

Comparison of sevoflurane and propofol for laryngeal mask airway insertion and pressor response in patients undergoing gynecological procedures

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Abstract

Background and Aims: A popular method of providing anesthesia for laryngeal mask airway (LMA) insertion is with the use of propofol. However, bolus propofol has been associated with adverse effects such as hypotension, apnea and pain on injection. Hence, time is needed to search an alternative. We aimed to compare the induction characteristics, ease of LMA insertion, hemodynamic changes and complications with inhalation of 8% sevoflurane vital capacity breath and propofol.

Material and Methods: A prospective randomized study of 60 American Society of Anesthesiologists' Grade I and II patients was conducted and distributed among two groups with 30 each undergoing gynecological procedures under general anesthesia. Group P received the injection propofol and Group S received sevoflurane. At the end point of induction, the LMA insertion was attempted. Scoring systems were used to grade the conditions for insertion of the LMA. Induction, LMA insertion characteristics, hemodynamic changes, complications were assessed. Data were recorded and analyzed. Comparison among the study groups was done with unpaired *t*-test, Mann-Whitney test and Chi-square test.

Results: Sevoflurane took a longer time for induction and for LMA insertion than propofol. There was no statistically significant difference between the two groups, with respect to LMA insertion characteristics, heart rate, mean arterial pressure. It is concluded that sevoflurane is associated with good hemodynamic stability and may prove useful incases where propofol is to be avoided. However, the ease of insertion provided with propofol is better.

Key words: Hemodynamic changes, laryngeal mask airway, propofol, sevoflurane

Introduction

The laryngeal mask airway (LMA) has gained extensive popularity for airway management during surgery. The LMA is a 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 (<20 cm H₂O) of positive pressure.^[1]

With use of LMA, muscle relaxation is not required, laryngoscopy is avoided and hemodynamic changes are minimized during insertion.^[2] LMA may be used when such response is desirable.^[3]

Satisfactory insertion of LMA after induction of anesthesia requires sufficient depth for suppression of airway reflexes,

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Access this article online

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DOI:
10.4103/joacp.JOACP_313_15

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How to cite this article: Chavan SG, Mandhyan S, Gujar SH, Shinde GP. Comparison of sevoflurane and propofol for laryngeal mask airway insertion and pressor response in patients undergoing gynecological procedures. *J Anaesthesiol Clin Pharmacol* 2017;33:97-101.

else it is associated with various complications. Ideal induction agent for LMA insertion would provide loss of consciousness, jaw relaxation, absence of upper airway reflexes without cardiorespiratory compromise. Propofol is probably the best intravenous agent and sevoflurane is the best volatile agent, though neither is ideal.^[1]

Propofol is the induction agent of choice for LMA insertion. Sevoflurane is nonirritating to the airways and mask induction with this agent is associated with low incidence of breath holding, coughing, and laryngospasm.^[4,5] Rapid insertion of LMA after vital capacity breath (VCB) 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.^[1]

The objectives of this study are to compare the induction characteristics, ease of LMA insertion, hemodynamic changes and complications during LMA insertion following induction of anesthesia with inhalation of sevoflurane and induction with propofol.

Material and Methods

This prospective randomized study was conducted from January 2014 to December 2014. This study was approved by the Institutional Medical Ethics Committee and written informed consent was obtained from all included patients. About 60 American Society of Anesthesiologists Grade I and II patients aged between 20 and 50 years, Mallampati Grade I, who were undergoing minor gynecological procedures under general anesthesia were distributed in two groups with 30 each namely, Group P– propofol group and Group S– sevoflurane group. Randomization was done by a computer-generated table of random numbers allotting equal number of patients in each group. Patients requiring endotracheal intubation, major procedures requiring muscle relaxation, head and neck, face surgery were excluded from the study.

