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Original Research Article

A comparative study to evaluate the effect of 8% sevoflurane compared to 1% Propofol for insertion of laryngeal mask airway in adult patients -A prospective, randomised & controlled study

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ABSTRACT

Aims: The airway management during the general anaesthesia is mainly done using laryngeal mask airway. The anaesthesia that is used for this purpose is either propofol or sevoflurane supplied through inhalational route for painless insertion. Hence, the study was conducted with the aim of comparing 8% sevoflurane and 1% Propofol with regard to efficacy and associated complications.

Materials and Methods: This prospective experimental study included adult subjects who were undergoing minor surgeries. The subjects were equally distributed into two groups. The Group-1 received propofol 2-2.5 mg/kg body weight and Group-2 received 8% sevoflurane. The study outcomes were determined induction characteristics such as loss of verbal contact, eyelash reflex, jaw relaxation and some attempts for insertion were assessed. The other parameters that were recorded were grading of the parameters, blood pressure, and heart rate and associated complications.

Results: A total of 60 participants were included in the study. Propofol took a lesser time for Induction characteristics as compared to that of sevoflurane. It was observed that propofol was associated with fall in heart rate and blood pressure and more rate of complications.

Conclusion: Faster induction was observed in Propofol while good hemodynamic stability was associated with Sevoflurane.

1. Introduction

The laryngeal mask airway (LMA) is a commonly used device used mainly for the flow of the airway or in emergency. LMA is maintained at the supraglottic level and it covers the larynx to provide instant ventilation.1 The safety of LMA in controlled ventilation, with the maintenance of 15–20 cm of H_2 O airway pressure has been well documented. Also, its safety across different age groups and a variety of surgeries have also been well established.[1] The key advantages are its minimally invasive nature, lesser trauma and ease of insertion without the need for muscle relaxation or laryngoscopy and minimal impact on hemodynamic parameters. The reported incidence of postoperative complications is also comparatively lesser.[2] These features make it an excellent apparatus for airway management in emergency and daycare settings.[2]

A wide variety of induction agents are used to gain required block and reflexes suppression of airway before LMA insertion. Intravenous (IV) medication like thiopentone, propofol, and ketamine and inhalational agents such as halothane and sevoflurane are widely used in practice with a varied degree of reported success rates.[3,4] Propofol is one of the preferred IV agents considering its efficacy and safety profile. But, pain following injection, and complications such as thrombophlebitis, cardiovascular, and respiratory depression are some of the key disadvantages of propofol.[4] Sevoflurane is one of the most popular inhalational agents with bronchodilator properties.[5] It is reported to result

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in faster induction, comparable hemodynamic stability, and desirable recovery characteristics.[6] But it is reported to be associated with breath holding, coughing, and laryngospasm.

But there are very few studies comparing these two anaesthetic agents head to head as induction agents of LMA placement.

1.1. Primary objective

1. To compare the quality and ease of LMA insertion following induction with sevoflurane (8%) or Propofol (1%).

1.2. Secondary objective

1. To compare the haemodynamic parameters following LMA insertion post induction with sevoflurane (8%) or Propofol (1%).

2. Materials and Methods

This study was a prospective obsrvational study conducted on adult subjects aged 18-48 years. Those who were undergoing minor surgical procedures under general anaesthesia were included in the study. The subjects were ASA grade I & grade II patients who were randomised into two groups. Group-I – Propofol (control group); Group-II – sevoflurane (study group) with 30 in each group. Adults <18years, >48years ASA III, IV, V, morbidly obese patients, and those requiring endotracheal intubation were excluded. The study was conducted for 18-month period between January 2018 to June 2019.

A pre-anaesthetic evaluation was done one day before surgery and was appraised on the day of surgery. A detailed medical history was taken. Systemic examination was carried out, and relevant investigations were advised. It was made sure that the informed written consent was taken from all the study subjects. Nil per oral status was maintained for all patients. Patients were premedicated with the tab. Ranitidine 150mg and tab Ondansetron 4mg, 6 hours before.

