Print ISSN: 2321-6379
Online ISSN: 2321-595X
DOI: 10.17354/ijss/2016/412

Original Article

Comparison of Onset of Induction and Easiness of Laryngeal Mask Airway Insertion in Adults: Propofol versus Sevoflurane Single Vital Capacity Breath Technique-high Concentration (8%)

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Abstract

Background: Laryngeal mask airway (LMA) insertion is an imperative tool in difficult airway scenarios. The ease of insertion in a spontaneously breathing patient and without the use of paralytic agents makes it a highly advantageous airway device.

Aims: In our study, we compare the onset of induction, to assess ease of LMA insertion, to assess number of attempts taken for correct placement, complications, if present during or following insertion of LMA, hemodynamic stability using sevoflurane high concentration inhalational technique and propofol intravenous (IV) induction technique in patients undergoing elective minor surgical procedures.

Materials and Methods: Prospective randomized study of American Society of Anesthesiologists physical status 1 or 2 patients was anesthetized with either a single vital capacity breath technique with sevoflurane 8% or IV propofol 2 mg/kg. Onset of induction and easiness of LMA insertion were studied, along with number of attempts taken for correct placement of LMA, hemodynamic stability, and complications.

Results: This study shows no significant difference between the two groups based on the demographic variables. The mean onset of induction was 44.40 s in the propofol group and 61.45 s in the sevoflurane group. The mean time for LMA insertion was 19.05 s in sevoflurane group and 12.88 s in propofol group.

Conclusion: Ease of insertion and placement of the LMA was found easier with propofol and prolonged in sevoflurane.

Key words: Laryngeal mask airway, Propofol, Sevoflurane, Vital capacity breath technique

INTRODUCTION

The laryngeal mask airway (LMA) is an airway device used frequently in anesthesia and critical care for airway management. It is an alternate and appropriate airway device to the facemask when endotracheal intubation is not mandatory. Acceptable placement of LMA needs enough depth of anesthesia. This study is undertaken to compare the easiness of insertion of LMA using propofol/sevoflurane for induction. In recent times, inhalational induction with sevoflurane using single vital capacity breath (VCB) technique has been used. It is an alternate method to intravenous (IV) induction in adult patients. This method is rapid, with greater acceptances light excitatory phenomena and better hemodynamic profiles. LMA placement is more rapid after VCB induction using 8% of sevoflurane. This makes the sevoflurane sole drug for both maintenance and induction of anesthesia. It will make conversion period easier. Hence, this study is conducted to compare the consistency, excellence, and time to LMA insertion in adults after using sevoflurane induction and propofol induction.

Access this article online

www.ijss-sn.com

Month of Submission : 05-2016
Month of Peer Review : 06-2016
Month of Acceptance : 07-2016
Month of Publishing : 07-2016

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MATERIALS AND METHODS

A prospective, randomized, controlled trial was conducted in Government Kilpauk Medical College and Hospital, Chennai. Institutional Ethical Committee approval and written informed consent were obtained. 80 adult patients under American Society of Anesthesiologists (ASA) physical status 1 and 2 of either sex undergoing elective minor surgical procedures were enrolled for this study.

Inclusion Criteria

Elective minor surgical procedures, both gender, ASA physical status 1-2, age from 18 years to 50 years, patients with normal body mass index from 18.5 to 25.

Exclusion Criteria

Patients not satisfying inclusion criteria, patients with cardiac disease, known case of malignant hyperthermia or suspected genetic propensity, patients with reactive airway disease. Boyles machine with circle CO_2 absorber circuit, volatile anesthetic drug sevoflurane with vaporizer, propofol, classic LMA size 3 and 4. Resuscitation kit should be kept ready; approximate size endotracheal tubes, airways, suction apparatus. Patients in both the groups were IV cannulated with 18-gauge venflon. Monitors connected are non-invasive blood pressure (NIBP), electrocardiogram (ECG), and pulse oxymetry, end tidal CO_2 ($ETCO_2$), premedicated with IV injection glycopyrrolate 0.2 mg, fentanyl 2 μg/kg, ranitidine 50 mg, ondansetron 0.1 mg/kg, then preoxygenated for 3 min with 100% O_2.

Propofol Group

Patients in the propofol group were preoxygenated with 100% oxygen for 3 min and anesthetized using propofol 2 mg/kg IV, given over a period of 30 s. The onset of induction (loss of eyelash reflex) was assessed. 30 s after the achievement of induction (i.e., 60 s after the start of propofol), jaw relaxation was assessed and, if achievable, LMA placement was attempted. If not possible, attempts were repeated every 30 s up to a max. 4 attempts, every time preceded by IV boluses of propofol about 0.5 mg/kg. NIBP, ECG, SPO_2, and $ETCO_2$ readings were recorded for 5 min in 1 min interval. Any failure of placement, defined as failure to insert the LMA after 4 attempts, they were rescued with suxamethonium 25 mg IV. The existence of difficulties correlated to induction and placement of the LMA was noted such as excitatory movement or withdrawal from pain, gagging, coughing, apnea, and laryngospasm. At the end of the surgery, the existence of blood on the LMA was noted.

