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Research Article

A comparative study of propofol and N_2O versus sevoflurane and N_2O with respect to haemodynamic response and ease of laryngeal mask airway insertion: a prospective randomized double blinded study

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ABSTRACT

Background: Laryngeal mask airway (LMA) is an accepted airway device for spontaneous and modest positive pressure ventilation. Propofol is widely used Induction agent. Sevoflurane is a newer pleasant volatile anaesthetic with rapid induction and recovery with stable haemodynamics. The aim of this study was to compare propofol and sevoflurane with respect of haemodynamic changes and conditions for LMA insertion.
Methods: This study was done on 60 female patients of ASA I, II grade between 20-60 years of age. Patients were randomized into two groups (n=30). All patients were preoxygenated and received inj. fentanyl 2µg/kg. Induction agent was propofol 2.5mg/kg (group P) or sevoflurane 8% with vital capacity breath (group S). Loss of eyelash reflex was the end point of induction. Induction time, conditions for LMA insertion, number of attempts, time of successful LMA insertion and haemodynamic parameters were noted.
Results: time for induction and LMA insertion was significantly faster in propofol group than group S ($p<0.05$). Successful LMA insertion in first attempt was 100% in group P with excellent conditions (score 18) while in group S, it was 86.7% with excellent to satisfactory conditions (score 16-17). A significant fall in mean arterial pressure ($p<0.05$) was noted in group P while pulse rates were comparable in both groups.
Conclusions: Sevoflurane vital capacity breath inhalational induction can be used as an effective alternative to propofol though it requires greater time for LMA insertion but with better haemodynamic stability.

Keywords: Laryngeal mask airway, Propofol, Sevoflurane, Haemodynamics, Ease of insertion

INTRODUCTION

Today, the LMA has a clearly established role as an airway device in elective setting when tracheal intubation is difficult or does not required like day care anaesthesia. It is a simple, well tolerated, safe, reusable, cost effective method for airway management. It ensures a better control of airway than the facemask, laryngoscopy is avoided and haemodynamic changes are minimized during insertion.[1] It avoids the disadvantages of endotracheal tube like pressure response during intubation and sore throat, croup, hoarseness postoperatively. LMA has also been included in ASA difficult airway algorithm. Satisfactory insertion of the Laryngeal Mask Airway requires sufficient depth of anaesthesia to provide loss of consciousness, jaw relaxation, absence of upper airway reflexes rapidly without cardio respiratory compromise.[2]

Propofol with or without opioid is the induction agent of choice for laryngeal mask airway insertion having rapid induction and upper airway reflexes depressing properties but pain on injection and cardiovascular depression are the major limiting factors. Sevoflurane, a halogenated, volatile anaesthetic agent with pleasant odour and low blood: gas solubility allows a fast, smooth induction and

a predictably early and smooth recovery with stable haemodynamics making it suitable for day care (ambulatory) anaesthesia. Recently, vital capacity breath inhaled induction of anaesthesia with sevoflurane has been used as an alternative to intravenous (i.v.) induction in adult.[3]

This method is rapid, with little excitatory phenomena, high patient acceptance and good haemodynamic stability. However it may have some disadvantages like post-operative nausea and vomiting, pollution of operation theatre when compared with i.v. propofol. Several studies have shown that induction of anaesthesia with sevoflurane is comparable with i.v. propofol.[4,5] Fentanyl was used as a co-induction agent because of known synergistic effect of opioids with both sevoflurane and propofol.[6]

The aim of this prospective randomized double blinded controlled study was to compare the conditions for Laryngeal Mask Airway (LMA) insertion and haemodynamic changes following induction of anaesthesia with sevoflurane or propofol.

METHODS

After approval from institutional ethical committee, this study was done on 60 female patients of American Society of Anaesthesiologists grade I and II between 20–60 years of age undergoing minor gynaecological surgical procedures under general anaesthesia. A written and informed consent was taken from all participating patients. On the basis of a randomization list in the study arm, patients were randomized into two groups of 30 patients each. Exclusion criteria were patient refusal, mallampati grade III or IV, history of gastro-oesophageal reflux, ASA grade III or IV, oropharyngeal pathology, history of cardio-vascular, renal, neurological disease, pregnancy or known allergy to any anaesthetic. All routine investigations were done.

Nil per oral status of at least 8 hours was maintained. Patients were premedicated with tablet ranitidine 150 mg and tablet alprazolam 0.25 mg orally on the previous night. On arrival to the operation room, nil per oral status was confirmed, an i.v. line was secured, maintenance infusion of balanced salt solution was started and monitors for electrocardiogram (ECG), non-invasive blood pressure (NIBP), pulse oximeter and capnography were connected. All patients were preoxygenated for 3 mins with 100% oxygen. All patients were received glycopyrrolate 4µg/kg, ondansetron 4mg and fentanyl 2 µg/kg i.v. prior to induction.

In Group P, propofol 2 . 5 mg/kg i.v. was given over 30 seconds along with N_2O 50% with O_2 (6L/min). In Group S, sevoflurane 8% vital capacity breaths flow along with N_2O 50% with O_2 (6L/min) for 30 seconds. The point of start of injection of propofol or introduction of sevoflurane 8% were considered as starting point of induction.

