Original Research

A comparative study of sevoflurane and propofol for laryngeal mask airway insertion

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Abstract

Background: Laryngeal Mask Airway (LMA) is a useful advent in the airway management, filling a niche between the face mask and the tracheal tube in terms of both the anatomical position and the degree of invasiveness. Propofol is an intravenous anesthetic agent which depresses both laryngeal and pharyngeal reflexes and provides profound relaxation of pharyngeal muscles. Incidences of gagging coughing, laryngospasm are less while using propofol than thiopentone. Sevoflurane is pleasant smelling, non-irritating to the airway, has a low blood gas solubility coefficient, good muscle relaxant effect, and high inspired concentration can be given without side effects or discomfort. It allows rapid smooth inhalation induction with excellent recovery characteristics.

Objective: To compare the quality of the condition provided for successful LMA insertion by sevoflurane induction with propofol induction methods.

Materials and Methods: Study was carried out in 100 patients at the New Civil Hospital, Surat. Patients were randomly divided into 2 groups comprising of 50 patients each. In Group-P induction with propofol 3 mg/kg intravenously over 30 seconds and in Group-S induction have done with inhalational sevoflurane 8% and nitrous oxide 50% in oxygen.

Results: The mean pulse rate before induction in Group-P was 79.92±9.18 beats/min and in Group-S it was 80.96±10.11 beats/min, $p>0.05$. Following LMA insertion the mean pulse rate increased in both the groups. However, the mean pulse rate did not differ significantly between the groups at any time following LMA insertion, $p>0.05$. The mean systolic blood pressure before induction in Group-P was 119.92±9.44 mmHg and in Group-S it was 118.40±8.60 mmHg, $p>0.05$. Comparing the 2 groups, this difference was insignificant. Following LMA insertion the mean systolic blood pressure decreased but mean systolic blood pressure did not differ significantly on comparing both groups at any time following LMA insertion, $p>0.05$. The mean SPO_2% at baseline in Group-P was 99.54±0.89% and in Group-S it was 99.72±12.7%, $p>0.05$. The mean time for cessation of verbal communication in Group-P was 32.9±7.07 seconds and in Group-S, it was 33.7±5.13 seconds. The mean time to successful LMA insertion in Group-P was 79.4±27.63 seconds and in Group-S, it was 128.5±19.46 seconds, $p<0.001$. Comparing the groups, the difference between both the groups was highly statistically significant. The mean time to successful LMA insertion was faster in Group-P compared to Group-S. In Group-P, in 40 (80%) patients, LMA insertion was done in the first attempt within the mean time of 68.12±12.14 seconds while in Group-S, in 32 (64%) patients, LMA was inserted in the first attempt within the mean time of 117.6±14.41 seconds. Comparing both groups, this difference was highly significant $p<0.001$. The second attempt was required in 8 (16%) patients in Group-P with the mean time of LMA insertion of 120.6 seconds compared to in 14 (28%) patients in Group-S with a mean time of LMA insertion of 143 seconds while comparing both the groups.

Conclusion: From this study, we conclude that inhalation of sevoflurane is quite effective, reliable and safe for laryngeal mask airway insertion when compared with intravenous propofol induction. It maintains stable hemodynamic profile during induction, produces attenuation of laryngeal reflexes, and has a lower complication rate during LMA insertion.

KEY WORDS: Laryngeal mask airway, propofol, Sevoflurane

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Introduction

Successful management of airway without adverse events is of prime importance while giving anesthesia. Laryngoscopy and endotracheal intubation are routinely used for securing the airway since a long time. But it is associated with transient and a significant rise in heart rate and blood pressure due to reflex sympathetic stimulation.[1] An alternative technique