A preanesthetic evaluation was done. On arrival to operation room, intravenous access was secured. Monitors for electrocardiogram, noninvasive blood pressure and pulseoximeter were connected. Patients were randomly allocated into Group P and Group S. Patients were premedicated with injection ondansetron 4 mg, injection glycopyrrolate 0.2 mg. All patients were preoxygenated for 3 min with 100% oxygen with flow rate 8L/min using Magill circuit with 2-Ltr reservoir bag. Patients received injection fentanyl 2 mcg/kg and injection midazolam 1 mg prior to induction. Patient's baseline vital data such as heart rate (HR), mean arterial blood pressure (MAP), SpO₂ were recorded.

Group P: Propofol 2.5 mg/kg body weight at the rate of 40 mg every 10 s was given.

Group S: Sevoflurane 8% was introduced into fresh gas flow of 8 L of oxygen and patients were instructed to take and hold it as long as they could.

The point of start of injection of propofol or introduction of sevoflurane 8% was considered as the starting point of induction. Loss of verbal contact was assessed by the response to calling out the patient's name. Loss of eyelash reflex was considered as the desired end point for induction in both techniques. After this, jaw relaxation was assessed by an anesthesiologist. If jaw relaxation was not adequate, it was reassessed after every 10 s. Once jaw relaxation was adequate, LMA insertion was attempted.

Time taken from the start of induction to loss of verbal contact, loss of eyelash reflex, jaw relaxation, successful LMA insertion, number of attempts of LMA insertion, HR, MAP, and End-tidal CO₂ (ETCO₂) were monitored and recorded from the beginning of induction upto 10 min of induction. Any side effects or complications were noted.

The conditions of insertion of LMA were graded by an observer on a three-point scale using six variables as Table 1. Scoring was done as excellent 18, satisfactory 16–17 and poor <16.

LMA was inserted by the method described by Brain. After insertion of LMA, anesthesia was continued. The study ended after 10 min when the patient was considered to reach an adequate depth of anesthesia.

After data collection, data entry was done in Excel. Data analysis was done with the help of SPSS Software Version 15 and Sigma Plot Version 12 (IBM and Windows 8 respectively). Quantitative data was presented with the help of mean, standard deviation, median and interquartile range. Comparison among the study groups was done with the help of unpaired *t*-test and Mann–Whitney test as per the results of normality test. Qualitative data was presented with the help of frequency and percentage table. Association among the study groups was assessed with the help of Chi-square test. *P* < 0.05 was considered statistically significant.

Results

Table 1 shows that insertion of the LMA was achieved in the first attempt in 29 patients and in the second attempt, in one patient in both the groups. Occurrence of complications

such as coughing, biting, jaw relaxation and laryngospasm during induction and LMA insertion was not of statistical significance.

Table 2 shows that there was no significant difference in age distribution, body weight of patients between the Group P and Group S group ($P > 0.05$).

Table 3 shows that sevoflurane took a longer time for induction and for LMA insertion as compared to propofol. This was statistically significant. Loss of verbal contact, loss of eye lash reflex, adequate jaw relaxation and LMA insertion were earlier with propofol.

Table 4 shows that there was no statistically significant difference in the overall score for LMA insertion characteristics.

Tables 5 and 6 show that the HR and MAP values at baseline and at the time of induction were not statistically significant. HR at 1 min after induction showed a fall with propofol. Statistically significant difference was noted at 3, 5 and 7 min after induction. No statistical difference was noted at 10 min.

There was statistically significant difference in MAP at 1, 3, 5, 7 and 10 min between the two groups.

Table 7 shows that there was no statistically significant difference in both the groups when $ETCO_2$ is compared.

Discussion

LMA was originally discovered by Dr. Brain A J. It is now very popular in airway management and is used extensively in different types of surgeries. Satisfactory insertion of LMA after induction of anesthesia requires sufficient depth of anesthesia and adequate blunting of airway reflexes.^[6] Insertion of LMA is said to be associated with less hemodynamic changes than endotracheal intubation.^[7-9]

One of the most common intravenous induction agents used for LMA insertion is propofol due to its greater depressant effect on airway reflexes^[6] and excellent jaw relaxation. It is however associated with adverse effects such as pain on injection, hypotension, hypersensitivity and apnea. Among the inhalational induction agents, sevoflurane is more suitable due to its pleasant

