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

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Abstract: ***Various anaesthetic agents are successfully used as induction agent for insertion of proseal laryngeal mask airway. This study was conducted comparing the efficacy of sevoflurane and propofol for insertion of proseal laryngeal mask airway in adults. Methods: This hospital based observational study was carried out after approval from the institutional ethics committee. 90 patients were divided equally and consecutively into two groups. Group P patients received intravenous propofol 1% 2.5 mg/kg body weight and group S patients received sevoflurane 8% with oxygen at 8 litres/minute. The time taken for induction and jaw relaxation number of attempts and condition for insertion of PLMA were noted. Also, the HR, SBP, DBP, MAP and SPO2 were noted. Result: Induction was significantly earlier in group P. The mean induction time of patients in group S was 54.02±3.88 and in group P was 42.15±2.75 seconds which was statistically significant (p<0.0001). Jaw relaxation time was statistically significant (p<0.0001) with mean jaw relaxation time of 79.91±4.50 seconds in group S and 63.33±4.50 seconds in group P. Excellent to satisfactory insertion conditions were seen in both the groups. Decline in heart rate was seen in both the groups at 2 minutes and5minutes after induction in comparison to the heart rate before induction. But, nosignificant difference was seen between the two groups. In both the groups, intragroupdecline in systolic and diastolic and mean blood pressure at 1 minute, 2 minutes and 5 minutes after induction were seen compared to that before induction. Conclusion: Induction was significantly faster with propofol. However, overall condition for insertion of PLMA was easy and comparable in both the groups. Thus, sevoflurane can be used as an alternative to propofol for insertion of PLMA.***

Keywords: Proseal LMA, Propofol, Sevoflurane

1. Introduction

Laryngeal mask airway was first described by a British anaesthesiologist, DrArchie Brain, in 1983 and was introduced into clinical practice in 1988. [1, 2,3] It was designed with the aim to produce an airway device that would be more practical thanthe face mask and less invasive than the tracheal tube. [2, 3, 4] Proseal laryngeal mask airway is the most complex of the laryngeal mask devices. It was designed with the goal to construct a laryngeal mask with improved ventilatory characteristics that also offer protection against regurgitation and gastric insufflation.

Adequate depth of anaesthesia and suppression of upper airway reflexes is required for successful insertion of Proseal LMA without any untoward effects such as gagging and coughing. Whereas, neuromuscular blocking drug is not required for its insertion. [5, 6] Propofol is the most popular intravenous induction agent for PLMA insertion. It has the advantages of rapid onset and short duration of action and adequate suppression of upper airway reflexes. Sevoflurane is a volatile inhalational induction agent, is suitable for inhalational induction even in high concentrations because of its low blood gas solubility and minimal respiratory irritant effect.This study compares the efficacy of sevoflurane and propofol as induction agents for insertion of Proseal LMA in adults.

2. Materials and Methods

This study includes 45 patients in each group, group S and group P. Group P patients were induced with IV propofol 2.5 mg/kg body weight and group S patients were induced with sevoflurane 8% with oxygen at 8 litres/minute by vital capacity breath technique. The study was carried out under the department of Anaesthesiology, Jorhat Medical Collegeand Hospital, Jorhat in the study period of one year from July 2021 to June 2022 with permission and approval from the Institutional Ethical Committee. The study design was a hospital based observational study. The sample size was calculated using sample size calculation formula. The inclusion criteria includes**:** age group of 18 to 60 year, ASA grade I and II physical status patients, patient's approval and are planned for elective surgeries under general anaesthesia. Exclusion criteria includes cervical spine disease, upper respiratory tract infection in the last 10 days, pharyngeal pathology, allergy to inhaled anaesthetics and propofol, known case of malignant hyperthermia, pregnancy, full stomach and risk of gastric regurgitation/aspiration, patient's requiring more than 2 attempts of PLMA insertion.

An informed consent was taken from all the patients who underwent this study. The patients were connected to standard monitor in the operation theatre. The preinduction HR, SBP, DBP, MAP were noted. Patients were

premedicated with injection palonosetron 0.075 mg slowly IV stat, injection glycopyrolate 0.2 mg IV stat.Patients in Group P were induced with intravenous injection of propofol 1% 2.5mg/kg body weight and for Group S patients the anaesthesia circuit was first primed with 8% sevoflurane with O_2 at 8 L/min. and then sevoflurane 8% was introduced into a fresh gas flow of 8L/min of oxygen and patients were instructed to take a vital capacity breath and hold it as long as they could.

