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ORIGINAL ARTICLE

A COMPARISON STUDY OF INDUCTION WITH SEVOFLURANE TO PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN DAYCARE ANAESTHESIA

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ABSTRACT: BACKGROUND: Laryngeal Mask Airway (LMA) is the most significant advance in airway management which fills the gap in airway management between tracheal intubation and use of the face mask.[1,2] LMA allows the administration of intravenous (i. v.) and inhaled anesthetics with minimal stimulation of airway.[1,2,3,4] in day care anaesthesia. Hence this study comparison between sevoflurane as newer induction anesthetic with iv Propofol to have sufficient depth for suppression of airway reflexes and to avoid untoward effects. **METHODS:** We compared insertion of LMA using 2.5 $mgkg^{-1}$ IV. Propofol (Group P) and vital capacity breathes induction using 8% sevoflurane (Group S) as induction agent. 50 patients in each group P and S of aged between 20-40 years of both sexes, scheduled for various elective surgical procedures belonging to ASA class I and II were included in the study. Patients with difficult airway, chronic smokers, morbidly obese and at risk of aspiration were excluded. We studied the primary outcomes as the time of induction, the time required for the insertion of LMA, the success rate of insertion and over all characteristics of insertion. The haemodynamic changes during the induction and insertion were taken as secondary outcomes. **RESULTS:** Jaw relaxation and ease of insertion of LMA were comparable in both the groups. Overall conditions for LMA insertion were comparable in both the groups. There was a high success rate for LMA insertion during first attempt in both the induction techniques. Complications like coughing, gagging, laryngospasm and patient movements were not observed in both the groups. Haemodynamic profile was more stable in the sevoflurane group. **CONCLUSIONS:** We concluded that using the vital capacity inhalation technique sevoflurane 8% is equally comparable to i. v. Propofol for insertion of LMA in adults for day care anaesthesia.

KEYWORDS: Laryngeal Mask Airway (LMA), Sevoflurane, Propofol, Daycare anaesthesia.

INTRODUCTION: Dr Archie IJ Brain, a British Anesthesiologist at London Royal Hospital in 1981 developed a novel device-the Laryngeal Mask Airway,[1] which is a most significant advance in airway management which fills the gap in airway management between tracheal intubation and use of the face mask. LMA use requires administration of intravenous iv or inhaled anesthetics with minimal stimulation of airway.[1,2,3,4] in day care anaesthesia. Since its introduction, various induction agents namely thiopentone,[5,6] propofol,[7-16] halothane,[17] sevoflurane[18,19,20] have been used for induction of anaesthesia for laryngeal mask airway placement. Satisfactory insertion of the laryngeal mask airway after induction of anaesthesia requires sufficient depth for suppression of airway reflexes and to avoid untoward effects due to airway instrumentation. Propofol with or without an opioid has been the induction agent of choice for LMA insertion as it provides better pharyngeal and laryngeal relaxation, depressing upper airway reflexes.[7,16,21,22] and also has a favorable recovery profile with low incidence of side effects. However it is by no means ideal, as it is associated with significant

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adverse effects like pain on injection and cardiovascular and respiratory depression (Hypotension, apnea).[7-16,21,22,23] Sevoflurane, a halogenated volatile anaesthetic agent, with pleasant odor is non irritating to the airways and is suitable for inhalation induction for both children and adults. It is also associated with a very low incidence of breath holding, coughing, and laryngospasm.[18,19,20,24] In addition, its low lipid solubility (Blood/gas partition coefficient at 37°c is 0. 63-0.69) allows a rapid and smooth induction.

Recently vital capacity breath inhaled induction of anaesthesia with 8% sevoflurane has been used as an alternative to i. v induction with Propofol in adult patients undergoing ambulatory surgeries.[20,25,26] Faster induction time, haemodynamic stability and satisfactory patient recovery characteristics of vital capacity breath sevoflurane induction and attenuation of airway reflexes can be of advantage in laryngeal mask airway insertion.[20,25,26] Hence, in the present study an attempt is being made to compare the induction characteristics, ease of laryngeal mask airway insertion, haemodynamic changes and any complications during laryngeal mask airway insertion.

