetic agent. It does not trigger malignant hyperthermia. Propofol appears to possess profound anticonvulsant properties. It has been reported to decrease spike activity in patients with cortical electrodes implanted for resection of epileptogenic foci and has been used successfully to terminate status epilepticus. Propofol can produce bronchodilation in patients with chronic obstructive pulmonary disease and does not inhibit hypoxic pulmonary vasoconstriction. Propofol appears to possess antiemetic properties that contribute to a lower incidence of emetic sequelae after general anesthesia [4].

## PATIENTS AND METHODS

One Hundred and four pediatric patients were enrolled in the present study after obtaining Ethical Committee approval from Sulaimani School of Medicine and informed written consent from parents. Patients' ages ranged from 1.5 to 5 years. They were all scheduled for elective tonsillectomy and/or adenoidectomy surgery at the Ear, Nose, and Throat (ENT) Department of Sulaimani Teaching Hospital from the period between March 1st and July 30th, 2015.

All patients were belonging to the American Society of Anesthesiologist physical status class (ASA) I and II and they were randomly divided into four groups:

Group I (n= 26, received no dose of Propofol) considered as a control group.

Group II (n=26, received 1mg/Kg Propofol).

Group III (n=26, received 2mg/Kg Propofol).

Group IV (n=26, received 3mg/Kg Propofol).

The fasting period was 4 hours for breastfed babies, 6 hours for bottle-fed and 8 hours for those on food meals. All the patients received the following pre-medication anesthetic agents based on milligram per kilogram (mg/kg) bodyweight orally: Midazolam 0.2 mg/kg and Ketamine 3 mg/Kg 15 to 30 minutes before operation. Patients with a history of difficult intubation or suspected difficult intubation notes in their Preanesthetic Evaluation have been excluded from the current study.

In the operation room appropriate size I.V. cannula (22 or 24 Gauge) was inserted to every patient after lying supine. Pre-oxygenation started with appropriate face mask size (size 2 for 1-3 year and size 3 for 3-5 years) for 3 - 5 minutes. Induction was done with gradual increments of spontaneously breathing sevoflurane up to 8% till the patient sleep.

Direct conventional laryngoscope with different curved and straight blades of different sizes and different endotracheal tube sizes were also available on the table. Before intubation was performed the following doses of Propofol were used for Group I (control), Group II, Group III, and Group IV, the control group did not receive Propofol, 1 mg/Kg, 2 mg/Kg and 3 mg/Kg respectively. Intubation was done by the same physician anesthetist for all of the patients.

During intubation, the patients were having different cardiovascular and / or neuromuscular responses. The present study recorded; cough, movement of the limbs, and tachycardia as normal heart rate vary with age, therefore, in children, the definition of tachycardia is age-dependent. World Health Organizations (WHO) defines normal heart rate as (100-160 bpm, 90-150 bpm, and 80-140 bpm) for age groups of (0-1 year, 1-3 year, and 3-6 year) respectively. In the current study, based on the age groups the tachycardia have been recorded when the heart rate is higher than normal for that age group.

In the present study movement as flexion of the limbs during intubation recorded and tried to distinguish the abnormal movement that would be caused by Propofol because occasionally induction of anesthesia with Propofol is accompanied by excitatory motor activity (so-called non-epileptic myoclonia).

Cough response during intubation had been recorded after being sure that it was not caused by the volatile agent, Sevoflurane had been used which is non-irritant to the upper airway and bronchi and does not trigger cough after induction. [5] Finally, we determined the smooth intubation condition when no response happened during the intubation, and the procedure went completely smoothly.

The Collected data were entered into the excel sheet program, data cleaning processes were conducted for variables. Statistical Package for Social Science (SPSS) version 21 was used for all statistical analyses. Descriptive statistics (numbers, and percentages) were used to describe the characteristics of studied variables. Association between variables was conducted by using the Chi-Square test. P-value <0.05 was considered significant.

## RESULTS

Our study involved 104 pediatric patients, aged from 1.5 to 5 years. 60 of them were male (57.7%) The majority of them were among the age group of 4.5 - 5 years (56.7%) and the weight group of 12.6 - 15 kg (49%), (Table 1). The demographic data (gender, age, weight) have no significant difference between the groups. (*P*-value > 0.05).