Table 1: Laryngeal mask airway insertion data

Parameter	Group P				Group S				Test	P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
Number of attempts	1.03	0.183	1.00	0.000	1.03	0.183	1.00	0.000	0.000	1.000
Insertion characteristics: Comparison among study group for insertion characteristics										
Jaw opening	2.90	0.31	3.00	0.00	2.83	0.38	3.00	0.00	-0.753	0.451
Ease of insertion	2.93	0.25	3.00	0.00	2.90	0.31	3.00	0.00	-0.463	0.643
Coughing	3.00	0.00	3.00	0.00	2.97	0.18	3.00	0.00	-1.000	0.317
Biting	3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	0.000	1.000
Gagging	2.97	0.18	3.00	0.00	3.00	0.00	3.00	0.00	-1.000	0.317
Laryngospasm	3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	0.000	1.000
Total	17.80	0.48	18.00	0.00	17.70	0.65	18.00	0.00	-0.428	0.669

*Normality test (Shapiro-Wilk) failed ($P < 0.050$), thus Mann-Whitney rank sum test applied. SD = Standard deviation, IQR = Interquartile range

Table 2: Demographic data

Parameter	Group P				Group S				Unpaired t-test	P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
Age (years)	37.8	7.16	36.5	7.50	39.3	5.92	38.00	5.25	-0.885	0.380
Weight (kg)	54.43	5.54	54.00	8.25	57.53	6.46	55.50	10.75	-1.994	0.051

SD = Standard deviation, IQR = Interquartile range

Table 3: Induction characteristics

Parameter	Group P				Group S				Unpaired t-test	P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
LMA size	3.27	0.45	3.00	1.00	3.27	0.45	3.00	1.00	0.000	1.000
Loss of verbal contact	40.13	7.27	40.00	10.00	64.80	7.40	65.00	10.00	-13.025	<0.001 [#]
Loss of eyelash reflex	53.60	10.25	55.00	15.00	79.90	8.48	80.00	15.00	-10.831	<0.001 [#]
Jaw relaxation*	66.57	9.87	65.00	5.75	96.63	9.21	99.00	15.00	-6.228	<0.001 [#]
Insertion time*	81.50	14.72	75.00	12.25	114.63	10.97	116.50	11.75	-5.767	<0.001 [#]

P value calculated for unpaired t-test except at *. *Normality test (Shapiro-Wilk) failed ($P < 0.050$), thus P value calculated for Mann-Whitney rank sum test,

[#] $P < 0.05$ (significant). LMA = Laryngeal mask airway, SD = Standard deviation, IQR = Interquartile range

smell, smooth and rapid induction and minimal respiratory irritant effect. The vital capacity induction technique with sevoflurane is comparable to that of bolus injection of propofol. This is associated with good hemodynamic stability and high patient acceptance.^[10] Administration of fentanyl before LMA insertion gives synergistic effect with propofol and sevoflurane.^[11]

We compared the induction and LMA insertion characteristics, hemodynamic response and complications associated with sevoflurane inhaled induction and propofol intravenous induction in adult gynecology patients.

Priya *et al.*^[8] in their study observed that propofol is known to depress laryngeal reflexes aiding LMA insertion. They concluded that propofol is better than sevoflurane for LMA insertion using the loss of eyelash reflex as the end point of induction probably due to better jaw relaxation. In our study, propofol took lesser time for induction in comparison with sevoflurane.

Our main difficulty regarding the quality of LMA insertion when using sevoflurane was initial difficulty in mouth opening.

Table 4: Overall score for insertion

Total	Study group (%)		Total (%)
	Group P	Group S	
<16 (poor)	0	0	0
16-17 (satisfactory)	5 (16.67)	6 (20)	11 (18.3)
18 (excellent)	25 (83.3)	24 (80.0)	49 (81.7)
Total	30 (100)	30 (100)	60 (100)