The primary outcomes were induction time, the time required for laryngeal mask airway insertion, the success rate and quality of insertion of LMA and the overall insertion characteristic scores in both drug groups. The Haemodynamic parameters in both the groups and other effects of the drugs were the secondary outcomes.

METHODOLOGY: The study was undertaken during 2008 to 2010 after obtaining ethical committee clearance as well as informed written consent from all patients. One hundred patients, aged between 20-40 years of both sexes, scheduled for various elective day care surgical procedures without difficult airway assessment and belonging to ASA class I and II were included in the study. Patients having assessed with difficult airway, morbid obese, who has anticipated to have gastric regurgitation, haemo-dynamically unstable and belonging to ASA class III and IV were excluded. All patients included in the study were premeditated with tab alprazolam 0.5 mg and tab Ranitidine 150 mg orally at bed time the previous night before surgery and kept nil orally 10 pm onwards on the previous night. Two anaesthesia machines were utilized for the study in both the groups, to make it double blinded.

After taking IV line with 18g cannula the patients were connected to Siemens SC-7000, multichannel monitor which records Heart rate, non-invasive measurements of SBP, DBP, MAP, $EtCO_2$ and continuous ECG monitoring and Spo2/pulse oxime try. The baseline systolic, diastolic blood pressure, mean arterial pressure and heart rate were recorded every minute for 5 mins. The cardiac rate and rhythm were also monitored from a continuous visual display of electrocardiogram from lead II.

A standard LMA (LMA size #3 was used for<70 kg and size #4 for >70 kg) lubricated with Lidocaine jelly on posterior surface was inserted using the method described by Brain. Prior to induction, all patients were pre-oxygenated with 100% O_2 at 8L/minute using Bain's circuit (Mapelson-D) with a 2L reservoir bag for 3 minutes and premedicated with inj atropine 0.02 mg/kg i. v. and inj midazolam 1 mg i. v in both the groups.

GROUP-P: Patients were induced with 2.5 mg/kg Propofol i. v. over 30 seconds, with 0.3 mg/kg lignocaine 2% preservative free iv to reduce the pain on injection. In group P- LMA placement was attempted at 1 minute following induction of anaesthesia (confirmed by loss of eyelash reflex) for 15 seconds after assessing jaw relaxation. If unsuccessful, as defined by inadequate jaw relaxation to

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allow LMA passage into the mouth, spontaneous/assisted ventilation of N_2O 50% and O_2 50% was given, and repeat attempts were made every 1 minute up to maximum of four attempts, each time preceded by boluses of 0.5 mg/kg i. v propofol.

GROUP-S: Pre-oxygenation with 100% O_2 was done using one anaesthesia machine. The second anaesthesia machine was used to deliver 8% sevoflurane in O_2: N_2O 50: 50%.

The anaesthesia circuit was primed with 8% sevoflurane in N_2O 50% and O_2 50% at 8 litre/minute for 30 seconds. Here the Bain's circuit reservoir bag was emptied, and adjustable pressure limiting valve closed and the patient end of system sealed by pressing the outlet firmly against the pillow.

All patients belonging to Group S were asked to exhale fully, inhale fully and hold their breath as long as possible (vital capacity breaths). At the end of expiration, the O_2 mask was removed and the mask connected to primed circuit from the second anaesthesia machine was applied. The patients were encouraged to perform the vital capacity breath maneuver and hold their breath. In group S the mask ventilation was continued for 1 min after the loss of eye lash reflex, before attempting to assess jaw relaxation and LMA placement. If unsuccessful patients were allowed to continue spontaneous/assisted ventilation on sevoflurane 8% in N_2O 50% and O_2 50% and received increments of 1 ml saline every 15 seconds. The second attempt was made at 2 minute 15 sec and third attempt at 3 minute 30 sec after commencement of induction.

Loss of eyelash reflex was considered as induction of anaesthesia in both the groups.

