

Comparison of Sevoflurane and Propofol for Laryngeal Mask Airway Insertion in Adults

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Abstract

Background: A randomized comparative study titled “Comparison of sevoflurane and propofol for insertion of laryngeal mask airway insertion in adults.” was done on 50 patients in the department of anesthesiology, at Prathima Medical College, Karimnagar, Telangana, India. **Subjects and Methods:** The conditions and hemodynamic changes for insertion of LMA were assessed in ASA grade I and II patients age 18 – 60 years while inserting LMA insertion. Patients were randomized into two groups. Inj Fentanyl 1.5 - 2µg/kg was given to both groups of patients. Propofol 2 – 2.5 mg/kg was given in group P. Group S patients were induced with 8% sevoflurane. Hemodynamic parameters and quality of insertion of LMA were assessed. Time taken for insertion of LMA in both groups was compared. **Results:** There was no significant difference in adverse response to LMA insertion. The quality of insertion with propofol was excellent in all patients. With sevoflurane quality of insertion ranged from excellent to satisfactory. But the airway related incidents in our study were more in the sevoflurane group when compared to the propofol group but are not of any statistical significance. Induction of anesthesia with sevoflurane was associated with the advantage that means arterial pressure was better maintained with sevoflurane compared with propofol. **Conclusion:** Thus, sevoflurane is associated with good hemodynamic stability, but the quality of anesthesia provided with propofol is higher. Prolonged jaw relaxation with sevoflurane compared to propofol may delay laryngeal mask airway insertion.

Keywords: Sevoflurane, Haemodynamics, Propofol, LMA insertion.

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Introduction

The laryngeal mask airway has gained widespread popularity for airway management during surgery. The laryngeal mask airway is an ingenious supraglottic airway device that is designed to provide and maintain a seal around the laryngeal inlet for spontaneous ventilation and allow controlled ventilation at modest levels (<15cms of H₂O) of positive pressure.^[1]

Laryngeal mask airway has been used in millions of patients and is accepted as a safe technique in a variety of surgical procedures.^[2] It ensures better control of the airway than the facemask, leaving the anesthetists hands free and avoids the disadvantages of the endotracheal tube-like pressor response during intubation and sore throat, croup, hoarseness postoperatively. The laryngeal mask also provides an effective and simple solution to many problems of difficult intubation. With use of LMA, muscle relaxation is unnecessary, laryngoscopy is avoided and hemodynamic changes are minimized during insertion.^[2]

Ideal induction agent for LMA insertion would provide loss of consciousness, jaw relaxation, absence of upper airway reflexes rapidly without cardiorespiratory compromise. Most currently available induction agents have been used for LMA insertion, but propofol is probably the best intravenous agent

and sevoflurane is the best volatile agent, though neither is

ideal.^[3]

IV propofol with or without opioid is the induction agent of choice for laryngeal mask airway insertion. Because of its favorable recovery profile and low incidence of side effects, propofol has become the drug of choice for insertion of laryngeal mask airway but is associated with pain on injection and cardiovascular and respiratory depression.^[4]

Sevoflurane, a halogenated, volatile anesthetic agent, is nonirritating to the airways, and mask induction with this agent is associated with a very low incidence of breath-holding, coughing, and laryngospasm. In addition, low lipid solubility allows a fast, smooth induction; and a predictably short recovery. The induction technique using a high inspired concentration of sevoflurane and vital capacity breaths provides good conditions for the insertion of LMA.^[5] Recently, vital capacity breath inhaled induction of anesthesia with sevoflurane has been used as an alternative to iv induction in adults. This method is rapid, with little excitatory phenomena, high patient acceptance and good hemodynamic stability.^[6] Rapid insertion of LMA after vital capacity breath induction may allow the use of sevoflurane as a single drug for the induction and maintenance of anesthesia, which would ease the transition period and lead to cost-saving.^[7]

Aims and Objectives

- To compare the induction with sevoflurane and propofol for LMA insertion.
- To assess the quality of jaw relaxation between them for LMA insertion.
- To estimate the incidence of respiratory complications (laryngospasm, coughing, and gagging) and cardiovascular complications with both agents.