has been developed for securing the airway with the use of Laryngeal Mask Airway (LMV). It is a useful advent in the airway management, filling a niche between the face mask and the tracheal tube in terms of both the anatomical position and the degree of invasiveness. It is easy to insert it blindly into the hypopharynx to form a seal around the larynx and has an important role in the management of difficult and failed intubation. Laryngoscopy and muscle relaxation are not necessary for the insertion of LMA. The LMA is better tolerated than the tracheal tube at 'lighter' levels of anesthesia and has a minimal cardiovascular response. LMA can be inserted in, awake as well as anesthetized patients with or without using muscle relaxant. Propofol is an intravenous anesthetic agent which depresses both laryngeal and pharyngeal reflexes and provides profound relaxation of pharyngeal muscles.[2,3] Incidences of gagging coughing, laryngospasm are less while using propofol than thiopentone.[4] Propofol when used as a bolus for induction as well as an infusion for maintenance of anesthesia for short procedures results in a significantly quicker recovery and earlier returns to psychomotor function. Sevoflurane, a new inhalation anesthetic agent, is pleasant smelling, non-irritating to the airway, has a low blood gas solubility coefficient, good muscle relaxant effect, and high inspired concentration can be given without side effects or discomfort. It allows rapid smooth inhalation induction with excellent recovery characteristics. Hence, inhalation induction of anesthesia with sevoflurane can be alternative to the use of rapidly acting intravenous induction agents.[5] Aims of our study were to compare the quality of the condition provided for successful LMA insertion by sevoflurane induction with propofol induction, To know the time required for LMA insertion with sevoflurane induction and compare it with propofol induction, to compare the hemodynamic changes produced during sevoflurane induction with that produced during propofol induction for LMA insertion, and to study occurrence of any adverse events during sevoflurane induction and propofol induction for LMA insertion and the patient acceptability of both the induction methods.

Material and Methods

The study was carried out in 100 patients at the New Civil Hospital, Surat. Pre-anesthetic examination of patients was done a day prior to the surgery. Patients were randomly divided into 2 groups, Group-P and Group-S, comprising of 50 patients each. In Group-P induction with propofol 3 mg/kg intravenously over 30 seconds with Lidocaine 0.3 mg/kg. In Group-S induction was done with inhalational sevoflurane 8% and nitrous oxide 50% in oxygen. Various vital parameters like pulse rate, blood pressure changes, respiration rate, and SPO_2% of all patients were recorded in case record form. Other clinical parameters like loss of eyelash reflex, jaw relaxation, and time to successful LMA insertion after giving the drug were also recorded and compare in both the groups. The statistical analysis was done with the help of Excel and SPSS 16 trial version.

Result

In this study, mean age in the Group-P was 27.9±9.31 years and in the Group-S was 28.7±9.86, $p>0.05$. The mean weight in Group-P was 59.18±4.59 and in Group-S was 59.88±4.42, $p>0.05$. The male:female sex ratio in Group-P was 62%:38% and in Group-S it was 54%:46% (Table 1).

The mean pulse rate before induction in Group-P was 79.92±9.18 beats/min and in Group-S it was 80.96±10.11 beats/min, $p>0.05$. Following LMA insertion the mean pulse rate increased in both the groups. In Group-P it increased by 6 beats/min after 1 minute, 7 beats/min after 2 minutes and 10 beats/min after 3 minutes from the basal value. In Group-S, it increased by 5 beats/min after 1 minute, 9 beats/min after 2 minutes and 12 beats/min after 3 minutes from the basal value. However, the mean pulse rate did not differ significantly between the groups at any time following LMA insertion, $p>0.05$. The mean systolic blood pressure before induction

Table 1: Age, weight, and sex distribution

Group	Group-P	Group-S	Z value *P* value
Age (in years)	27.9±9.31 (18-62)	28.7±9.86 (18-65)	0.42 *P*>0.05
Weight (Kg)	59.18±4.59 (50-66)	59.88±4.42 (50-65)	0.78 *p*>0.05
Sex (M:F)	31:19 (62%:38%)	27:23 (54%:46%)	-

Table 2: Comparison of attempts for LMA insertion

Duration (time interval)	1st attempt		2nd attempt		3rd attempt	
	Group-P	Group-S	Group-P	Group-S	Group-P	Group-S
Mean time to LMA insertion	68.12±12.14	117.6±14.41	120.6±9.16	143.5±9.15	155.0±5.0	160.0±3.54
Number of patients	40	32	8	14	2	4
Percentage (%)	80	64	16	28	4	8
Z value	15.86		5.65		1.26	
P value	*P*<0.001		*P*<0.05		*P*>0.05	