In both the groups, Observer 1 assessed jaw relaxation 1 min after loss of eye lash reflex and Observer 2, who stayed outside the operation theatre during the induction period, was called in. Observer 1 further blinded the observer 2 to the technique of induction by concealing the injection site, the vaporizer with the help of a screen.

The following data were recorded by Observer 2:

- The ease of insertion and jaw relaxation.
- The response of the patient to LMA insertion including the presence or absence of gagging, coughing, patient movements and laryngospasm.
- The number of attempts for LMA insertion.

Observer 2 graded the conditions of LMA insertion on the basis of the following table, adopted from Priya V, Divatia JV, et al.

Criteria	Score		
	3	2	1
Introduction of LMA			
Jaw opening	Full	Partial	Nil
Ease of insertion	Easy	Difficult	Impossible
Patient response			
Coughing	Nil	Minor	Severe
Gagging	Nil	Minor	Severe
Patient movements	Nil	Moderate	Vigorous
Laryngospasm	Nil	Partial	Total
Total score			

Table 1: Grading of conditions for LMA insertion

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The overall conditions for insertion of LMA were assessed as excellent, satisfactory or poor based on the total score obtained by summing up the individual scores of each component. Maximum total score - 18 – Excellent, 16to17 – Satisfactory, <16 – Poor. After insertion of LMA, anaesthesia was continued with 50% nitrous oxide and oxygen and halothane (1%) and further management was left to the discretion of the observer one depending on the nature of surgery. Any failure of insertion, in either of the groups, defined as failure to insert the LMA after 4 times, were given with succinylcholine 25 mg. i. v. to facilitate LMA insertion. The study ended when the patient was considered to reach an adequate depth of anaesthesia as noticed by regular breathing after insertion of LMA. Statistical analysis: The observations were statistically evaluated using Frequencies and Cross table, Independent Samples t-test, Paired sample t-test and Repeated measure ANOVA.

DEFINITIONS: Loss of consciousness is defined as loss of eyelash reflex and is considered as the end point of induction. Time of induction is defined as the interval from the beginning of induction to the loss of eyelash reflex. Time for LMA insertion-time (in seconds) taken from the loss of eyelash reflex to successful insertion of LMA. The attenuation of laryngeal reflex was graded as Grade I (Full) when, laryngeal mask airway was inserted smoothly. Grade II (Partial) when insertion was accompanied by gagging coughing or involuntary movements. Grade III (Poor) when LMA insertion was not possible. Success of LMA insertion was defined as ability to insert LMA for oxygenation and ventilation without the need for other rescue methods. Failure of insertion-defined as failure to insert LMA after four attempts. Choosing laryngeal mask airway size 3 for patients weight <70 kg, Size 4 for patient's weight >70 kg irrespective of gender. Induction complications were defined as presence of oxygen desaturation (less than 90%), coughing, laryngospasm, patient movements and any other events that require termination of induction techniques or requiring any other pharmacological interventions. Apnea was defined as cessation of respiration for more than 30 seconds after insertion of LMA.

RESULTS: The demographic results were as specified in the table A. There was no significant difference in age, sex and the weight of the patient.

Demographic data	Group P	Group S	P valve
Age	31. 16±5. 30	31. 54±6. 214	p>0. 05
Sex (M/F)	22/28	20/30	p0. 685
Weight in kgs	55. 50±4. 50	54. 98±6. 05.	p>0. 05

Table A

The mean time required for induction with Propofol in our study was 50.9±9.09 secs. Also the mean time required for induction with sevoflurane in our study was 73.8±16.14 secs. The difference in induction time in both the groups is statistically significant ($p<0.05$). The mean time required for LMA insertion with Propofol in our study was 75.24±13.49 secs. The mean time required for insertion with sevoflurane in our study was 74.96±10.96 secs. The difference in LMA insertion time in both the groups is not statistically significant ($p>0.05$). In group P, it was found that LMA insertion was easy in 48 patients and difficult in 2 patients. These two patients also had partial jaw relaxation. In group S, it was easy in 49 patients and difficult in 1 patient had partial jaw relaxation. None of the patients had cough, gagging and laryngospasm while inserting the LMA in either group.

