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Original Article

Haemodynamics During Induction with Sevoflurane Versus Propofol Using Laryngeal Mask Airways in Forearm Orthopaedic Surgeries in Older Children

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Abstract

Background: To compare the hemodynamic changes during induction of anesthesia with propofol and sevoflurane in children undergoing forearm orthopedic surgeries.

Methods: In this descriptive study 60 pediatric patients, scheduled for forearm orthopedic surgical procedure under general anesthesia requiring LMA insertion were included. The selected patients were allocated into two groups; A (Propofol) and B (Sevoflurane) of 30 each. Group A was induced with IV Propofol 2mg/kg while Group B was induced by sevoflurane 6-8%. Anesthetic induction was supposedly achieved after loss of eyelash reflex.

Results: Compared with base line, both groups showed a statistically significant decline in mean arterial pressure after induction. Propofol group (A) showed a larger transient decrease in MAP compared to sevoflurane group (B) (p<0.001). There was a statistical significant overall greater decline in MAP and heart rate after induction with propofol when compared with sevoflurane.

Conclusion: Sevoflurane provides slightly better hemodynamic stability compared to propofol during anesthetic induction.

Key Words: Laryngeal mask airway, Propofol, Sevoflurane

Introduction

Forearm orthopedic surgeries are commonly performed procedures in older children. Laryngeal mask airway commonly called LMA is a good option for elective ventilation during surgery, as its insertion is facilitated by sedation that is good enough to obtund the airway reflexes. Paralysis is not usually required for laryngeal mask airway insertion. Laryngeal mask airway protects the airway without having to introduce a foreign body in trachea leading to less risk of bronchospasm compared to endotracheal intubation. Laryngeal Mask Airway (LMA) can be used for either spontaneous or controlled ventilation.[1] It can be inserted after deep anesthetic induction which leads to the suppression of airway reflexes.[2] Inhalational anaesthetic sevoflurane andintravenous propofol are mostly used to sedate patients for LMA insertion Propofol is considered as the drug of choice for the insertion of LMA because of its depressant effect on airway reflexes.[3] Propofol has several adverse effects including pain on injection, apnea, hypotension and excitatory patient movement.[4]

On other hand sevoflurane is non-pungent inhalational anesthetic with a low blood gas solubility coefficient (0.69) and minimal respiratory irritant characteristics that makes it suitable as inhalational agent for induction of anesthesia and insertion of the LMA.[5,6] Sevoflurane has added advantages over propofol for providing better hemodynamic stability and smoother transition to the maintenance phase without a period of apnea.It's relative disadvantages are delayed relaxation of the jaw and a longer time for the insertion of LMA. Sevoflurane has extensive worldwide use for insertion of LMA but there are limited local studies [7,8]

Depolarizing muscle relaxants like succinylcholine are mostly administered for endotracheal intubation. Compared to adults, children are more susceptible to hyperkalemia, cardiac arrhythmias, myoglobinemia, masseter spasm and malignant hyperthermia after the administration of succinylcholine. It's routine use for tracheal intubation in the pediatric age group has been criticized after cardiac arrest and deaths were reported in some children. Non-depolarizing muscle relaxants are alternative to succinylcholine but they are slower in onset, have longer duration of action, and need to reverse neuromuscular block. Additionally, succinylcholine can cause prolonged neuromuscular blockade due to immaturity of the neuromuscular junction. This has led to the investigation into techniques of intubation without muscle relaxation. Inhalational induction with Sevoflurane and Intravenous induction with Propofol are two alternatives most commonly studied for intubation in children without use of muscle relaxants.[8]In a study conducted in USA in 2001 in which sevoflurane was given for induction to 13 patients, showed mean heart rate of 123.0 ± 32.0 at baseline and after intervention it was 128.0 ± 25.0 beats/min. Similarly, the mean arterial pressure was 67.0 ± 8.0 at baseline which dropped to 58.0 ± 13 mmHg[9]. Propofol and sevoflurane are both used in the country. In countries like Pakistan the supply of many anaesthetic drugs are erratic; therefore there is need for investigating acceptable alternatives.

Patients and Methods

After ethical approval, randomized controlled clinical trial with a quantitative descriptive design was conducted on orthopedic patients at the Department of Anesthesiology, Benazir Bhutto hospital, Rawalpindi, with a diagnosis of forearm orthopedic surgeries from March to September 2015. The calculated study sample size was 30 patients in each group.The inclusion criteria was ASA physical status I or II,age 8-16 years and patients undergoing forearm orthopedic surgeries. Patients with an allergy / sensitivity to volatile anesthetics or to propofol, with known or suspected genetic susceptibility to malignant hyperthermia, diabetics, morbidly obese and difficult airways were excluded. To facilitate the process and to confirm an ASA physical status I, II, patients underwent a standardized subjective and objective examination, as recommended. Standard monitoring of electrocardiogram (ECG), pulse oximetry (SpO2), non invasive blood pressure and mean arterial pressure (NIBP,MAP) and capnography (ETCO2) by using cardiac monitors were used during intra-operative period.Patients then were randomly allocated into two groups. Group A labelled was propofol induction group and group B as Sevoflurane induction group. Patients in either group received nalbuphine 0.2mg/Kg IV 15 minutes before induction.In group A, patients were pre-oxygenated for five minutes and were anesthetized with propofol 2mg/kg IV mixed with lidocaine 0.3 mg/kg, given over 30 seconds. The patients were then asked to count from 1 – 50. The point of time at which patient stopped counting was taken as loss of verbal response and it was considered as loss of consciousness (LOC) i.e. induction.In group B, Anesthesia was induced with sevoflurane with oxygen; with a total gas flow of 6 L/min. initially sevoflurane was started at 5% then gradually increased up to 8%. The point of time at which there was loss of eyelash reflex was considered as loss of consciousness (LOC) i.e. induction.Patient's heart rate and mean arterial pressure were recorded at pre-induction and post induction in both groups. Hypertension and hypotension was determined by a change of more than 20% in mean arterial pressure of pre-induction value.