in Group-P was 119.92±9.44 mmHg and in Group-S it was 118.40±8.60 mmHg, $p>0.05$. Comparing the 2 groups, this difference was insignificant. Following LMA insertion the mean systolic blood pressure decreased by 9 mmHg after 1 minute, by 17 mmHg after 2 minutes, and by 15 mmHg after 3 minutes in Group-P. In Group-S mean systolic blood pressure decreased by 12 mmHg after 1 minute, by 17 mmHg after 2 minutes and by 12 mmHg after 3 minutes. Mean systolic blood pressure did not differ significantly on comparing both groups at any time following LMA insertion, $p>0.05$. The mean SPO_2% at baseline in Group-P was 99.54±0.89% and in Group-S was 99.72±12.7%, $p>0.05$. The mean time for cessation of verbal communication in Group-P was 32.9±7.07 seconds and in Group-S, it was 33.7±5.13 seconds. Comparing the 2 groups it is statistically insignificant, $p>0.05$.

The mean time for loss of eyelash reflex was 42.9±9.37 seconds in Group-P and was 42.3±5.73 seconds in Group-S. The difference between the 2 groups is statistically insignificant, $p>0.05$. The mean time to jaw relaxation was short in Group-P as compared to 107±13.93 seconds in Group-S. The difference between the 2 groups is statistically highly significant, $p>0.001$. The mean time to successful LMA insertion in Group-P was 79.4±27.63 seconds and in Group-S, it was 128.5±19.46 seconds, $p<0.001$. Comparing the groups, the difference between both the groups was highly statistically significant. The mean time to successful LMA insertion was faster in Group-P compared to Group-S. In Group-P, in 40 (80%) patients, LMA insertion was done in the first attempt within the mean time of 68.12±12.14 seconds while in Group-S, in 32 (64%) patients, LMA was inserted in the first attempt within the mean time of 117.6±14.41 seconds. Comparing both groups, this difference was highly significant, $p<0.001$. A second attempt was required in 8 (16%) patients in Group-P with the mean time of LMA insertion of 120.6 seconds compared to 14 (28%) patients in Group-S with a mean time of LMA insertion of 143 seconds while comparing both the groups. This difference was significant. Comparing both groups, the mean time for LMA insertion in first and second attempt was faster in Group-P as compared to Group-S. In Group-P and 40 patients in Group-S have found the induction pleasant. Remaining patients did not give any comment regarding induction. Not a single patient found induction unpleasant.

Discussion

In this study, a rise in the mean pulse rate from the basal value in both groups did not differ significantly. The study conducted by Lian[6] observed an insignificant increase in heart rate during LMA insertion in propofol and sevoflurane group, $p>0.05$. Thwaites[7] also observed similar findings while J.E Hall[8] found that the heart rate increased after induction but did not reach statistical significance on comparing all the 3 groups, $p>0.05$.M. Mazi[9] studied the effect of sevoflurane for TT insertion and LMA insertion. They observed a significant increase in heart rate during LMA insertion and TT insertion, but during LMA insertion the rise in heart rate was comparatively less. In this study, significant fall in mean systolic blood pressure from the baseline value was seen in both the groups after induction of anesthesia. Comparing both the groups, fall in the mean systolic blood pressure was statistically insignificant. In Lian study,[6] decrease in mean blood pressure during the study period was 18.0% mmHg and 17.0% mmHg in the propofol and sevoflurane groups, respectively. Thwaites[7] in his study did not observe a significant decrease in mean arterial pressure which was more in propofol group compared to sevoflurane group. J.E Hall[8] observed that there was a comparable change in the blood pressure in groups with only small decreases which readily stabilized. In this study high concentration of sevoflurane produces a relatively stable hemodynamic profile although associated with a fall in mean systolic blood pressure and a rise in the mean pulse rate during LMA insertion which was comparable to propofol induction and also observed that none of the patients suffered oxygen desaturation following induction for LMA insertion at any time. Mary E. Molloy[10] observed that SPO_2 was 96% in propofol group compared to 99% in sevoflurane group. LianKah's[6] study, found that none of the patients suffered oxygen desaturation in either propofol group or sevoflurane group.

