COMPARISON OF SEVOFLURANE VERSUS PROPOFOL FOR TRACHEAL INTUBATION IN CHILDREN

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ABSTRACT

Objective: To compare the quality of intubation and hemodynamic response in children undergoing endotracheal intubation facilitated with propofol versus sevoflurane.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Anesthesia, Combined Military Hospital Multan, from Aug 2018 to Apr 2019.

Methodology: A total number of 112 children planned for tracheal intubation were included in this randomized controlled trial. Patients were randomly allocated into two equal groups. In group P (propofol) patient's 2.5-3.0 mg/kg propofol was given before insertion of endotracheal tube and in group S (sevoflurane) patients 8.0% sevoflurane with 100% O_2. Quality of intubation was assessed in all children at the time of intubation. Hemodynamic response of patients was also noted before induction of anesthesia, immediately after intubation and after 5 minutes of intubation.

Results: Mean age of children included in this study was 2.11 ± 0.80 years. Quality of intubation was excellent in 51 (91.1%) patients in propofol group and in 38 (67.9%) patients in sevoflurane group (*p*-value 0.009). Mean HR after 5 minutes of intubation in group S and group P 111.98 ± 5.43 beats/min versus 109.05 ± 5.99 beats/min with *p*-value 0.008. Mean arterial pressure after 3 minutes of intubation mean arterial pressure in group S and P was 74.58 ± 4.45 mmHg versus 71.0 ± 3.90 mm Hg with *p*-value <0.001. After 5 minutes of intubation mean arterial pressure in group S and P was 73.16 ± 4.13 mmHg versus 68.61 ± 4.07 mmHg with *p*-value <0.001.

Conclusion: Sevoflurane was found to be associated with less changes in hemodynamic parameters as compared to propofol but quality of intubation conditions was poor using sevoflurane. Propofol is a better drug as compared to sevoflurane for providing better intubation conditions.

Keywords: Tracheal intubation, Sevoflurane, Propofol, Tracheal Intubation.

INTRODUCTION

Endotracheal intubation is routinely assisted by the use of depolarizing muscle relaxants (DMRs) such as succinylcholine[1]. Succinylcholine administration in children is associated with risk of arrhythmias, and malignant hyperthermia in some cases[2,3]. In children, even the use of DMRs is associated with adverse events e.g. prolonged duration of neuromuscular blockage, need of reversal and inability to reverse neuromuscular blockage quickly if tracheal intubation is not possible[4]. To overcome complications of DMRs, alternative methods of muscle relaxants such as propofol and inhalation using sevoflurane are used for facilitation of ETT insertion in children. Propofol has a rapid onset of action and has shorter half-life. However, propofol administration has been shown to be associated with pain at the time of injection and limb movement during induction[5]. Inhalation anesthetics such as Sevoflurane can also be used as an alternative to facilitate tracheal intubation[6].

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Some studies have concluded that endotracheal intubation facilitated with Sevoflurane provide better quality of intubation as compared to propofol[7,8]. But on the other hand, Darji *et al* concluded that quality of intubation according to Cooper's score is better with propofol (93.3%) versus only 80% with sevoflurane[9]. This study also found better hemodynamic control in terms of heart rate and mean arterial pressure (MAP) saturation in sevoflurane group as compared to propofol group. Like mean pulse rate just after intubation was 119.1 ± 6.7 beats per minute in propofol group and 114 ± 11.8 beats per minutes in sevoflurane group. And mean arterial pressure (MAP) was 84.6 ± 10.8 mmHg in sevoflurane group and 73.1 ± 6.2 mmHg in propofol group[9]. But quality of intubation was better in propofol group. Thwaits *et al* also found similar results and concluded that propofol is better than sevoflurane for endotracheal intubation in children[9]. In that study quality of tracheal intubation according to Copenhagen Consensus Conference (CCC) score was excellent in 82% children receiving propofol and only 55% in children receiving sevoflurane[10].

The purpose of the proposed study is to compare the quality of endotracheal intubation and hemo-

dynamic response facilitated with propofol versus sevoflurane in children. Because propofol and sevoflurane are both commonly used for endotracheal intubation. And literature has mixed evidence regarding superiority of one drug over the other. So there is a need to conduct this study to evaluate which of the drug is better for endotracheal intubation.

METHODOLOGY

A total number of 112 children having age 1-3 years, who were planned for any surgical procedure under general anesthesia were included in this randomized controlled trial. Children with upper respiratory tract infections, in whom endotracheal intubation (ETT) was done in emergency conditions and known to be allergic to any of the study drugs were excluded. Sample size for this study is calculated by taking expected frequency of excellent quality of intubation in 82% children using propofol versus in 55% children using sevoflurane[9]. Level of significance (α) 5.0% and power of test (1-β) 80%, the calculated sample size is 106 patients and we took 112 patients for this study.

Ethical approval from IRB of Combined Military Hospital Multan was taken. Informed consent from guardians of each children was taken before inclusion. The study duration was August 2018 to April 2019.

Patients were divided into two groups before insertion of endotracheal tube using envelop based draw randomization. Patients were divided into group P and group S depending upon the folded paper chosen by them. Group P; these patients received propofol for insertion of endotracheal tube. Group S; these patients received sevoflurane for insertion of endotracheal tube. All endotracheal intubations were done by a senior consultant anesthetist having at-least 5 years of post-fellowship experience. All patients were premedicated with IV and Midazolam 0.02 mg/kg. 10 minutes before surgery. In group P patient's 2.5 to 3.0 mg/kg propofol was given before insertion of endotracheal tube in 30 seconds and in group S patients 8.0% sevoflurane with 100% O_2 at gas flow of 6.0 liters. Sevoflurane was continued till the end of intubation. During endotracheal intubation the quality of intubation was evaluated using Copenhagen Consensus Conference (CCC) score for Assessment of Quality of Intubation (table-I).

