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Original Research Article

COMPARISON OF HEMODYNAMIC CHANGES DURING LARYNGEAL MASK AIRWAY INSERTION USING PROPOFOL AND SEVOFLURANE

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ABSTRACT

Background: The laryngeal mask airway (LMA) is a popular choice for ambulatory patients owing to its swift airway. Propofol and sevoflurane compete for LMA insertion, with propofol relaxing airway reflexes and sevoflurane offering a non-pungent odor. This study examined the impact of anesthesia induction with sevoflurane and propofol on the characteristics of laryngeal mask airway (LMA) insertion in adult patients, focusing on the preference for propofol for its ability to suppress reflexes.

Materials and Methods: This prospective, comparative study was conducted on 60 patients scheduled for elective minor surgical procedures under general anesthesia in the Department of Anesthesiology, Mahatma Gandhi Memorial Hospital, Warangal. The patients were divided into two groups, each comprising 30 patients. Before the initiation of the study, Ethical and Research Committee clearance was obtained from the Institutional Ethical Committee.

Results: No significant differences were observed in age, sex, weight, height, BMI, or surgery duration. However, significant differences were observed in the time to loss of eyelash reflex, jaw relaxation, and successful LMA insertion. The number of attempts required for airway device insertion and ease of airway insertion complications were also significant factors. Additional propofol requirements were also noted. No significant differences were observed in the complications during anesthesia induction, coughing, gagging, or laryngospasm. Patient satisfaction showed no significant difference, but there was a significant difference in the incidence of nausea and vomiting between the two groups.

Conclusion: This study compared hemodynamic changes during laryngeal mask airway (LMA) insertion using sevoflurane inhalation and propofol intravenous administration. The results showed significant differences in procedural aspects, with one group experiencing a shorter time to loss of eyelash reflex and successful insertion. The hemodynamic parameters showed no significant differences, but movement and apnea incidences were more frequent in one group. Both techniques are effective in maintaining hemodynamic stability and patient satisfaction but differ in procedural efficacy and specific complications.

Keywords: Laryngeal mask airway, Propofol, Sevoflurane, Hemodynamic changes.

INTRODUCTION

Airway management is a crucial aspect of anesthetic practice. The laryngeal mask airway (LMA) has emerged as a crucial tool since its introduction by Archie Brain in 1983. The LMA offers a less invasive alternative to endotracheal intubation and is widely employed for elective surgeries and situations where intubation is either unnecessary or contraindicated. One of the primary considerations during airway

device placement is the hemodynamic stability of the patient, particularly in individuals with compromised cardiovascular function.[1,2] In this context, anesthetic induction agents such as propofol and sevoflurane play a key role, as their pharmacologic profiles can significantly influence hemodynamic responses during LMA insertion. LMA can be used as an alternative to endotracheal intubation in a less invasive way since it is extensively used during elective surgeries and circumstances when intubation is unnecessary or cannot be used. Hemodynamic stability of the patient is one of the main factors in the forestanding of airway device placement especially in patients with compromised cardiovascular system.[1,2] In this regard, anesthetic induction agents like propofol and sevoflurane are fundamental agents because their pharmacologic characteristics can considerably affect the hemodynamic reaction that takes place during LMA insertion.

Conversely, sevoflurane is a non-irritant safe volatile anesthetic agent that has smooth mask induction and is mostly applied in children and hemodynamically unstable patients. Sevoflurane is relatively stable for cardiovascular responses compared to other volatile agents, and sevoflurane results in bronchodilatation, which is excellent in the handling of airways. However, it is also clear that it is dose-dependent hypotensive by the effect of peripheral vasodilation, especially in higher concentrations.[6,7] Sevoflurane also induces conditions that seem to be similar to those observed with propofol during the insertion of LMA, with fewer hemodynamic disturbances in certain populations when used in inhalation, particularly via the inhalational route.[8] Important to establish perioperative care Compared studies of the hemodynamic effect of these agents during LMA insertion are important to optimize care. Indeed, several studies have shown mixed findings--in some, it has shown more cardiovascular stability with sevoflurane, and in some more significant depressions of blood pressure with propofol which again requires precise titration and monitoring.[9,10] In addition, other factors that also affect the hemodynamic response include the age of the patient, comorbidities, the type of surgery, the depth of anesthesia, and the adjunct medications (opioids, muscle relaxants) and these factors need to be taken into consideration when one is making comparisons. This study aimed to compare hemodynamic response to LMA insertion after either propofol or sevoflurane induction.