Results

Mean age of patients in group A (propofol) was found to be 11.6 years while that of group B (sevoflurane) was 11.5 years (Table 1). Pre induction Mean heart rate in group A (propofol) was found to 95.6 beats per minute (BPM) with standard deviation ± 8.1 compared to 94.1 ± 12.4 beats/min in group B (sevoflurane). The post induction mean heart rate was 86.8 ± 6.8 in group A and 90.6 ± 12.0 in group B. The mean change in heart rate from pre to post induction period was 8.8 ± 3.6 BPM in group A compared to 3.6 ± 1.4 BPM in group B. The heart rate decreased less in group B and this difference in mean change was found statistically significant (p-value <0.001). (Table 2).

Table I: Demographic characteristics of patients in the two study groups (each group =30)

	Group A No. (%)	Group B No. (%)	Total No. (%)
Gender			
Male	14 (46.6%)	15 (50.0%)	29(48.3%)
Female	16 (53.4%)	15 (50.0%)	3 (51.6%)
Age (years)			
Mean± SD	11.6 ± 2.8	11.5 ± 2.7	11.6 ± 2.7

Table 2: Comparison of Pre and Post Induction Heart rate between study groups

	Group A (n=30)	Group B (n=30)	p-value
Pre induction HR (beats/min)			
Mean ± SD	95.6± 8.1	94.1± 12.4	0.58
Post induction HR (beats/min)			
Mean ± SD	86.8± 6.8	90.6± 12.0	0.13
Mean change in HR (beats/min)			
Mean ± SD	8.8 ± 3.6	3.6 ± 1.4	<0.001

Pre induction Mean Arterial Pressure in group A (propofol) was 79.9 ± 5.6 mmHg compared to 81.5 ± 5.1 mmHg in group B (sevoflurane). The post induction mean arterial pressure was found to be 73.3 ± 5.3 in group A and 78.4 ± 5.4 mmHg in group B. The mean change in MAP from pre to post induction period was 6.5 ± 1.8 mmHg in group A and 3.1 ± 1.3 mmHg in group B. It was noted that the change in MAP remained much static after induction in group B compared to significant decrease in group A (p-value <0.001) (Table 3).

Table 3. Comparison of pre and post induction mean arterial pressure (MAP) between study groups

	Group A (n=30)	Group B (n=30)	p-value
Pre induction MAP (mmHg)			
Mean ± SD	79.9± 5.6	81.5 ± 5.1	0.26
Post induction MAP (mmHg)			
Mean ± SD	73.3± 5.3	78.4 ± 5.4	0.01
Mean change in MAP (mmHg)			
Mean ± SD	6.5 ± 1.8	3.1 ± 1.3	<0.001

Discussion

The development of new anesthetic agents like Sevoflurane and propofol have reduced the need for muscle relaxant for tracheal intubation in Children.[10] Sevoflurane is a halogenated inhalational anesthetic with low blood gas solubility. It is non-pungent and non-irritant to airway. It provides rapid, smooth induction and rapid emergence from anesthesia which makes it suitable for induction and intubation in pediatrics patients.[11] Chen L et al, have studied end tidal concentration for tracheal intubation. They concluded that Sevoflurane appears to be suitable for use in Pediatric patients as an induction.[12]

Yasuda N et.al have studied the clinical characteristics of Sevoflurane in children. They concluded that Sevoflurane with nitrous oxide provides satisfactory anesthetic induction and intubating condition.[5]

Propofol is a short acting intravenous anesthetic agent providing rapid and smooth induction and rapid recovery. It's use leads to lower laryngotracheal reactivity along with decreased muscle tone. Interest in relaxant free intubation was renewed due to the ability of propofol to suppress laryngeal reflexes.[13-17]

The study was undertaken in 60 children of ASA I & II in the age group of 8-16 yrs. Random division of 60 children was done into two groups of 30 each. The demographic data of the two groups was quite similar. Premedication of all patients was done with Nalbuphine 0.2 mg/kg. LMA insertion, short-acting volatile anesthetics and intravenous anesthetics has allowed anesthesiologists to achieve a more consistent recovery profile that facilitates fast-tracking after general anesthesia.[20-23] Anesthetic techniques that optimize intraoperative surgical conditions while providing rapid, early recovery have assumed increased importance.[24,25]AEPI and BIS can lead to a lack of reliable depth of anaesthesia monitors .[8,16]

Conclusion

Sevoflurane provides better hemodynamic stability compared to propofol during anesthetic induction in children undergoing orthopedic surgeries.

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