After induction, patients of both the groups were given injection fentany l 1.5µg/kg body weight intravenously. Jaw relaxation was assessed after induction and if not found to be adequate, it was reassessed every 15 seconds. Once jaw relaxation became adequate, proseal LMA insertion was attempted by digital insertion technique.Induction time(from the start of induction to loss of verbal contact), jaw relaxation time were noted and blood pressure, heart rate, spo2 were recorded from beginning to 5 minutes of induction.

The insertion condition of PLMA was graded on a three-point scale using six point variables. The individual scores of each component were summed up and on the basis of the total score obtained, overall conditions for insertion of PLMA was assessed as :Excellent: score 18; Satisfactory: score 16-17; Poor :score <16.

Statistical analysis: Data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS and Graph Pad Prism version. Continuous variables were compared using student's t-test. Categorical variables are analyzed using Chi square test or Fischer's exact test, whichever was applicable. Calculated p-value <0.05 was considered significant.

3. Results

The age, gender, weight and ASA grade distribution in both the groups were comparable in both the groups with a p-value >0.05 as shown in Table 1. In our study, induction was significantly earlier with propofol. The mean induction time of patients in group S was 54.02±3.88 and in group P was 42.15±2.75 seconds which was statistically significant (p<0.0001) as shown in figure 1. Difference in jaw relaxation time between the two groups was statistically significant (p<0.0001) with mean jaw relaxation time of 79.91±4.50 seconds in group S and 63.33±4.50seconds in group P (figure 2).

Table 1: Demographic Profile

Variables		Group S	Group P	p-value
Age (years)		36.07±10.34	35.02±9.57	0.620
Weight (kgs)		54.98±6.57	54.51±7.19	0.748
Sex	Male	21(46.7%)	22(48.9%)	0.833
	Female	24(53.3%)	23(51.1%)	
ASA	ASA I	34(75.6%)	35(77.8%)	0.803
	ASA II	11(24.4%)	10(22.2%)	

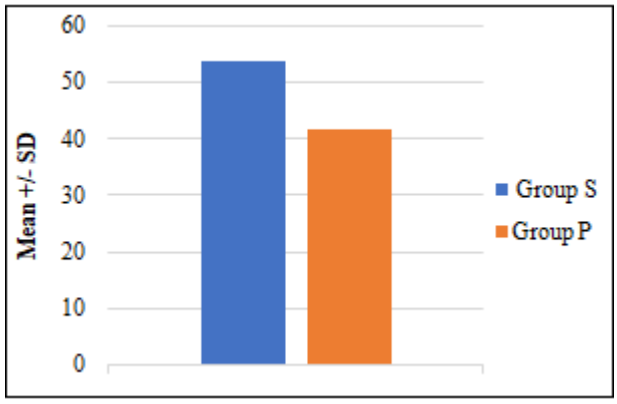

Figure 1: Distribution of Mean Induction Time

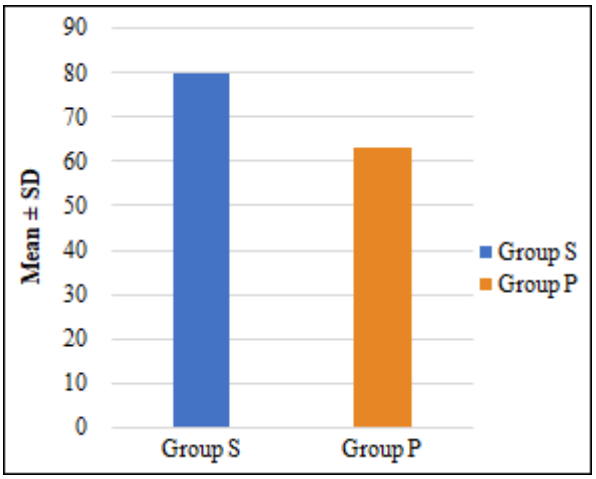

Figure 2: Distribution of mean jaw relaxation time

All patients in group P had the PLMA inserted in first attempt, whereas, 2 patients in group S required a second attempt for insertion as shown in table 2. But, there was no statistically significant differences when compared between the two groups.

Table 2: Distribution of number of attempts

Number of attempts	Group S		Group P		p-value
	n	%	n	%	
1	43	95.6	45	100	0.494
2	2	4.4	0	0	
Total	45	100	45	100	

As shown in table 3, jaw relaxation was comparable in both the groups. Partial jaw relaxation was found in 4 patients in group S and 2 patients in group P. Ease of insertion was comparable in both the groups. It was easy in all patients in group P and 43 patients in group S. In the other two patients in group S, it was difficult. Coughing, biting, gagging and laryngospasm were not seen in any patients of both the groups. The condition for insertion of PLMA in both the groups were comparable.