MATERIALS AND METHODS

The cross-sectional comparative study was done in the Department of Anesthetiology, Kakatiya Medical College and MGM Hospital, Warangal, Telangana for a period of 24 months, i.e., from September 2022 to August 2024. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in vernacular language.

Inclusion Criteria

1. Patients with ASA Grade 1 and 2.
2. Patients of age above 18 years and below 60 years.
3. Patients were posted for elective minor surgical procedures under general anesthesia.
4. Patients are willing to give consent.
5. Patients are willing to participate.

Exclusion Criteria

1. Patients with ASA Grade 3 and 4.
2. Patients with difficult airway, Mallampati Grade 3, and 4.
3. Patients presenting as emergency cases.
4. Patients of age less than 18 and greater than 60 years.
5. Patients who are allergic to inhaled anesthetics and propofol.
6. Patients who were not willing to give consent.
7. Patients are not willing to participate.

A detailed clinical history and physical examination were carried out on patients followed by a thorough review of their hospital records. All the patients meeting the inclusion criteria were included in the study. Patients were assessed pre-operatively, the procedure was explained, and written informed consent was taken. Overnight fasting was advised. Assessment of pain using a modified four-point verbal rating scale was explained preoperatively. All patients were pre-medicated with tab Alprazolam the previous night.

In the operation theatre, patients were premedicated with Inj. ondansetron, Inj. Glycopyrrolate and then induced with inj. Propofol or sevoflurane. Based on induction, the subjects were divided into 2 groups: N=30 for group S (induction with sevoflurane) and N=30 for group P (induction with propofol) Then they were subjected to insertion through laryngeal mask airway and compared in ease of insertion and hemodynamic changes such as blood pressure, heart rate, SPO_2, time for insertion, etc. The data was recorded and noted down in the master charts. All the data was documented and analyzed by subjecting it to statistical analysis.

Statistical Analysis: The collected data was entered into Microsoft Excel 2010 and analyzed using IBM SPSS Statistics for Windows, Version 24 (IBM Corp., Armonk, NY, USA). Qualitative data were expressed as frequency and percentage. Associations between categorical variables were tested using the Chi-square test with continuity correction for 2×2 tables, and Fisher's exact test when expected counts were low. Quantitative data were presented as mean ± standard deviation. Paired t-test was applied for within-group comparisons if data were normally distributed. One-way ANOVA was used for comparing more than two groups. A p-value <0.05 was considered statistically significant.

RESULTS

A total of n=60 patients were included in the study based on the inclusion and exclusion criteria and they were equally allotted randomly into two groups. Table 1 depicts the baseline characteristics of the cohorts included in the study. A critical analysis of the table indicates that there were no significant differences between the groups Sevoflurane and Propofol regarding the demographic and clinical parameters, and thus they were fairly balanced with each other. There were also no statistically significant differences in the mean age, gender distribution, ASA classification, weight, BMI, and duration of surgery ($p > 0.05$). The mean age in the sevoflurane was a little bit higher (46.6 versus 43.17 years) and the proportion of males and ASA I was comparable between the groups. There was also a close match between the mean BMI and the average time of surgery. These parameters ensure that any difference in the outcomes could have been attributed to the induction agent and not the difference in the demographic characteristics of the patients.

Table 1: Baseline Characteristics

Characteristic	Sevoflurane (n=30)	Propofol (n=30)	p-value
Age (years), Mean ± SD	46.60 ± 11.41	43.17 ± 13.13	0.284
Gender (Male), n (%)	18 (60%)	21 (70%)	0.813
ASA 1, n (%)	12 (40%)	13 (43.3%)	0.69
Weight (kg), Mean ± SD	62.27 ± 6.42	63.19 ± 5.84	0.591
BMI (kg/m^2), Mean ± SD	24.17 ± 2.19	23.44 ± 2.41	0.127
Surgery Duration (min), Mean ± SD	131.89 ± 18.45	129.35 ± 16.03	0.859