P > 0.05 not significant. Pearson Chi-square test

Table 5: Heart rate

Study parameter	Group P				Group S				Unpaired t-test	P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
PR baseline	83.70	7.52	82.00	12.75	80.60	6.02	82.00	10.25	1.762	0.083
Induction	87.70	7.22	88.00	14.00	84.90	5.94	86.00	8.75	1.640	0.106
At insertion*	89.47	6.89	90.00	12.25	89.13	7.13	90.00	10.00	-0.215	0.829
1*	82.80	6.75	85.00	9.25	95.10	4.44	94.50	6.25	-6.264	<0.001#
3'	85.80	5.83	86.00	10.25	96.43	5.11	98.00	7.25	-7.510	<0.001#
5'	81.63	5.49	82.00	11.25	90.80	7.17	90.00	13.00	-5.557	<0.001#
7*	81.37	6.65	81.00	10.00	84.50	5.53	85.00	4.00	-3.677	<0.001#
PR 10'	82.20	5.92	81.00	6.50	84.20	5.45	85.00	6.00	-1.361	0.179

P value calculated for unpaired *t*-test except at *. *Normality test (Shapiro-Wilk) failed (*P* < 0.050), thus “*” *P* value calculated for Mann-Whitney rank sum test,

#*P* < 0.05 (significant). Comparison of heart rate between the two groups was done using “unpaired *t*-test”. SD = Standard deviation, IQR = Interquartile range, PR = Pulse rate

Table 6: Mean arterial pressure

Study parameter	Group P				Group S				Unpaired t-test	P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
MAP baseline	94.90	9.44	93.50	13.75	95.67	5.52	95.50	7.25	-0.384	0.702
Induction	91.07	8.65	91.50	11.25	90.67	4.76	90.50	7.50	0.222	0.825
At insertion	86.70	7.96	86.50	12.50	87.77	4.78	88.00	7.00	-0.629	0.532
1'	82.32	7.60	81.50	12.00	86.91	5.76	86.17	4.67	-2.636	0.011#
3'	80.83	6.86	82.00	10.75	85.00	5.94	85.00	4.25	-2.516	0.015#
5'	79.87	6.62	80.50	9.75	86.13	5.04	86.50	6.00	-4.124	0.000#
7'	83.78	6.85	87.00	10.25	86.20	4.14	82.66	7.00	-2.160	0.035#
MAP 10'	84.01	5.29	87.66	9.25	87.08	4.46	84.33	6.00	2.430	0.018#

#*P* < 0.05 (significant). SD = Standard deviation, IQR = Interquartile range, MAP = Mean arterial blood pressure

Table 7: End-tidal CO₂

Study parameter	Group P				Group S				Unpaired t-test	P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
ETCO ₂ baseline	33.47	2.22	34.00	3.00	34.53	2.81	34.00	4.00	-1.629	0.109
Induction	34.50	1.68	34.50	2.00	35.10	1.95	35.00	3.00	-1.277	0.207
Insertion	35.23	1.55	35.00	2.00	35.60	2.43	35.00	3.00	-0.697	0.488
1'	37.30	1.91	37.00	3.00	36.17	2.93	36.00	4.00	1.776	0.081
3'	36.57	2.66	37.00	4.00	35.70	2.63	35.00	3.00	1.269	0.209
5'	36.30	1.97	36.00	3.00	35.33	1.88	35.00	3.00	1.945	0.057
7'	35.63	1.83	36.00	3.00	34.83	1.42	34.50	2.00	1.895	0.063
ETCO ₂ 10'	35.10	1.56	35.00	2.00	34.77	1.65	35.00	2.00	0.803	0.425

#*P* < 0.05 (significant). SD = Standard deviation, IQR = Interquartile range, ETCO₂ = End-tidal CO₂

Interestingly, Dwivedi *et al.*^[4] also reported jaw tightness after sevoflurane anesthetic induction, which resulted in failure to insert the LMA in several patients. However, in our study, LMA was successfully inserted in all patients.

Sivalingam *et al.*^[9] reported that in propofol group, 12% patients had cough and in sevoflurane group, 20% patients had cough. In our study, we encountered coughing in one patient in Group S (3.3%) and gagging in one patient in Group P, which concurs with above studies.

In our study, we did not encounter laryngospasm in any of the patients in both groups. In our study, in 29 patients (96.6%), in both propofol and sevoflurane groups, successful insertion of LMA was done in the first attempt.