Tachycardia, movement of the limbs, and cough were mostly reported among the control group (57.9%, 73.7%, and 100.0%) respectively as compared to group II. While patients in group II had more smooth intubation conditions, this association statistically was not significant (*P*-value > 0.05), apart from the association between movement in the two groups which was statistically significant (*P*-value <0.01). (Table 2, Figure 1).

Generally, tachycardia and movement were mostly reported in the control group (71% and 100%) respectively as compared to group III (2 mg/Kg propofol).

These associations were statistically significant (*P*-value <0.01). Although cough was 0% in group III still it was statistically not significant in compared to the control group (table 3, Figure 1).

Tachycardia and movement of the limbs were mostly reported in the control group (84.6% and 100.0%) respectively as compared to group IV (3 mg/Kg Propofol).

These associations statistically were significant (*P*-value <0.01). Although cough was 0% in group IV still it was statistically not significant in comparison to the control group (Table 4, Figure 1).

All the intubation conditions that accompanied cough were among the control group (100%). With the introduction of Propofol in three different doses (1 mg, 2 mg, and 3 mg /Kg) no cases of cough response were recorded during the intubations. Also, no case of movement was recorded in both groups of 2 mg/Kg and 3 mg/Kg of Propofol. While tachycardia persists in all the groups but the percentage decreased significantly from 43% in the control group to only 8% in the group of 3 mg/Kg Propofol. It was determined that smooth intubation conditions increased with an increased dose of Propofol (Figure 1).

**Table 1. Demographic Distribution of the Study Sample.**

| Demographic | | Total N(%) | Studied groups | | | | *P values* |
|---|---|---|---|---|---|---|---|
| | | | Control N(%) | 1mg/Kg Propofol N(%) | 2 mg/Kg Propofol N(%) | 3 mg/Kg Propofol N(%) | |
| **Gender** | **Male** | 60(57.7) | 13(50) | 13(50) | 18(69.2) | 16(61.5) | 0.418 |
| | **Female** | 44(42.3) | 13(50) | 13(50) | 8(30.8) | 10(38.5) | |
| **Age** | **1.5-2** | 9(8.7) | 1(3.8) | 3(11.5) | 3(11.5) | 2(7.7) | 0.5 |
| | **2.5-3** | 14(13.5) | 3(11.5) | 3(11.5) | 5(19.2) | 3(11.5) | |
| | **3.5-4** | 22(21.2) | 4(15.4) | 4(15.4) | 9(34.6) | 5(19.2) | |
| | **4.5-5** | 59(56.7) | 18(69.2) | 16(61.5) | 9(34.6) | 16(61.5) | |
| **Weight** | **10-12.5** | 11(10.6) | 2(7.7) | 2(7.7) | 4(15.4) | 3(11.5) | 0.314 |
| | **12.6-15** | 51(49) | 8(30.8) | 17(65.4) | 14(53.8) | 12(46.2) | |
| | **15.1-16.5** | 22(21.2) | 7(26.9) | 5(19.2) | 4(15.4) | 6(23.1) | |
| | **16.6-18** | 20(19.2) | 9(34.6) | 2(7.7) | 4(15.4) | 5(19.2) | |

**Table 2. Intubation condition among the control group and group II (1 mg/Kg Propofol).**

| Intubation conditions | Control N(%) | 1 mg/Kg Propofol N(%) | *P- values* |
|---|---|---|---|
| **Tachycardia** | 22 (57.9%) | 16 (42.1%) | 0.058 |
| **Movement of the limbs** | 14 (73.7%) | 5 (26.3%) | 0.01 |
| **Cough** | 3 (100%) | 0 (0.0%) | 0.118 |

**Table 3. Intubation condition among the control group and group III ( 2mg/Kg Propofol).**

| Intubation conditions | Control N(%) | 2 mg/Kg Propofol N(%) | *P*- values |
|---|---|---|---|
| **Tachycardia** | 22 (71.0%) | 9 (29.0%) | 0.001 |
| **Movement of the limbs** | 14 (100%) | 0 (0.0%) | 0.001 |
| **Cough** | 3 (100%) | 0 (0.0%) | 0.118 |

**Table 4. Intubation condition among the control group and group IV (3 mg/Kg Propofol)**

| Intubation conditions | Groups | | *P*-values |
|---|---|---|---|
| | Control N(%) | 3 mg/Kg Propofol N(%) | |
| **Tachycardia** | 22 (84.6%) | 4 (15.4%) | 0.001 |
| **Movement of the limbs** | 14 (100%) | 0 (0.0%) | 0.001 |
| **Cough** | 3 (100%) | 0 (0.0%) | 0.118 |