Subjects and Methods

A prospective randomized study was conducted on 50 ASA grade I & II patients, aged between 18 – 60 years who are undergoing minor surgical procedures under general anesthesia. Both inpatients and day cases were included in the study. They were randomized into two groups of 25 each.

- Group S – sevoflurane group
- Group P – propofol group

Inclusion criteria

- Patients of age between 18 – 60 years ASA grade I & II patients

Exclusion criteria

- Adults <18years, >60years
- ASA III, IV, V
- Morbidly obese

Patients requiring endotracheal intubation Major procedures requiring muscle relaxation

A pre-anesthetic evaluation was done on the previous day of surgery and was reviewed on the day of surgery. A detailed medical history was taken. Systemic examination was carried out and relevant investigations were advised. Informed written consent was taken from all patients. Nil per oral status was maintained for all patients. Patients were premeditated with tab. Ranitidine 150mg and tab Ondansetron 4mg. On arrival to operation room-

- IV line was secured
- Monitors for ECG, NIBP and SPO2 were connected.

Patients received injection fentanyl 1.5 - 2µg/kg prior to induction. All patients were pre oxygenated for 3min with 100% oxygen using a fresh gas flow of 8l/min. Patients were randomly allocated into group S and group. Patients' baseline vital data like heart rate, NIBP, SPO2 was recorded.

Group P – received propofol 2 –2.5mg/kg body weight at the rate of 40mg every 10 sec was given.

Group S – Sevoflurane 8% was introduced into a fresh gas flow of 8l of oxygen and patients were instructed to take a vital capacity breath and hold it as long as they could.

The point of the start of injection of propofol or introduction of sevoflurane 8% was considered as the starting point of induction. Their anesthesia circuit was primed with 8% sevoflurane with O2 at 8 L/min.

Loss of verbal contact was considered as the desired endpoint for induction in both techniques, which was assessed by the response to calling out the patient's name. Then the time of loss of eyelash reflex was noted. After this jaw relaxation was assessed by anesthesiologist after the loss of eyelash reflex. If jaw relaxation was not adequate, it was

reassessed after every 15 seconds. Once jaw relaxation was adequate, LMA insertion was attempted.

The following data were recorded:

1. Time is taken from the start of induction to loss of verbal contact, loss of eyelash reflex, jaw relaxation and successful LMA insertion.
2. The number of attempts of LMA insertion.
3. A total dose of the requirement of propofol in each patient.
4. NIBP, HR and SPO2 were monitored from the beginning of induction upto 5 minutes of induction.

The conditions of insertion of LMA were graded by an observer on a three-point scale using 6 variables. Overall conditions for insertion of LMA were assessed as excellent, satisfactory, or poor on the basis of total score obtained by summing up the individual scores of each component. The maximum score of 18.

The following parameters are assessed during LMA insertion:

- Jaw relaxation.
 - Ease of LMA insertion.
 - Coughing.
 - Biting.
 - Gagging.
 - Laryngospasm.
 - The number of attempts of LMA insertion.
- ❖ Excellent 18.
 - ❖ Satisfactory 16 –17
 - ❖ Poor < 16

LMA was inserted by the method described by Brain. After insertion of LMA, anesthesia was continued with 66% N2O + 33% O2 + halothane. The study ended when the patient was considered to reach an adequate depth of anesthesia and was well settled after the insertion of LMA. Manual ventilation was employed if necessary.

Method of Statistical Analysis:

The following methods of statistical analysis have been used in this study. The Excel and SPSS (SPSS Inc, Chicago) software packages were used for data entry and analysis.

The results were averaged (mean + standard deviation) for each parameter for continuous data and numbers and percentages for categorical data presented in Table and Figure.

Results

Fifty adult patients of ASA I and II between the age group of 18 – 60years of either sex posted for surgeries in general surgery, obstetric, gynecological, urologic and orthopedic surgeries were selected for the study. They were randomly divided into two groups- group P and group S. group P denotes patients who received propofol and group S denotes patients who received sevoflurane.

There is no statistically significant difference in age distribution. The data was compared using student t- test.