The hemodynamic responses were stable for both the groups. Priya *et al.*^[8] observed the hemodynamic responses were stable with both groups. There was statistically significant difference in MAP and HR in propofol group, 3 min after induction.

Thus, it can be concluded that induction and insertion of LMA is faster and easier with propofol and sevoflurane is associated with good hemodynamic stability and may prove useful incases in which cardiovascular system compromise is to be avoided. Using VCB technique, sevoflurane 8% is comparable to intravenous propofol for insertion of LMA in adults undergoing short general anesthesia procedures.

Although more time is required for jaw relaxation with sevoflurane than propofol may delay LMA insertion,^[12] there is a high and same success rate for LMA insertion during the first attempt in both the induction techniques.

Sevoflurane can serve as an effective substitute to intravenous induction in critically ill patients with cardiovascular decompensation or wherever the use of propofol is contraindicated. Sevoflurane is an acceptable alternative to the more commonly used propofol for LMA insertion.^[13]

Financial support and sponsorship
Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Hagberg C, Artime C. Airway management in the adult. In: Miller's Anesthesia. 8th ed. Philadelphia: Churchill Livingstone; 2015. p. 1647-58.
- Mizrak A, Kocamer B, Deniz H, Yendi F, Oner U. Cardiovascular changes after placement of a classic endotracheal tube, double-lumen tube, and laryngeal mask airway. *J Clin Anesth* 2011;23:616-20.
- Siddiqui NT, Khan FH. Haemodynamic response to tracheal intubation via intubating laryngeal mask airway versus direct laryngoscopic tracheal intubation. *J Pak Med Assoc* 2007;57:11-4.
- Dwivedi R, Dwivedi S, Chourasia HK. A comparative study of sevoflurane and propofol for laryngeal mask airway insertion in adults. *Int J Sci Study* 2015;3:67-71.
- El-Radaideh KM, Al-Ghazo MA. Single breath vital capacity induction of anesthesia with 8% sevoflurane versus intravenous propofol for laryngeal tube insertion in adults. *Saudi Med J* 2007;28:36-40.
- Sengupta J, Sengupta M, Nag T. Agents for facilitation of laryngeal mask airway insertion: A comparative study between thiopentone sodium and propofol. *Ann Afr Med* 2014;13:124-9.
- Sukhupragarn W, Leurcharusmee P, Sotthisopha T. Cardiovascular effects of volatile induction and maintenance of anesthesia (VIMA) and total intravenous anesthesia (TIVA) for laryngeal mask airway (LMA) anesthesia: A comparison study. *J Med Assoc Thai* 2015;98:388-93.
- Priya V, Divatia JV, Dasgupta D. Comparison of propofol versus sevoflurane for laryngeal mask airway insertion. *Indian J Anesth* 2002;46:31-4.
- Sivalingam P, Kandasamy R, Madhavan G, Dhakshinamoorthi P. Conditions for laryngeal mask insertion. A comparison of propofol versus sevoflurane with or without alfentanil. *Anaesthesia* 1999;54:271-6.
- Negargar S, Peirovifar A, Mahmoodpoor A, Parish M, Golzari SE, Molseqi H, *et al.* Hemodynamic parameters of low-flow isoflurane and low-flow sevoflurane anesthesia during controlled ventilation with laryngeal mask airway. *Anesth Pain Med* 2014;4:e20326.
- Topuz D, Postaci A, Sacan O, Yildiz N, Dikmen B. A comparison of sevoflurane induction versus propofol induction for laryngeal mask airway insertion in elderly patients. *Saudi Med J* 2010;31:1124-9.
- Ravi S, Krishnamoorthy K, Ganesan I. Comparison of sevoflurane and propofol for laryngeal mask airway in children. *Indian J Clin Anaesth* 2015;2:137-40.
- Vora KS, Shah VR, Patel D, Modi MP, Parikh GP. Sevoflurane versus propofol in the induction and maintenance of anaesthesia in children with laryngeal mask airway. *Sri Lanka J Child Health* 2014;43:77-83.

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