Table 2 shows the LMA Insertion characteristics of the two groups. Analysis of this table has revealed that propofol was better regarding the efficiency of insertion as well as comfort. All the parameters of time to loss of eyelash reflex, jaw relaxation, and total time to LMA insertion were significantly lower when using propofol ($p < 0.05$). Success on the first attempt was more frequent in the propofol population (70% to 36.7%, $p = 0.005$) and easy insertion was more frequently reported (76.7% to 50%, $p = 0.05$). These data indicate that propofol allows insertion of LMA in slightly better and faster conditions than sevoflurane probably because of more complete suppression of airway reflexes and faster action.

Table 2: LMA Insertion Characteristics

Parameter	Sevoflurane (n=30)	Propofol (n=30)	p-value
Time to loss of Eyelash Reflex (sec)	46 ± 11	38 ± 7	0.02*
Time to Jaw Relaxation (sec)	143 ± 45	75 ± 15	<0.001*
Time to LMA Insertion (sec)	165 ± 53	88 ± 21	<0.001*
First-Attempt Success, n (%)	11 (36.7%)	21 (70%)	0.005*
Easy Insertion, n (%)	15 (50%)	23 (76.7%)	0.05*

**Significant*

Table 3 describes the occurrence of adverse events during procedures. Analysis of the table shows that there was a substantial difference between the rate of adverse events in the two groups. Propofol was found to have with higher frequency of apnea (83.3% versus 10.0%, and p=0.001), intra-procedural motions (50% versus 20%, and p=0.01), and the necessity to use extra propofol (60% versus 16.7%, and p=0.001). In contrast, postoperative nausea and vomiting were much more common in the sevoflurane group, (33.3% vs. 10%, $p = 0.01$). More frequent hypotension was observed in the propofol group (23.3% as compared to 10.0%), but it was not statistically significant ($p = 0.149$). All these findings show the respiratory depressing properties of propofol and the emetogenic properties of sevoflurane.

Table 3: Adverse Events During Procedures

Complication	Sevoflurane (n=30)	Propofol (n=30)	p-value
Movements During Insertion	6 (20%)	15 (50%)	0.01*
Apnea	3 (10%)	25 (83.3%)	<0.001*
Additional Propofol Required	5 (16.7%)	18 (60%)	0.001*
Nausea/Vomiting Post-op	10 (33.3%)	3 (10%)	0.01*
Hypotension	3 (10%)	7 (23.3%)	0.149

**Significant*

Table 4 shows the comparison of hemodynamic stability between the two groups. Analysis of the table shows that hemodynamic parameters remained largely comparable between groups. Baseline heart rates and post-induction values did not show significant differences. Systolic and diastolic blood pressures remained within normal limits in both groups at various time points, with non-significant variations. Oxygen saturation (SpO_2) was consistently above 98% in both groups. The data suggest that both agents maintain acceptable hemodynamic stability during and after induction, with no critical deviations in cardiovascular parameters, though minor differences in SBP and DBP were observed.

Table 4: Hemodynamic Stability

Parameter	Time	Sevoflurane	Propofol	p-value
Heart Rate (bpm)	Baseline	87.3 ± 12.4	86.03 ± 10.86	0.523
	Post-induction	95.1 ± 17.68	90.6 ± 12.12	0.885
SBP (mmHg)	5-min post	108.53 ± 13.15	121.63 ± 10.89	0.246
DBP (mmHg)	Post-induction	86.17 ± 9.94	86.33 ± 9.66	0.092
SpO_2 (%)	All timepoints	>98%	>98%	>0.26

Table 5 shows the patient satisfaction and respiratory outcomes in two groups. Patient satisfaction and respiratory outcomes were similar across groups. Both groups reported smooth induction in 80% of cases, and the incidence of sore throat was identical (20%). End-tidal CO_2 ($EtCO_2$) levels remained stable in both groups. However, sevoflurane had a better nausea profile postoperatively, while propofol enabled quicker and more efficient LMA insertion. These findings highlight a trade-off between smoother insertion with propofol and better postoperative comfort with sevoflurane, allowing individualized anesthetic choice based on clinical priorities.