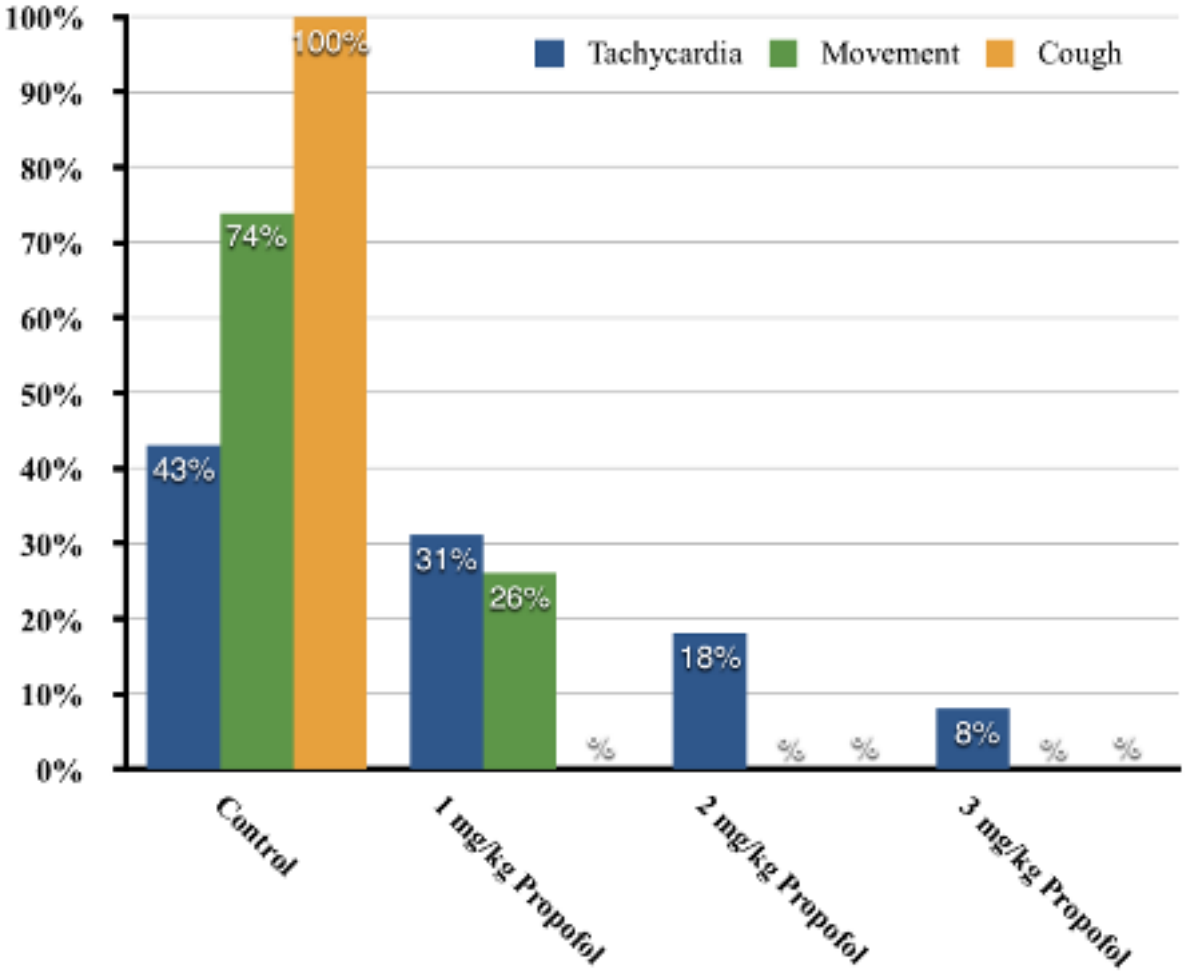


**Figure 1. Different intubation condition in relation with studied groups.**

## DISCUSSION

Skeletal muscle relaxation in children can be achieved without the use of neuromuscular blocking drugs (NMBDs). This is by the administration of a high concentration of the inhalational anesthetic agent. Food and Drug Administration (FDA) is forbidding the routine use of depolarizing muscle relaxants in pediatric patients. It can cause arrhythmia and cardiac arrest. It may also result in postoperative myalgia, increased intracranial and intra-orbital pressure, masseter muscle rigidity, hyperkalemia, and malignant hyperthermia [6]. Also, using non-depolarizing muscle relaxants may produce prolonged neuromuscular blockade, potentiate histamine release, increase the side effects from anticholinesterases used for reversing the agents, and lead to an inability to quickly reverse the blockade in the event of unexpected difficult intubation [7, 8]. Tracheal intubation without the use of muscle relaxant in pediatrics now became a common practice among pediatric anesthesiologist [9, 10] and a survey concluded that this technique is widespread, especially among German anesthetists in ambulatory anesthesia centers where general anesthesia with tracheal intubation in children is often induced without using any neuromuscular blocking drugs at all [11].

Different combinations of anesthetic drugs have been used for intubation without a muscle relaxant. [12] In the present study, we have used a combination of Sevoflurane 8% and Propofol up to 3 mg/kg. Aouad, et al in their systemic review found that the combination of Sevoflurane 8% and Propofol without muscle relaxant have no serious adverse events [7].

Because of the lack of a standard scoring system for measuring the quality of tracheal intubation [13]. Different ways have been used to measure the intubation condition such as; modified or unmodified Helbo-Hansen, Ravlo, Trap-Andersen Scoring system, [14, 15], or Copenhagen scale [16]. In other studies, however, Jaw/Vocal cords/Cough 3-point scores have been used [11]. In our study, we have recorded three responses from the patients during intubation and these were: cough, movement of the limbs, and tachycardia.

In our study, all the intubation conditions with cough were among the control group (100%). With the introduction of Propofol with the three different doses (1 mg, 2 mg, and 3 mg /kg) no any case of cough reported. No cases of movement of the limbs were reported in both groups of 2 mg/kg and 3 mg/kg Propofol. While tachycardia persists in all the groups but the percentage significantly decreased from 43% in the control group to only 8% in group IV (3 mg/kg Propofol).