In this study time to cessation of verbal communication was 32.9 seconds in Group-P compared to Group-S where it was 33.7 seconds, $p>0.05$. Time to loss of eyelash reflex was 42.9 seconds in Group-P compared to Group-S where it was 42.3 second, $p>0.05$. Comparing both the groups, the difference between them was insignificant. However, the time required for jaw relaxation was less in Group-P compared to Group-S, 62±22.76 vs. 107±13.93 seconds, respectively. The difference was highly significant. LianKah[6] observed that sevoflurane and propofol produced equally rapid loss of consciousness. A.Thwaites observed that sevoflurane induction was significantly slower compared to propofol induction. Mary E. Molloy observed that the mean time to loss of consciousness was 44 seconds in propofol group compared to a sevoflurane group in which it was 25 second, $p<0.05$. In this study, the time to loss of verbal communication and time to loss of eyelash reflex in both groups was nearly equal. But time to jaw relaxation was longer in sevoflurane group compared to propofol group. The reason for the poor mouth opening in our patients is the lag time during which results in inadequate anesthesia during the initial attempt at insertion.[11] A second possibility is related to the anesthetic agent itself, propofol is known to have a relaxant effect on jaw muscles whereas inhaled anesthetics may cause increased muscle tone and spasticity.[11]

In this study, we observed that time to successful LMA insertion in Group-P was 79.4±27.63 seconds and in Group-S it was 128.5±19.46 seconds. When both2 groups were compared, the difference was highly significant. Sivalingam[12] observed that the mean time for LMA insertion was shorter in propofol group and in propofol–alfentanil group compared to sevoflurane group and in the sevoflurane-alfentanil group,

$p<0.05$. M. Muzi observed that average time to acceptable condition for LMA insertion was achieved in 1.7 minutes in sevoflurane-N_2O and O_2 induction compared to TT groups where it was 4.6 and 6.1 minutes in sevoflurane-N_2O and sevoflurane-O_2 induction group, respectively. As jaw relaxation was better with propofol, less time was needed for LMA insertion, whereas more time was necessary for the same in sevoflurane group because of the initial difficulty in opening the mouth. In our study, we observed that out of 50 patients in each group, in Group-P in 40% of patients, LMA insertion was done in the first attempt within a mean time of 68.12 seconds. While, in Group-S in 32 patients, LMA insertion was done in the first attempt within the mean time of 117.6 seconds. This difference was highly significant $p<0.001$. The second attempt was required in 8 patients in Group-P within the mean time of 120.6 seconds compared to 14 patients in Group-S within the mean time of LMA insertion was 143.5 second, $p<0.05$. This difference was statistically significant. Only 2 patients in Group-P compared to 4 patients in Group-S required the third attempt with almost equal mean time to LMA insertion. This difference was insignificant, $p>0.05$. In all the patients, LMA was inserted successfully irrespective of the groups. Studies are in correlation with our study are Lian Kahand J.E Hall. In our study, less number of attempts were necessary for LMA insertion in propofol group compared to sevoflurane group. We attribute this difference to better jaw relaxation produced by propofol induction. In our study, we observed that out of 50 patients in each group, 12 patients in Group-P compared to 5 patients in Group-S required additional propofol for LMA insertion which was a significant difference. Additional propofol was required more in Group-P than in Group-S. Nine patients had head movement during LMA insertion in Group-P compared to 4 patients in Group-S. Fourteen patients in Group-P had limb movements compared to 5 patients in Group-S during LMA insertion. More patients coughed in Group-P i.e. 7 patients compared to 2 patients in Group-S during LMA insertion. The incidence of apnea was found more in Group-P. It was seen in 12 patients in Group-P as compared to 4 patients in Group-S. Our results suggests that overall incidence of complications was more in Group-P compared to Group-S. None of the patients experienced pain on injection at the injection site of propofol or had laryngospasm salivation, gagging or hiccough in either group. In our study, we observed that 39 patients in Group-P and 40 patients in Group-S have found the induction pleasant. Remaining patients did not give any comment regarding induction. Not a single patient found induction unpleasant. In contrast to our study, J.E.Hall found that patient satisfaction with induction was high in all patients irrespective of sevoflurane group or propofol group.

Conclusion

From this study, it can be concluded that modified vital capacity breath inhalation induction technique with 8% sevoflurane along with 50% N_2O in O_2 using a 2-liter reservoir bag is quite effective, reliable, and safe for laryngeal mask airway insertion when compared with intravenous propofol induction. It maintains stable hemodynamic profile during induction, produces attenuation of laryngeal reflexes and has a lower complication rate during LMA insertion, with a lower incidence of apnea and a smoother transition to the maintenance phase. However, sevoflurane takes a little longer time for LMA insertion than propofol due to initial jaw tightness.

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