On arrival to the operation room, an IV line was secured, and monitors for ECG, NIBP, $ETCo_2$ and SPO2 were connected. Patients received inj. Fentanyl 1.5 – 2mcg/kg before induction. The study subjects were preoxygenated for 5min with 100% oxygen using a fresh gas flow of 8L/min. Patients baseline vital data like heart rate, SBP, DBP, MAP, SPO2 were recorded.

In Group – I patients received Propofol 2-2.5mg/kg body weight at the rate of 40mg every 10 sec was given.

In Group – II patients Sevoflurane 8% was introduced, and the anesthetic circuit was primed into fresh gas flow of 8L of oxygen. The sample size was calculated assuming the expected mean and standard deviation of the time taken for LMA insertion in the Propofol as μ, σ1 (136.73,5.98) and in the LMA as μ, σ 0 (141.73,6.48), as per the literature. The other parameters considered for sample size calculation included were 80% power of study and 5% two-sided alpha error. The required sample size was calculated as 24 subjects in each group. To account for the loss to follow up another 3 subjects were added to required sample size. It was rounded of to include 30 subjects in each group.

The starting point of induction was the beginning time of injecting of propofol or sevoflurane. The loss of verbal contact was the desired endpoint which was assessed by patient's response to calling out the name. Following this loss of eyelash reflex was noticed followed by assessment of jaw relaxation. It was reassessed every 15 seconds till the jaw relaxation was adequate. After this LMA insertion was attempted. Successful LMA insertion time was recorded.

The following data were recorded.

1. Number of LMA insertion attempts
2. HR, SBP, DBP, MAP were monitored once in a minute and then for 5 minutes
3. Continuously SPO2, ETCO2 were monitored.

To grade the intubating conditions, a three-point scale checklist was used. There were 6 variables namely jaw relaxation, ease of LMA insertion, coughing, biting, gagging, and laryngospasm. Based on the total score they were finally categorized as excellent, satisfactory or poor. Score 18 was considered excellent (maximum score), satisfactory score was considered from 16-17 and poor <16.

Brain described the appropriate size LMA insertion method. After insertion of LMA, 66% N2O + 33% O2 + 2% Sevoflurane anesthesia was continued. When the patient has reach ed an adequate depth of anaesthesia and was well settled LMA, the study was stopped.

Data analysis was conducted by intention to treat (ITT) analysis. The baseline data was noted down. Mean & SD was compared for normally distributed quantitative variables, median and interquartile range (IQR) was compared for non-normally distributed quantitative variables. Chi-squared test or Fisher's exact test (below 30) compared categorical variables. Data were analysed using R statistical software.

3. Result

The mean a number of attempts for Propofol group was 1.00, and that of sevoflurane was 1.07 and was not significant at P value is >0.05(0.13). (Table 1)

Propofol had an earlier loss of verbal contact and loss of eyelash reflex (P value 0.03 and 0.04 respectively) and was statistically significant. Other variables was almost similar in both the groups and they didn't show a statistically significant result (P values 0.59 and 0.50 2 respectively) when student t- test was used. (Table 2)

Table 1: Comparison of baseline parameters

Patient factors	**Propofol (n=30)mean ± SD**	**Sevoflurane (n=30) Mean ± SD**	**P value**
Age	31.50±7.66	32.60±7.22	t =0.57; p=0.56
Gender (Male: female)	1:2 (10, 20)	1: 1 (15, 15)	p = 0.2949
Weight	65.43±11.87	65.43±10.41	t =0.31; p=0.75
LMA Insertion attempts	1±0.00	1.07±0.25	t =1.53; p=0.13

Table 2: Comparison of parameters related to the onset of anaesthesia between two study groups