Finally, it was determined that excellent condition with smooth intubation was increased with an increased dose of Propofol.

The number of researches has been done to find an optimum dose of Propofol, in a study done by Lerman et al, they found that 3 mg/kg of Propofol is excellent intubation aid in their study in pediatric anesthesia when they compared three different doses of Propofol (1 mg/kg to 2 mg/kg and 3 mg/kg) for intubation after the induction was done by Sevoflurane 8%. They found 50, 72, and 90 cases of excellent intubations for the three doses respectively [17]. This is also inconsistent with our study.

Additionally in the systemic review of randomized trials performed by Aouad et al. (2012), they concluded that Sevoflurane with Propofol 3 mg/kg is achieving excellent intubation conditions in children without the use of muscle relaxant [7]. This statement agrees with our findings.

Furthermore, Siddik-Sayyid et al, found that 2 mg/kg Propofol is superior to 1 mg/kg and they concluded the superiority of 2 mg/kg Propofol to 1 mg/kg for intubation in anesthetized children with Sevoflurane 8%, their results were as follow; the incidence of excellent intubation condition was 56, 92, 15 for 1 mg/kg Propofol, 2 mg/kg Propofol and saline respectively [18] .Meanwhile, Kim et al. concluded that the optimum dose of Propofol required for excellent intubating conditions was 1.39±0.37 mg/kg in 50% of children during inhalation induction using 5% Sevoflurane and 60% nitrous oxide in the absence of neuromuscular blocking agents [19].

Another study done by Jo et al. in a relatively small study sample (n=28) to determine the proper dose of propofol using the up-and-down method, they concluded that; Propofol 1.5-2 mg/kg provides excellent intubating conditions at 3-4% End Tidal Sevoflurane in children without using any neuromuscular blocking agent [20].

The researchers that disagree to intubate without relaxant are those who emphasize adult intubation and not children. A meta-analysis done by Lundstrøm et al. found that avoidance of NMBD may increase the risk of difficult tracheal intubation in adults [21]. We did not find any similar study in pediatrics against intubation without the use of muscle relaxants.

In Conclusion, Propofol is an effective intubation aid in the pediatric age group when anesthetized with Sevoflurane also the study showed that 3 mg/kg Propofol is superior to 2 mg/kg and 2 mg/kg is superior to 1 mg/kg in aiding intubation condition for children anesthetized with Sevoflurane.

### Conflict of interest

None

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