In our study, excellent insertion characteristics were observed in 41 patients in group S and 43patients in group P and satisfactory insertion characteristics were found in 4 patients in group S and 2 patients in group P. No patient came under the category of poor insertion characteristics (table 4) There is no statistically significant difference between group S and group P, with respect to PLMA insertion characteristics.

Table 3: Grading of conditions for PLMA insertion

Parameters	Grade	Description	Group S	Group P	p-value
Jaw relaxation	3	Full	41(91.11%)	43(95.55%)	0.677
	2	Partial	4(8.89%)	2(4.44%)	
	1	Difficult	0	0	
Ease of proseal LMA insertion	3	Easy	43(95.55%)	45(100%)	0.494
	2	Difficult	2(4.44%)	0	
	1	Impossible	0	0	
Coughing	3	Nil	45(100%)	45(100%)	1.000
	2	Transient	0	0	
	1	Persistent	0	0	
Biting	3	Nil	45(100%)	45(100%)	1.000
	2	Transient	0	0	
	1	Persistent	0	0	
Gagging	3	Nil	45(100%)	45(100%)	1.000
	2	Transient	0	0	
	1	Persistent	0	0	
Laryngospasm	3	Nil	45(100%)	45(100%)	1.000
	2	Partial	0	0	
	1	Total	0	0	

Table 4: Overall score for insertion

Score	Group S	Group P	p value
18 (Excellent)	41(91.11%)	43(95.55%)	0.200
16-17 (Satisfactory)	4(8.89%)	2(4.44%)	
<16 (Poor)	0	0	

In our study, decline in heart rate was seen in both the groups at 2 minutes and5 minutes after induction in comparison to the heart rate before induction (figure 3). But, nosignificant difference was seen between the two groups. No significant difference was seen between the groups in terms of systolic bloodpressure. However, decline in systolic blood pressure, diastolic blood pressure, mean arterial pressure at 1 minute, 2 minutes and5minutes after induction were seen in both the groups compared to before induction (figure 4).