	Propofol **Mean ±**	**SevofluraneMean ± SD**	**P value**
Loss of verbal contact	61.37 ± 5.54	64.60 ± 6.07	t=2.15; p=0.03
Loss of eyelash reflex	89.17 ± 5.27	91.80 ± 4.42	t=2.09; p=0.04
Jaw relaxation	118.0 ± 4.85	118.6 ± 4.75	t=0.54; p=0.59
LMA insertion	141.73 ± 6.48	142.7 ± 5.40	t=0.67; p=0.50

Table 3: Comparison of Grading of intubating conditions between two groups

Parameter	**Grade**	**Description**	**Propofol**	**Sevoflurane**
	3	Full	29 (96.7%)	29(96.7%)
Jaw relaxation	2	Partial	01(3.3%)	01(3.3%)
	1	Difficult	00(0%)	00(0%)
	3	Easy	29(96.7%)	29(96.7%)
Ease of LMA insertion	2	Difficult	01(3.3%)	01(3.3%)
	1	Impossible	00(0%)	00(0%)
	3	Nil	29(96.7%)	29(96.7%)
Coughing	2	Transient	01(3.3%)	01(3.3%)
	1	Persistent	0(0%)	0(0%)
	3	Nil	30(100%)	30(100%)
Biting	2	Transient	00(0%)	00(0%)
	1	Persistent	00(0%)	00(0%)
	3	Nil	29(96.7%)	29(96.7%)
Gagging	2	Transient	01(3.3%)	01(3.3%)
	1	Persistent	00(0%)	00(0%)
	3	Nil	30(100%)	29(96.7%)
Laryngospasm	2	Partial	00(0%)	01(3.3%)
	1	Total	00(0%)	00(0%)
	16	Poor	0(0%)	0(0%)
Complaint score	17	Satisfactory	4(13.3%)	5(16.7%)
	18	Excellent	26(86.7%)	25(83.3%)

3.1. Description

96.7% of the subjects in both study groups had full jaw relaxation and ease in inserting the LMA. Biting and laryngospasm were not present in any groups. 86.7% in the propofol group and 83.3% in the sevofluorane group. Excellent intubation was seen in 26 (86.7%) subjects, and 4 (13.3%) had satisfactory intubation in the propofol group. Whereas in sevoflurane group 25 (83.3%) patients had excellent grading for LMA insertion, and 5 (16.7%) had a satisfactory condition for LMA insertion. (Table 3)

Comparison of hemodynamic parameters across study groups:

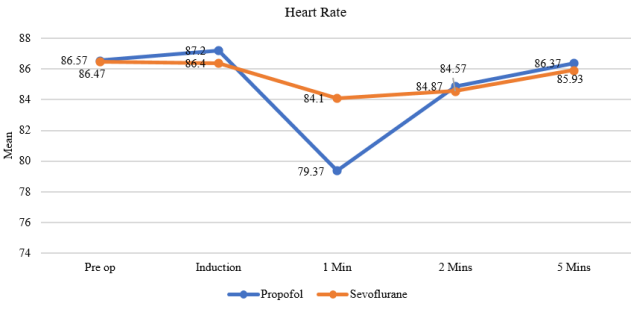

Fig. 1: Comparison of Heart rate between Propofol and sevoflurane group eye at different follow up visits

3.1.1. Heart rate

The heart rate was similar at the baseline and initially for about a minute. But propofol displayed a significant sharp

fall in heart rate at 1 minute (P=0.028). No statistically significant difference was noted at 2 minutes and 5 minutes after induction. (Figure 1)