Patients belonging to various departments like orthopedics,

gynecology, surgery and urology took part in the study. [Table 3]

The number of attempts for LMA insertion was compared using student t-test and was not significant. [Table 4]

Table 1: Comparison of age in both groups

Group	N	Mean Age	Std. Deviation	Min	Max	't' value	'p' value	significance
Propofol	25	31.16	11.09	18	53	-2.005	.055	Not significant
Sevoflurane	25	37.68	11.89	18	56			

Table 2: Sex distribution

Group	Sex		Total
	Male	Female	
Propofol	15	10	25
	60.0%	40.0%	100.0%
Sevoflurane	9	16	25
	36.0%	64.0%	100.0%
Total	24	26	50
	48.0%	52.0%	100.0%

Table 3: Comparison of patients in various departments.

Group	Departments				Total
	OBG	Ortho	Surgery	Urology	
Propofol	3	14	7	1	25
	12.0%	56.0%	28.0%	4.0%	100.0%
Sevoflurane	9	3	6	7	25
	36.0%	12.0%	24.0%	28.0%	100.0%
Total	12	17	13	8	50
	24.0%	34.0%	26.0%	16.0%	100.0%

Table 4: Comparison of the number of attempts at laryngeal mask airway insertion for successful placement

Group	N	Mean No. of attempts	Std. Deviation	Min	Max	't' value	'p' value
Propofol	25	1.00	.00	1	1	3.273	.077
Sevoflurane	25	1.12	.33	1	2		

Hemodynamic parameters:

Table 5: Comparison of heart rate between the two groups

Pulse Rate	Propofol			Sevoflurane			't' value	'p' value
	N	Mean	SD	N	Mean	SD		
Pre	25	84.00	8.22	25	84.96	7.71	-4.26	.672
Induction	25	81.56	7.92	25	84.48	8.20	-1.281	.206
1 min	25	78.60	8.56	25	86.48	10.74	-2.868	.006
2 min	25	77.28	8.99	25	82.68	11.76	-1.824	.074
5 min	25	76.56	10.02	25	79.84	9.98	-1.160	.252

Table 6: Comparison of systolic blood pressure between the two groups

Systolic BP	Propofol			Sevoflurane			't' value	'p' value
	N	Mean	SD	N	Mean	SD		
Pre	25	124.72	8.66	25	128.88	8.15	3.061	.087
Induction	25	119.44	9.23	25	125.36	12.01	3.819	.057
1 min	25	111.52	9.10	25	118.36	11.06	5.706	.021
2 min	25	107.84	7.96	25	112.56	9.01	3.855	.055
5 min	25	103.04	9.14	25	104.44	11.45	.228	.635

Table 7: Comparison of diastolic blood pressure between the two groups

Diastolic BP	Propofol			Sevoflurane			't' value	'p' value
	N	Mean	SD	N	Mean	SD		
Pre	25	78.40	6.78	25	81.44	8.28	2.018	.162
Induction	25	76.56	6.67	25	80.48	8.82	3.142	.083
1 min	25	70.56	5.40	25	74.00	7.64	3.381	.042
2 min	25	69.44	4.34	25	71.12	7.64	.914	.344
5 min	25	65.84	9.41	25	69.44	8.73	1.966	.167

Table 8: Comparison of mean arterial pressure between the two groups

MAP	Propofol			Sevoflurane			't' value	'p' value
	N	Mean	SD	N	Mean	SD		
Pre	25	93.84	6.64	25	97.25	7.11	-1.755	.086
Induction	25	90.85	6.11	25	93.44	8.40	-2.209	.062
1 min	25	84.21	5.49	25	88.79	7.38	-2.487	.016
2 min	25	81.88	4.88	25	84.93	7.72	-1.671	.101

5 min	25	78.24	8.18	25	82.41	7.22	-1.913	.062
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Table 9: Comparison of time for laryngeal mask airway insertion

	Propofol			Sevoflurane			't' value	'p' value
	N	Mean	SD	N	Mean	SD		
Loss of verbal contact	25	57.40	15.01	25	65.40	9.67	5.018	.030
Loss of eyelash reflex	25	73.00	13.92	25	81.20	9.39	5.965	.018
Jaw relaxation	25	89.20	15.52	25	103.20	12.07	12.675	.001
LMA insertion	25	100.80	14.48	25	122.00	15.61	24.776	.000