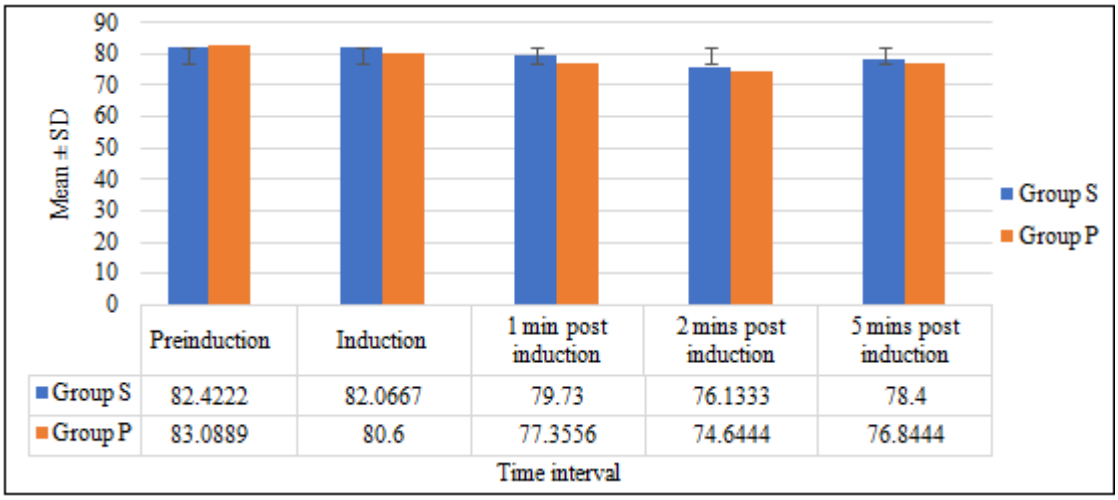

Figure 3: Distribution of Mean Heart Rate

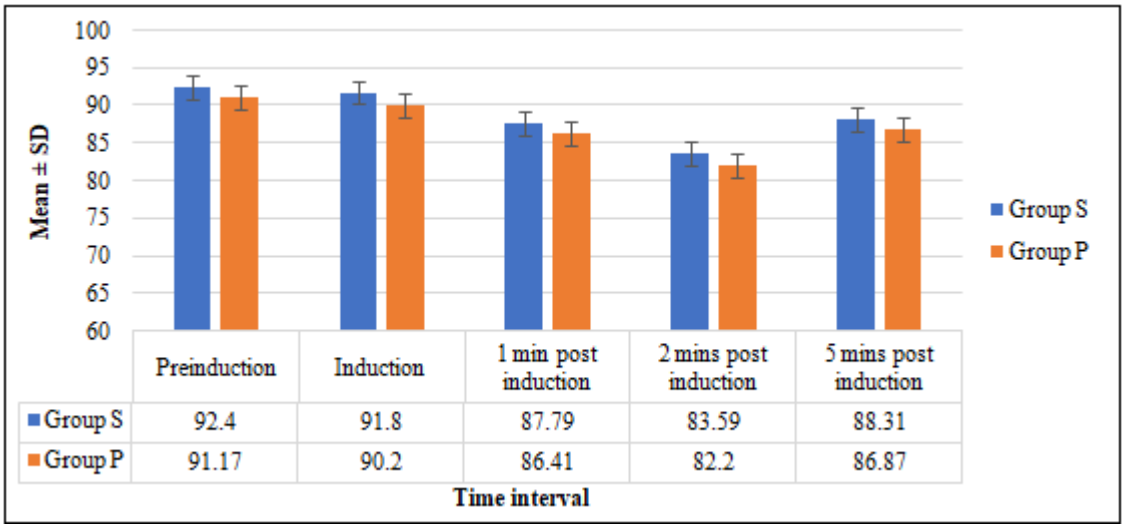

Figure 4: Distribution of Map

4. Discussion

Propofol and sevoflurane, have been used successfullyused as induction agents for Proseal LMA insertion, without causing any untoward effects like gagging, coughing etc. This study aims to compare the efficacy of these two drugs as induction agents for insertion of Proseal LMA in adults.

It was observed that the demographic parameters of the two groups for this study were comparable. The age, sex, weight, height and the ASA grade differences were statistically insignificant (p value > 0.05) in both the groups.

In our study, induction was significantly earlier in group P (p<0.0001) in comparison to group S. Similarly, S. B. Ganatra et al. [(7)] in 2002, Guiqian Shao and Guohua Zhangin2007, [(8)] Sivanaik DVR et al in 2015 [(9)] and Chavan SG et al in 2017, [(10)] in their study also observed that the mean induction time was significantly shorter with propofol compared with sevoflurane for LMA insertion.

Jaw relaxation time between the two groups was statistically significant (p<0.0001). The likely explanation for the delayed relaxation of jaw in group S patients wasthe lag time during which the alveolar concentration of sevoflurane equilibrates with the brain, which results in inadequate anaesthesia during the initial attempt at insertionwhich can be supported by the fact that the PLMA was eventually insertedinall patients. Another possible explanation for the difference may be that the group Ppatientsreceived more anaesthetic, as equipotent doses of both drugs could not be determined. Another possibility is related to the anaesthetics themselves. Propofol is known to have a relaxant effect on jaw muscles, [(11)] whereas inhaled anaesthetics may cause increasedmuscle tone and spasticity.[(12)] Therefore, for a similar depth of anaesthesia, theremaybe greater jaw relaxation with propofol. This correlates well with the studies of Hall et al in 1997, [(13)], Siddik et al in 2005, [(14)], Ravi S, Krishnamoorthy K, Ganesan I in 2015, [(15)]where jaw relaxation was achieved earlier with propofol than with sevoflurane.

In our study, the condition of PLMA insertion was comparable in both the groups. Excellent to satisfactory insertion conditions were seen in both the groups. These findings are similar to the study by Sivanaik DVR et al [(9)].

No significant differences were seen between the groups in terms of systolic and diastolic and mean blood pressure. However, in both the groups, intragroup decline in systolic and diastolic and mean blood pressure at 1 minute, 2 minutes and 5 minutes after induction were seen compared to that before induction, which is similar to the study of Patel MG [(16)].

5. Limitations

Comparison of the depth of anaesthesia between the two groups was not done as it was difficult to compare the depth of anaesthesia between inhaled and IV anaesthetics. Patients with ASA grades III and IV were excluded from the study. Hence, we could not assess the haemodynamic changes in the patients having serious co-morbid conditions. The study was done in a single centre and was carried out in a tertiary care hospital, so hospital bias cannot be ruled out. Hemodynamic measurements were recorded at 1, 2 and 5 minutes after induction, perhaps episodes of hypotension or hypertension were missed within this assessment interval. Ongoing COVID 19 pandemic and lockdown during the study duration has further hampered the study.

6. Conclusion

From this observational study, it can be concluded that induction with propofol is better than induction with sevoflurane for insertion of PLMA in adults with respect to the induction time and the time required for jaw relaxation. But, overall conditions for PLMA insertion, success rate for PLMA insertion during first attempt and haemodynamic changes were comparable in both the groups. Thus, sevoflurane compares favourably with propofol, but prolonged jaw relaxation time may delay the proseal laryngeal mask airway insertion.

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