3.1.2. Systolic blood pressure

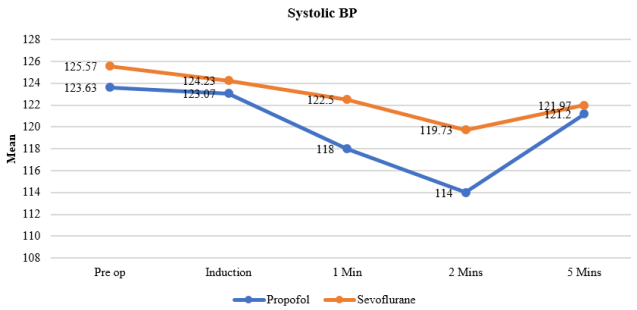

Fig. 2: Comparison of systolic BP between Propofol and sevoflurane group eye at different follow-up visits

The SBP was similar across study groups in the preoperative period, at the time of induction and at 5 minutes. At 1 minute (P=0.016) and 2 minutes (P value=0.002) we observed the fall in the SBP in propofol and a significant difference between the two groups was observed.

3.1.3. Diastolic blood pressure

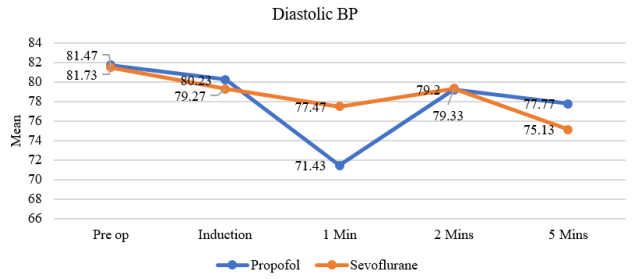

Fig. 3: Comparison of diastolic BP between Propofol and sevoflurane group eye at different follow-up visits

The similar DBP values were observed preoperatively, at induction, 2 minutes and 5 minutes between the groups. At 1 min propofol had significantly less DBP compared to Sevoflurane. (P= <0.001).

3.1.4. Mean arterial pressure

The MAP preoperatively, at induction, at 2 minutes and 5 minutes was similar in both groups. At one-minute propofol showed a significant fall in MAB (p=<0.05).

4. Discussion

Airway management is a daunting job for any anesthesiologist. In 1988, Dr Archi Brain, a British Anaesthesiologist

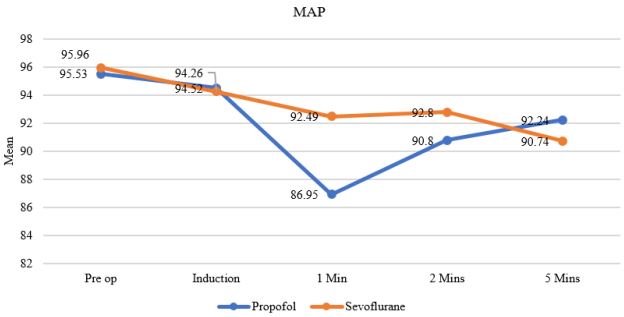

Fig. 4: Comparison of MAP between Propofol and sevoflurane group eye at different follow up visits

developed this LMA device, and now it's being used in large scale surgeries.[7] Laryngeal mask airway has emerged as a promising tool in his armamentarium to tackle difficult airway.

Propofol is a common intravenous anaesthetic agent used for LMA insertion because of its greater depressant effect on airway reflexes. Sevoflurane has the advantages of low blood gas solubility and minimal respiratory irritant effect which makes it an effective induction agent even in high concentration. Fentanyl was used as a co-induction agent because of the known synergistic effect of opioids with both sevoflurane and Propofol.[8]

In our study, Propofol took lesser time for loss of verbal contact and loss of eyelash reflex in comparison with sevoflurane. However, the time taken to successfully insert laryngeal mask was equal in both groups. Our study corresponds to a cross sectional study which noted both propofol and sevoflurane took similar times to jaw relaxation where sevoflurane group took 98 ± 10.34 seconds and Propofol took 93.75± 16.34 seconds.[9] The LMA insertion was also similar in both groups where Sevoflurane time was 137.05± 17.42 and propofol 140.16± 21.67 sec). Another study observed that sevoflurane (84±24 seconds) was associated with significantly slower induction time when compared with propofol (57± 11 seconds).[4] However, the complications observed such as apnoea were less in sevoflurane. A study observed faster induction with sevoflurane, probably because they used sevoflurane in combination with nitrous oxide.[6]

In the present study, time required for jaw relaxation in propofol group was 118.0±4.84 and that of sevoflurane group was 118.6±4.75 which is concurrent to a randomized control trail, where time necessary for jaw relaxation in propofol group and sevoflurane group was found to be 62.84 ± 8.06 and 92.76 ± 10.83s (P = <0.001).[10] This was similar to the previous study findings.