Table 5: Patient Satisfaction & Respiratory Outcomes

Outcome	Sevoflurane (n=30)	Propofol (n=30)	p-value
Pleasant Induction, n (%)	24 (80%)	24 (80%)	1.00
Sore Throat, n (%)	6 (20%)	6 (20%)	1.00
$EtCO_2$ Stability	Maintained	Maintained	>0.31
Key Finding	Better nausea profile	Faster insertion	-

DISCUSSION

Laryngeal mask airway (LMA) has evolved as a useful alternative to endotracheal intubation, especially in patients where hemodynamic fluctuations have to be minimized. Direct laryngoscopy is associated with which is associated with tachycardia, hypertension, and risk of myocardial ischemia, and is crucial for patients with cardiovascular comorbidities. However, LMA insertion provides a more stable hemodynamic profile, [11-13] Bhattacharya et al,[14] have found that hemodynamic response was higher in endotracheal intubation as compared to LMA emphasizing its superiority in attenuating stress response in hypertensive patients. The present study found that the baseline characteristics of the cohort divided into two groups were comparable based on age, gender, ASA physical status, body weight, BMI, and duration of surgery between the propofol and sevoflurane groups ($p > 0.05$), ensuring homogeneity for outcome evaluation. Our findings are in agreement with studies of Siddik et al,[15] Karam et al,[16] and Koppula et al,[17] there were no significant demographic or clinical differences between the groups induced with propofol or sevoflurane. In this study, we found that the time to loss of eyelash reflex, jaw relaxation, and LMA insertion was significantly shorter with the propofol group as compared to the sevoflurane group ($p < 0.001$). This indicates the propofol group has a quicker onset of anesthesia. First-attempt success rate and ease of insertion were also significantly higher in the propofol group ($p = 0.005$ and 0.05, respectively). Similar observations have been found in the studies of Soomro et al,[18] Molloy et al,[19] and Paneerselvam et al,[20] confirming the superior insertions conditions offered by propofol.

The difference among groups based on the adverse events was notable. Apnea and movement during insertion were much more common in the propofol group ($p< 0.001$ and 0.01, respectively), reflecting its well-known effects as a respiratory depressant. Conversely, incidences of nausea and vomiting were remarkably higher in the sevoflurane group ($p = 0.01$) probably as a result of emetogenic effects of the inhalational agents. These tendencies are associated with the results of the research by Tolba et al,[21] and Goyal et al.[22] In terms of the hemodynamic parameters, no significant changes occurred between the groups at various points of time. After induction, mean arterial blood pressure, diastolic and systolic blood pressure, and heart rate were maintained at normal levels when inserting LMA. Such findings show that the two agents maintain cardiovascular stability. The current finding is also confirmed by earlier studies by Negargar et al.[23] Karam et al,[24] and Mathur et al,[25] which emphasize the fact that propofol and sevoflurane deliver satisfactory hemodynamics during the insertion of LMA. SpO_2 and $EtCO_2$ values were stable across all time points in both groups, and differences were statistically insignificant ($p > 0.05$). This shows that adequate oxygenation and ventilation were maintained by both agents throughout the procedure. Postoperative outcomes including patient satisfaction, were high in both groups, with 80% rating the induction experience as pleasant. However, sevoflurane was associated with a higher incidence of postoperative nausea and vomiting, in agreement with findings from Gupta et al,[26] and Tolba et al.[21] Overall, propofol provides more favorable insertion characteristics for LMA placement, including faster onset and higher success rates, while sevoflurane offers better postoperative nausea control with minimal hemodynamic disturbance. Both agents are effective and safe, and the choice should be individualized based on the clinical context.

CONCLUSION

The results of our study showed that hemodynamic parameters showed no significant differences between the groups at baseline, after induction, and at subsequent time intervals. However, significant differences were noted in the incidence of movement and apneas, with one group experiencing these issues more frequently. Postoperative patient satisfaction was equivalent between the groups, indicating that despite the differences observed during induction and LMA insertion, patients reported similar levels of satisfaction with their anesthetic experiences. In conclusion, both sevoflurane inhalational and propofol intravenous anesthesia techniques are effective for LMA insertion in terms of maintaining hemodynamic stability and patient satisfaction; however, they differ in procedural efficacy and the incidence of specific complications.

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