Sevoflurane Group

A closed circuit with circle absorber for CO_2 with a 2-L breathing bag was used. The closed circuit was primed with 8% sevoflurane in a 2:1 of N_2O to O_2 for 1 min at a rate of 6 L/min of fresh gas flow. Then, the patients were asked to take a deep breath after maximum exhalation and to hold as long as possible and then expire to residual volume. The onset of induction (loss of eyelash reflex) was assessed. 90 s after the induction, the jaw relaxation was assessed. 90 s was selected because it signifies the time at which all patients finished their VCB. If jaw relaxation was not possible, attempts were repeated every 30 s up to a max 4 attempts. At this time, anesthesia sustained with sevoflurane 8% and N_2O 67% in O_2. Once jaw relaxation was possible, LMA insertion was tried. Successful LMA insertion, time to LMA insertion (s), number of attempts (n), presence of blood on LMA, and hemodynamic parameters were observed.

The data were analyzed with SPSS software version 19.1 and $P < 0.05$ was considered statistically significant. Demographic data, the onset of induction, the time taken for LMA insertion, complications, and hemodynamic variables among the groups were analyzed with unpaired Student's *t*-test. Chi-square analysis was used for comparing gender and number of attempts for insertion.

RESULTS

The number of attempts for LMA insertion was comparable in both the groups without any statistically significant difference. The only thing was time to LMA insertion was prolonged in sevoflurane group.

Compared between both groups, there was significant variation in the 1, 3 min post-insertion mean blood pressure, $P < 0.0001$ (Tables 1 and 2). This study shows no significant difference between the two groups based on the demographic variables. The time to LMA insertion in sevoflurane group was significantly longer than propofol group ($P < 0.05$) (Table 3). Onset of induction in sevoflurane group was longer than the propofol group ($P < 0.05$). The hemodynamic responses were more stable in the sevoflurane group ($P < 0.05$). There was no statistical difference between the two groups in number of attempts and complications for LMA insertion (Tables 4 and 5).

DISCUSSION

In our study, we observed sevoflurane single VCB inhalational induction takes more time for the onset than the propofol group which was statistically significant (Table 6).[1,2] The time taken for LMA insertion was more with the sevoflurane group which was statistically significant. The hemodynamic stability was better with sevoflurane group. Placement of LMA after propofol

Table 1: Comparison of 1 min BP after LMA insertion between propofol and sevoflurane group

Group	Mean	SE	*P* value
Propofol	77.55	0.9	<0.0001
Sevoflurane	83.90	0.5	

BP: Blood pressure, LMA: Laryngeal mask airway, SE: Standard error

Table 2: Comparison of 3 min BP after LMA insertion between propofol and sevoflurane group

Group	Mean	SE	*P* value
Propofol	86.78	0.8	<0.0001
Sevoflurane	91.35	0.6	

BP: Blood pressure, LMA: Laryngeal mask airway, SE: Standard error

Table 3: Comparison of time to LMA insertion between propofol and sevoflurane group

Group	Mean	SE	*P* value
Propofol	12.88	0.6	<0.0001
Sevoflurane	19.05	0.6	

LMA: Laryngeal mask airway, SE: Standard error

Table 4: Comparison of occurrence of apnea between propofol and sevoflurane group

Group	Apnea		*P* value
	Present	Absent	
Propofol	17	23	0.009
Sevoflurane	4	36	

Table 5: Comparison of number of attempts between propofol and sevoflurane group

Group	Mean	SE	*P* value
Propofol	1.1	0.04	0.215
Sevoflurane	1.2	0.06	

SE: Standard error

Table 6: Comparison of onset of induction (obliteration of eyelash reflex) between propofol and sevoflurane group