Hemodynamic response such as changes in mean arterial pressure (MAP) and heart rate was also noted before induction of anesthesia, immediately after intubation and after 5 minutes of intubation.

Data analysis was carried out using SPSS-20. Quality of intubation between the groups was compared by using Chi-square test. Independent sample t-test was applied to determine changes in heart rate and MAP at different time intervals between the groups. A *p*-value ≤ 0.05 was taken as significant association.

RESULTS

Out of 112 children, there were 62 (55.36%) female children and only 50 (44.64%) male children. Mean age of children included in this study was 2.11 ± 0.80 years (range 1-3 years). Most of the children were having ASA status I, 110 (98.21%) children were of ASA status I and only 2 (1.79%) children were of ASA status II.

On comparison of quality of intubation between the groups, quality of intubation was excellent in 51 (91.1%) patients in propofol group and in 38 (67.9%) patients in sevoflurane group (*p*-value 0.009).

On comparison of HR between the groups, Mean HR there was no significant difference in baseline HR, and HR after 3 minutes. After 5 minutes of intubation, HR was 111.98 ± 5.43 beats/min in group S versus 109.05 ± 5.99 beats/min in group P (*p*-value 0.008). On comparison of MAP between the groups, baseline MAP was similar between the groups, MAP after 3 minutes was was 74.58 ± 4.45 mmHg in group S versus 71.0 ± 3.90 mmHg in group P (*p*-value <0.001). After 5 minutes, MAP was 73.16 ± 4.13 mmHg in group S versus 68.61 ± 4.07 mmHg in group P (*p*-value <0.001) (table-II).

Table-I: Copenhagen consensus conference (CCC) score for Assessing of quality of intubation.

Laryngoscopy	Easy	Fair	Difficult
Vocal Cords			
Position	Abducted	Intermediate	Closed
Movement	None	Moving	Closing
Reaction to Intubation			
Limbs	None	Slight	Vigorous
Coughing	None	Diaphragm	>10s
	Excellent	Good	Poor

Clinically Acceptable: Excellent = all score excellent, Good = all scores excellent or good
Clinically Unacceptable: Poor = any score poor

Table-II: Comparison of quality of intubation in sevoflurane versus propofol group.

Quality of Intubation	Propofol Group (Group I)	Sevoflurane Group (Group II)	*p*-value
Excellent	51 (91.1%)	38 (67.9%)	0.009
Good	04 (7.1%)	16 (28.6%)	
Poor	01 (1.8%)	02 (3.6%)	

Table-III: Comparison of mean heart rate and mean arterial pressure (MAP) at different intervals.

		At Baseline	At 3 minutes	At 5 minutes
Mean Heart Rate	Sevoflurane	113.58 ± 5.45	114.19 ± 5.11	111.98 ± 5.43
	Propofol	114.75 ± 5.24	112.89 ± 4.96	109.05 ± 5.99
p-value		0.25	0.17	0.008
MAP	Sevoflurane	76.69 ± 4.25	74.58 ± 4.45	73.16 ± 4.13
	Propofol	77.07 ± 4.47	71.00 ± 3.90	68.61 ± 4.07
p-value		0.65	<0.001	<0.001

DISCUSSION

Introduction of newer anesthetic drugs, such as propofol and sevoflurane has minimized the need for muscle relaxants for ETT insertion in pediatric population. Sevoflurane belongs to inhalation halogenated anesthetics with low blood solubility. Sevoflurane is very less pungent and does not causes irritation of airway that makes it very suitable for induction in children[11-13]. A study by Inomata *et al* evaluated the end tidal concentration of sevoflurane for sevoflurane and found MACEI of 2.69%, the authors concluded that sevoflurane is a suitable alternate for tracheal intubation and there is no need to use muscle relaxants[14]. Propofol has a shorted induction time thereby provides smooth and rapid induction and hence rapid recovery. It also reduces muscle tone and thereby reduces laryngeal reflexes that makes it suitable for tracheal intubation without using muscle relaxants[15,16].

This study was undertaken in 110 children of ASA 1 in the age group of 1-3 years. We found that quality of intubation was better in propofol group as compared to the sevoflurane group. Quality of intubation was excellent in 51 (91.1%) patients in group Pversus in 38 (67.9%) patients in group S.

A study by Reddy *et al* reported good intubating conditions in 30% patients and excellent in 43.3% patients using propofol and using sevoflurane they found good intubating conditions in 10% patients and excellent in 83.3% sevoflurane. The authors also reported excellent intubating conditions in 43.3% patients and good in 30% patients in propofol group versus excellent intubating conditions in 83.3% patients and good in 10% patients in sevoflurane plus propofol group. Reddy *et al* also reported similar results[17].

In present study we also noted hemodynamic response to intubation in our study, heart rate reduced first after induction and then increased after intubation. We found significantly higher increase in heart rate in sevoflurane as compared to propofol group. Similar result were reported by Vitanen *et al*, they also found reduction in HR after induction and increase in HR after intubation, but the rise in HR was more in sevoflurane as compared to propofol group[18].

In our study, mean arterial BP was decreased after induction and after intubation in both groups. However, reduction in MAP was more in propofol group as compared to sevoflurane group. A study by Thwaities *et al* also reported similar results they reported a mean reduction of MAP of about 20 mmHg in propofol group as compared to nearly 10 mmHg in sevoflurane group[10].

CONCLUSION

Sevoflurane was found to be associated with less changes in hemodynamic parameters as compared to propofol but quality of intubation conditions was poor using sevoflurane. Propofol is a better drug as compared to sevoflurane for providing better intubation conditions.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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