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Excellent insertion characteristics were observed in 42 patients in both the groups (84%) and satisfactory insertion characteristics were found in 8 patients in both the groups (16%). No patient came under the poor insertion characteristics category. There is no statistically significant difference between the two groups, with respect to LMA insertion characteristics. Insertion of the LMA was achieved in the first attempt in 48 patients and in the second attempt in two patients in group P, and in the first attempt in 49 patients and in second attempt in 1 patient in group S. There was no statistical significance.

The mean heart rate came back to the basal levels by 3rd min. The increase in mean HR during insertion and 1, 2 minutes after insertion compared to basal value was statistically significant ($p<0.05$) in Group P. The increase in the mean HR during induction, insertion and 1, 2, 3, minutes there after compared to basal value was statistically significant ($p = .000$) in Group S.

The increase in mean MAP at one minute after insertion was statistically significant when compared to basal values ($p<0.001$) in Group P. The decrease in mean MAP at one minute after insertion was statistically significant when compared to basal value ($p<0.001$) in Group S. Statistical evaluation between the groups showed that the decrease in mean MAP observed in group P was statistically significant when compared to decrease in mean MAP in group S ($p<0.05$) at insertion, 1 min, 2 min, 3 min, 4 min and 5 min following insertion.

DISCUSSION: Laryngeal mask airway originally discovered by Dr. Brain A J has become very popular in airway management, used extensively in different types of surgeries. Insertion of LMA requires administration of an induction agent and suppression of airway reflexes. Depth of anaesthesia should be as deep as required for insertion of endotracheal tube. Insertion of LMA is said to be associated with less haemodynamic changes than endotracheal intubation.[7,9,10,13] The advantages of Propofol for LMA insertion are the rapidity of induction, adequate jaw relaxation and suppression of protective airway reflexes.[7] However Propofol is by no means an ideal agent as it has been associated with several adverse effects, like pain on injection, hypersensitivity, movements, apnea and hypotension.[8,9,11,14,18] The recently introduced inhalation agent sevoflurane appears to be a promising alternative to Propofol for LMA insertion. This is because of its pleasant, smooth and rapid induction, haemodynamic stability and good intubating conditions.[7] Various authors have used sevoflurane as an induction agent for inserting LMA[18,20] and many have compared sevoflurane and Propofol for the same purpose.[7,8,10,19,20] Some of the authors have found sevoflurane to be as good as propofol[7,8,10,14,22] while others have found Propofol to be a better agent.[9] Hence to know and compare this study was conducted and it was conducted in the period between November 2008 and August 2010. One hundred patients between age group 20-40 years of either sex belonging to ASA physical status I and II posted for elective surgery under general anaesthesia were randomly assigned to two groups of 50 each, group P (Propofol) and group S (Sevoflurane) . Patients with difficult airway were excluded. All were premeditated with injection Midazolam 1 mg IV, and injection atropine 0.6 mg IV. The LMA insertion was attempted in these patients after induction as below:

1. Group P (Propofol) –induction with Propofol 2. 5mg/kg with lignocaine 0.3mg/km preservative free.
2. Group S (sevoflurane) –induction with 8% sevoflurane using vital capacity breaths.

The traditional method of tidal volume induction with incremental increase in inspired sevoflurane concentration is an acceptable method for LMA insertion. However it has the disadvantage that induction may be slower.[20]

This problem can be surmounted by adopting sevoflurane induction where in patients take vital capacity breaths with the maximum dial setting (8%) of sevoflurane after a deep expiration to residual volume. This technique is supposed to speed up induction time as the patient can be induced within 1-3 breaths. This technique has been successfully used in insertion of LMA by various authors in different settings like in young fit adults, in day care surgery, and in elderly patients and is claimed to be a good alternative to intravenous induction with Propofol or tidal volume sevoflurane induction.[7,12,19,20,26] Hence in our study we selected the above method for inducing the patients with sevoflurane. In our study we also considered the loss of eyelash reflex as the end point of induction.