Table 10: Grading of conditions for laryngeal mask airway insertion

Parameter	Grade	Description	Group S	Group P
Jaw relaxation	3	Full	23	25
	2	Partial	02	00
	1	Difficult	00	00
Ease of LMA insertion	3	Easy	23	25
	2	Difficult	02	00
	1	Impossible	00	00
Coughing	3	Nil	23	25
	2	Transient	02	00
	1	Persistent	00	00
Biting	3	Nil	23	25
	2	Transient	02	00
	1	Persistent	00	00
Gagging	3	Nil	25	25
	2	Transient	00	00
	1	Persistent	00	00
Laryngospasm	3	Nil	25	25
	2	Partial	00	00
	1	Total	00	00

Table 11: Distribution of grading of Conditions for LMA insertion

Group	Complaints Score			Total
	16.00	17.00	18.00	
			25	25
			100.0%	100.0%
Sevoflurane	2 8.0%	1 4.0%	22 88.0%	25 100.0%
Total	2 4.0%	1 2.0%	47 94.0%	50 100.0%

A comparison of heart rate between the two groups was made using the student t-test. The heart rate at baseline and at the time of induction was not statistically significant. Heart rate at one minute after induction showed a fall with propofol, which was statistically significant. No statistically significant difference was noted at 2 minutes and 5 minutes after induction. [Table 5]

There was no statistically significant difference in systolic blood pressure in the preoperative period between the two groups. There is no significant difference in systolic blood pressure during induction.

There was a statistically significant difference in systolic blood pressure at one minute and two minutes when compared between the two groups. A fall in the systolic blood pressure in group P was noted when compared to group S. There is no statistical difference between the two groups at 5 minutes. [Table 6]

There is no significant difference in diastolic blood pressure during induction. There was a statistically significant difference in diastolic blood pressure at one minute when compared between the two groups. A fall in the diastolic blood pressure in group P was noted when compared to group S at one minute. There is no statistical difference between the two groups at 2 minutes & 5 minutes. [Table 7]

There was no statistically significant difference in mean arterial blood pressure in the preoperative period between the

two groups. There is no significant difference in mean arterial blood pressure during induction. There was a statistically significant difference in mean arterial blood pressure at one minute when compared between the two groups. A fall in the mean blood pressure in group P was noted when compared to group S.

There is no statistical difference between the two groups at 2 and 5 minutes. [Table 8]

Sevoflurane has taken a long time for induction and LMA insertion. Verbal contact, eyelash reflex, jaw relaxation and LMA insertion was lost earlier with propofol and is statistically significant. [Table 9]

The occurrence of complications like coughing, biting, jaw relaxation and laryngospasm during induction and LMA insertion did not reach statistical significance in our study. [Table 10]

The overall insertion was excellent with propofol with all 25 patients scoring 18. With sevoflurane, 22 patients had excellent conditions for LMA insertion and 3 had the satisfactory condition for LMA insertion when grading was done using 18 point score. [Table 11]

Discussion

Satisfactory insertion of LMA after induction of anesthesia requires sufficient depth of anesthesia.^[8] Propofol is a

common intravenous anesthetic agent used for LMA insertion because of its greater depressant effect on airway reflexes.^[9] sevoflurane is suitable for inhalational induction techniques even in high concentrations because of its low blood gas solubility and minimal respiratory irritant effect. The vital capacity induction technique with sevoflurane was used to make the technique similar to that of an intravenous bolus injection of propofol.^[10] Fentanyl was used as a coinduction agent because of the known synergistic effect of opioids with both sevoflurane and propofol.^[11]

Propofol is a known induction agent for the insertion of LMA with excellent jaw relaxation and allowed easy insertion of LMA. But is no means ideal as it has been associated with several adverse effects including hypotension, apnoea and pain on injection?^[12] Recently single-breath vital capacity breath inhaled induction of anesthesia with sevoflurane has been used as an alternative to iv induction in adults. This is associated with high patient acceptance and good hemodynamic stability.^[13] So in this study, we compared the quality and speed of LMA insertion in adult patients after sevoflurane VCB inhaled induction and propofol intravenous induction of anesthesia.