Group	Mean	SE	*P* value
Propofol	44.40	0.7	<0.0001
Sevoflurane	61.45	1.0	

SE: Standard error

induction was achieved in all patients, paralleled with two failures in sevoflurane group.[3] The number of attempts and complications of LMA insertion were comparable in both the groups. With sevoflurane VCB technique, the hemodynamic parameters during the induction and placement of LMA were stable. Sevoflurane produced a lesser frequency of apnea and allowed better conversion to the phase of maintenance.[4] On the other hand, the onset of induction and the time taken for LMA placement were longer. The time delay to LMA insertion was due to jaw muscle tightness. The safety and consistency of sevoflurane single VCB induction makes it, an alternate method to IV induction of propofol for the placement of the LMA in adult patients when propofol is contraindicated.[5] Propofol is an IV induction agent which has a rapid onset of action with good relaxation properties. It is administered as a 1% solution. Administration of 1.5-2.5 mg/kg IV produces unconsciousness within 30 s. The rapid induction and rapid return of consciousness with minimal residual effects are the most important advantages of propofol.[6] Sevoflurane is an inhalational anesthetic agent. With a blood gas partition coefficient of 0.69% and minimum alveolar concentration of 2.1, it ensures rapid induction and rapid recovery after discontinuation of anesthesia. Sevoflurane causes least degree of airway irritation among the other volatile anesthetics and has smooth conversion to maintenance phase without apnea.[5,7] Sevoflurane associated with delayed jaw muscle relaxation and may take a longer time for insertion of LMA. On the other hand, it has better hemodynamic profile and can be used in high-risk patients.[8] Molloy and Buggy (1999): Conducted a study titled "Propofol or sevoflurane for LMA insertion." The study population consisted of 88 patients of ASA I or II underwent general anesthesia for the elective surgeries allocated into 2 groups. Patients in propofol group (n = 44) received 2.5 mg/kg propofol IV and in sevoflurane group (n = 44) received sevoflurane 8% in N_2O 50% and O_2 50%. LMA placement is attempted at 1 min interval from loss of eyelash reflex. The mean time to successful LMA placement is 1.3 min in propofol group and 2.2 min in sevoflurane group. They noted that complications were similar in both groups. They concluded that modified VCB inhalational induction with sevoflurane 8% is efficient for LMA placement in many cases, but it takes longer time than the propofol.[2] Kati and Demirel (2003): Conducted a study titled "Comparison of propofol and sevoflurane for LMA insertion." In this study, 100 patients aged between 20 and 40 years are randomly assigned into two groups. Group 1 received propofol (2.5 mg/kg IV) for induction, and the Group 2 received sevoflurane 6% (50% N_2O + 50% O_2) by the tidal volume technique of inhalational anesthesia. In both the groups, insertion of appropriate sized LMA was attempted. LMA placement time is found to significantly lengthier in the sevoflurane group than in the propofol group.[9] Priya and Divatia (2002): Conducted a study titled "A comparison of propofol versus sevoflurane for LMA insertion." 50 female patients of ASA Grade I/II are randomly allocated into 2 groups (n = 25 in every group) - Group S (inhalational sevoflurane) and Group P (IV propofol). Group P received IV propofol mean dosage 2.5 mg/kg and Group S 8% sevoflurane in 50%

N_2O and 50% O_2 for 30 s. After loss of eyelash reflex, LMA insertion was excellent in Group P (64%) than in Group S (32%). 72% of patients in Group P had complete jaw opening when compared to 44% of Group S. Hence, they concluded that propofol is better than sevoflurane for LMA insertion. Philip and Lambard (1999): Conducted a study titled "Comparison of vital capacity induction with sevoflurane to IV induction with propofol for adult ambulatory anesthesia." In this study, there were 56 patients allocated randomly to receive either 8% sevoflurane in 75% N_2O/O_2 from already primed circuit (VC group n = 32 patients) or propofol 2 mg/kg bolus (IV group n = 24) and time to induction, loss of consciousness, and side effects are monitored. In the VC group patients, 59% have lost responsiveness in one breath taking 39 ± 3 s. All vital capacity patients finished the induction and all measures; induction time is appreciably shorter time for the vital capacity group than IV group. They concluded that vital capacity induction with sevoflurane is a satisfactory alternative to propofol IV induction of general anesthesia for the adult ambulatory anesthesia.[10]

CONCLUSION

In our study, we conclude that inhalational induction by VCB technique using 8% sevoflurane is an alternate to IV induction using propofol for insertion of LMA in adult patients. When compared to IV propofol induction, sevoflurane VCB technique had stable hemodynamic parameters and less incidence of apnea. It allowed smooth conversion to maintenance phase and minimal occurrence of apnea. Even though onset of induction is more and extended jaw muscle tightness can delay LMA placement in patients with sevoflurane, it is a good alternative to propofol especially when it is contraindicated.

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How to cite this article: Dharmalingam AL, Thamilselvi BS, Murukan MS, Anandan H. Comparison of Onset of Induction and Easiness of Laryngeal Mask Airway Insertion in Adults: Propofol versus sevoflurane Single Vital Capacity Breath Technique-high Concentration (8%). Int J Sci Stud 2016;4(4):231-234.

Source of Support: Nil, **Conflict of Interest:** None declared.