Induction time was taken as the time from the injection of the intravenous drug or placement of face mask in case of inhalational agent to the loss of eyelash reflex. In our study mean induction time in group P was 50.9 ±9.09 secs and in group S was 73.8±16.14 secs. However this is not clinically very significant, which concurs with the results of Hall JE et al. [Propofol 60 sec (49-70) , Sevoflurane 71sec (55-86)], Zhang et al. [Propofol 58 sec (±28sec)], [Sevoflurane 103sec (±34sec)], Thwaiites A et al. (Propofol 57 sec, Sevoflurane 84 sec).[19,14,24]

There is no statistically significant difference between both the study groups. In our study insertion of LMA was attempted 1 min after the loss of eye lash reflex in both the groups. This is done in order to wait for the lag time that occurs in equilibration of alveolar concentration with the brain concentration with sevoflurane. Similar results have been obtained by Priya et al. Our study results for the time taken for insertion of LMA with propofol, are comparable with the studies conducted by Lian Kah Ti, Mark YH et al. (74±29 sec) , Sahar M Siddik-Sayyid, Marie T Aouad et al. (84±22 sec) , Zhang Guohua et al. (89±28s).[8,11,14]

LMA insertion characteristics in both the groups were compared based on six criteria (jaw opening, ease of insertion, patient movement, coughing, gagging and laryngospasm), each scored on a scale from 1 to 3. Total score of 18 was considered excellent. Score 16-17 was considered satisfactory and score below 16 was considered to be poor. Similar grading system was used by Sivalingam P et al. and Priya V et al. in their studies. In our study we did not encounter any coughing and gagging in both the groups which concurs with the results of Priya et al.[10,9]

Priya et al. found 12% movement in Propofol group and 28% movements in sevoflurane group. These authors have found higher number of patients in Propofol group having movements during LMA insertion which also compares with our study, where in there was movements in 6% in Propofol and 2% in sevoflurane group.

Ismail Kati et al. found no incidence of laryngospasm in both Propofol and sevoflurane group in their study. In Priya et al. study laryngospasm was noticed in 12% of sevoflurane group, In Siddik-Sayyid et al. laryngospasm was noticed in 8% of sevoflurane group, but in our study we did not find laryngospasm in any of the patients in both groups, which concurs with the results of Ismail Kati et al.

Ismail Kati et al. did not find significant difference between the groups and could insert in the first attempt in 100% of patients in both groups. In our study in 48 patients (96%) in Propofol group and in 49 patients (98%) in sevoflurane group, successful insertion of LMA was done in the first attempt. There is no statistical significance between the two groups. Our study compares with the study conducted by Ismail Kati et al. for the attempts to insert LMA.

Haemodynamic changes: The haemodynamic responses were stable for both the groups.

In Propofol group, a maximum increase of HR of 10 bpm occurred during LMA insertion and returned to basal value by 3rd minute after the insertion. In sevoflurane group an increase of HR of 11 bpm during insertion and 17 bpm during the 2nd minute of insertion, HR did not reach the basal value even at 5th minute. This is statistically significant. This is in accordance with pharmacological effect of Propofol which inhibits the baroreceptor reflexes and decreases the heart rate and that of sevoflurane which has no effect on the baro-receptor reflex and produces a reflex increases in heart rate. In both the group there is a reduction of MAP compared to the basal MAP. However there was statistically significant decrease of MAP in Propofol group compared to sevoflurane group. In both the groups MAP did not change during and after the insertion of LMA which was comparable to the study by Thwaites et al. and Priya et al. who also noted lower mean arterial pressure values in patients receiving Propofol.

CONCLUSION: Induction with IV Propofol is faster than inhalational induction with sevoflurane VCB technique. Overall conditions for LMA insertion were comparable in both the groups. There is a high success rate for LMA insertion during first attempt, complications like coughing, gagging, laryngospasm and patient movements were not observed in both the groups and haemodynamic profile was more stable in the sevoflurane group.

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