Patients were randomly divided into two groups of 25 each: Group P (propofol) and group S (sevoflurane). Patient's response to LMA insertion was noted and graded. Gagging, coughing, biting, laryngospasm, jaw relaxation and ease of LMA insertion were graded. For assessing hemodynamic status- pulse rate, systolic and diastolic blood pressure were recorded before induction (baseline), at induction, 1 minute, 2 minutes and 5 minutes after LMA insertion.

Timing of insertion of LMA insertion

In our study mean time taken from induction to successful laryngeal mask insertion was significantly shorter with propofol compared with sevoflurane. With the sevoflurane group, the LMA insertion has taken 122 ± 15.6 seconds while propofol has taken 100.8 ± 14.48 seconds. Jaw relaxation has taken a long time in the sevoflurane group with $p < 0.001$, which is highly significant.

Priya et al,^[14] in their study noted that propofol is known to depress laryngeal reflexes facilitating LMA insertion. They concluded that propofol is better than sevoflurane for LMA insertion, using the loss of eyelash reflex as the endpoint of induction, probably due to better jaw relaxation. Even in our study, propofol took lesser time for induction in comparison with sevoflurane.

A Thwaites, S Edmonds and Smith 7 in their study observed that induction with sevoflurane was significantly slower when compared with propofol (mean 84 (SD24) sec vs 57 (SD11) sec) but was associated with a lower incidence of apnoea and shorter time to establish spontaneous ventilation.

Hemodynamic changes while inserting LMA Pulse:

The heart rate at baseline and at the time of induction did not show much difference. Heart rate at one minute after induction showed a fall in the propofol group, which was statistically significant with p -value of 0.006. No statistically significant difference was noted at 2 minutes and 5 minutes after induction.

Systolic blood pressure

There was no statistically significant difference in systolic blood pressure in the preoperative period and during induction between the two groups but was statistically significant fall at one and two minutes. A significant fall in the systolic blood pressure in-group P was noted when compared to group S.

There was no statistically significant difference between the two groups at 5 minutes. At 5 minutes fall in blood pressure was noted in both groups as halothane was added by that time for maintenance of anesthesia.

Mean arterial pressure

There was no statistically significant difference in mean arterial blood pressure in the preoperative period and during induction between the two groups but was statistically significant at one minute. There is no statistical difference between the two groups at 2 and 5 minutes.

The induction of anesthesia with sevoflurane was associated with the advantage that means arterial pressure was better maintained with sevoflurane compared with propofol. The relative hypotension associated with propofol may be disadvantageous in elderly and coronary artery disease.

A Thwaites, S Edmonds and I Smith 7, while comparing the hemodynamic parameters noted induction of anesthesia with 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 anesthesia. In contrast, they noted that a decrease with MAP with sevoflurane was only 10 mm Hg. Almost similar results were noted in our study also.

Analysis of condition for LMA insertion and patients response.

In this study, inadequate jaw relaxation was found in 2 patients in the sevoflurane group. In the same patient ease of LMA insertion was difficult requiring the second attempt. The statistical analysis using Chi-square test revealed no significant difference between the 2 groups. Gagging, coughing and biting was found in 2 patients in the sevoflurane group but was statistically not significant. In one patient in the sevoflurane group, both coughing and biting were noted.

All patients in the propofol group had LMA inserted in first attempt. In sevoflurane group 2 patients had LMA inserted in the second attempt, probably due to inadequate jaw relaxation.

The overall condition of LMA insertion was graded as excellent in all 25 patients belonging to the propofol group. 23 patients in the sevoflurane group had excellent conditions with score of 18. 1 patient in the sevoflurane group had a score of 17 and another score of 16 with LMA insertion grading as satisfactory.

Lian et al,^[7] in their study found that more attempts at insertion of LMA were required in patients in the sevoflurane group versus those in the propofol group. They suggested that this was primarily because of the incidence of initially impossible mouth opening.

Conclusion

In our study even though sevoflurane is associated with good hemodynamic stability, but the quality of anesthesia provided with propofol is superior. Prolonged jaw relaxation

with sevoflurane, when compared to propofol, may delay laryngeal mask airway insertion. None of the patients had trauma during insertion, as noticed by the absence of blood in LMA after removal in both groups. Patients who received propofol complained of pain while injection and patients who received sevoflurane complained of odor while the mask was held. Thus sevoflurane is an acceptable alternative to a protocol for LMA insertion in adults.

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