Propofol is a known IV agent which permits easy insertion of LMA. However, there some side effects to it such as hypotension and apnoea. Sevoflurane is IV induction agent which has high patient acceptance and good

hemodynamic stability. Patients response to LMA insertion, gagging, coughing, biting, jaw relaxation, laryngospasm and ease of LMA insertion were graded. In this study, 1 patient had partial jaw relaxation in both the groups. Sevoflurane group had partial laryngospasm. Gagging and coughing were found in both groups which indicate the inadequate depth of anaesthesia and suppression of airway reflexes which in turn leads to complications like aspiration, trauma, and desaturation.

In the present study Propofol group had LMA insertion in the first attempt in all the patients whereas in sevoflurane 2 patients required two attempts for LMA insertion. 96.7% of the subjects in both study groups had full jaw relaxation and ease in inserting the LMA. Biting and laryngospasm were not present in any groups. 86.7% in the propofol group and 83.3% in the sevofluorane group. Excellent intubation was seen in 26 (86.7%) subjects, and 4 (13.3%) had satisfactory intubation in the propofol group. Whereas in sevoflurane group 25 (83.3%) patients had excellent grading for LMA insertion, and 5 (16.7%) had a satisfactory condition for LMA insertion. The study findings were in line with a randomized double blinded study where features like coughing, gagging and patient movements did not reach statistical significance and they noted that sevoflurane induction took a longer time because sevoflurane had fewer relaxation properties. 13 A cross sectional study found that both sevoflurane and Propofol had similar quality for insertion of LMA and concluded that sevoflurane is a good alternative to Propofol for LMA insertion, which is similar to our study as far as these parameters are taken into consideration.[9]

Considering the haemodynamic changes the heart rate, and measures of blood pressure, at baseline and at the time of induction or at 5 mins did not show much difference whereas there was a statistically significant sudden fall in heart rate, systolic, diastolic and mean arterial pressure when induced with propofol at anyone point of time between induction and 5 minutes. Similar results were observed where Propofol showed a minor decrease in systolic, diastolic and mean arterial pressure. This property of hypotension in propofol may deem harmful when treating the elderly especially the one suffering from coronary artery disease.[9] A double blind comparison study compared the hemodynamic parameters noted that propofol was associated with a decrease of approximately 20 mmHg in MAP which occurred within 2 min and persisted for at least 5 min of anaesthesia. In contrast, they noted that decrease with MAP with sevoflurane was only 10 mm Hg. Almost similar results were noted in our study also.[4]

An observational study found that compared with baseline values average decrease in MAP during the study was 18.7% and 17% in Propofol and sevoflurane groups respectively. Another study observed that hemodynamic responses were stable in both groups however significant difference in MAP in the Propofol group three minutes, which is comparable to the current study.[11]

The limitation of the study is that depth of anesthesia between the two groups was not compared. However, it is difficult to compare the depth of anesthesia between inhaled and IV anesthetics.

5. Conclusion

The time required for jaw relaxation and overall LMA insertion conditions is similar in both and groups. When the loss of eyelash reflex and loss of verbal contact considered Propofol was superior to sevoflurane (8%). Sevoflurane provided an equivalent LMA insertion condition while maximising hemodynamic stability. Hence it can be taken as an acceptable alternative to Propofol.

6. Source of funding

None.

7. Conflict of interest

None.

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