Loss of eyelash reflex was considered as the end point of induction in both groups. If jaw relaxation was not adequate then it was reassessed after every 15 seconds, each time preceded by propofol boluses of 0.5mg/kg for group P and continue sevoflurane 8% in group S. Once jaw relaxation was adequate, LMA insertion was attempted using technique described by Brain by an experienced anaesthesiologist blinded to induction technique. The time for induction i.e. the time (in seconds) taken from start of induction of anaesthesia to the loss of eye lash reflex, and the time for Laryngeal Mask Airway insertion i.e. the time (in seconds) taken from start of induction of anaesthesia to successful Laryngeal Mask Airway insertion were recorded and grading of conditions of LMA insertion was done (Table 1). Successful placement of LMA was confirmed by chest wall movement, capnography and numbers of attempts were noted.

Table 1: Grading of conditions IN LMA insertion.

Parameter	Grading/Description		
	Grade 3	Grade 2	Grade 1
Jaw opening	Full	Partial	Nil
Ease of insertion	Easy	Difficult	Impossible
Coughing	Nil	Minor	Severe
Gagging	Nil	Minor	Severe
Laryngospasm	Nil	Partial	Total
Patient movements	Nil	Moderate	Vigorous

Total score – 18 (Excellent); 16-17 (Satisfactory); <16 (Poor).

Haemodynamic parameters i.e. mean arterial pressure (MAP) and pulse rate were recorded at baseline, induction, 1minute, 2minutes and 5 minutes after start of induction.

Statistical analysis

Continuous variables were presented as Mean±SD (standard deviation) and categorical data as number (%). Continuous variables were compared using student's unpaired t-test and categorical data using chi-square test incorporating Fishers exact test. Significance is assessed at 5% level (statistically significant P value ≤0.05).

RESULTS

Demographic profile was similar for the two groups. Mean age for group P was 32.83±7.91 years and for group S was 33.16±7.76 years and mean weight for group P was 52.16±6.06 kg and for group S was 51.83±6.15 kgs, which were comparable in both groups (Table 2).

Loss of eyelash reflex (induction time), adequate jaw relaxation and LMA insertion were earlier with propofol (50.16±10.47, 76.83±8.95 and 88.00±7.61 seconds respectively) as compared with sevoflurane (65.50±9.13, 106.50±12.87 and 126.83±15.05 seconds respectively) and this was statistically significant between two groups (p<0.001) (Table 3).

Analysis of grading of conditions of LMA insertion was done. No incidence of coughing, gagging, and laryngospasm during LMA insertion was observed in both the groups. Jaw opening was partial in three patients (10%) in group S. Moderate patient movement were also noted in three patients of group S. The overall insertion was excellent with propofol with all 30 patients scoring 18.

Table 2: Demographic profile.

	Group P (n=30)	Group S (n=30)	P value
Age (years)	32.83±7.91	33.16±7.76	P >0.05
Weight (kg)	52.16±6.06	51.83±6.15	P >0.05

Table 3: Time of events.

Event	Time (Seconds)		
	Group P (n=30)	Group S (n=30)	P value
Loss of eyelash reflex	50.16±10.47	65.50±9.13	<0.001
Time of jaw relaxation	76.83±8.95	106.50±12.87	<0.001
Time of LMA insertion	88.00±7.61	126.83±15.05	<0.001

Table 4: Grading of conditions for LMA insertion.

Parameter	Grading	Description	Group P (n=30)	Group S (n=30)	P value
Jaw opening	3	Full	30	27	0.24
	2	Partial	0	3	
	1	Nil	0	0	
Ease of insertion	3	Easy	30	30	
	2	Difficult	0	0	
	1	Impossible	0	0	
Coughing	3	Nil	30	30	
	2	Minor	0	0	
	1	Severe	0	0	
Gagging	3	Nil	30	30	
	2	Minor	0	0	
	1	Severe	0	0	
Laryngospasm	3	Nil	30	30	
	2	Partial	0	0	
	1	Total	0	0	
Patient movements	3	Nil	30	27	0.24
	2	Moderate	0	3	
	1	Vigorous	0	0	

With sevoflurane, 25 patients (83.33%) had excellent conditions for lma insertion and five patients (16.66%) had satisfactory conditions (score 16-17) (table 4, figure 1 and 2). All patients of group p had successful lma insertion in first attempt. In group s, 26 patients (86.7%) had successful lma insertion in first attempt and four patients (13.3%) in the second attempt. The number of attempts required was not statistically significant (p=0.11) between the two groups (Table 5).

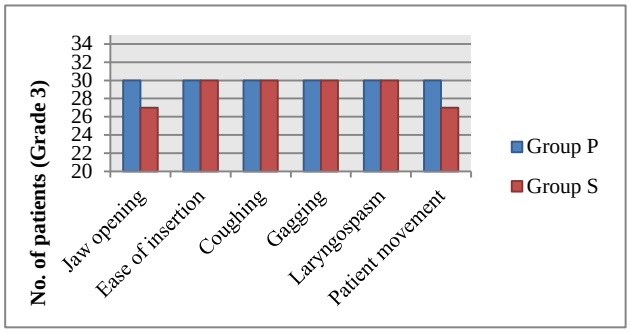

Figure 1: Conditions for LMA insertion (Grade 3).

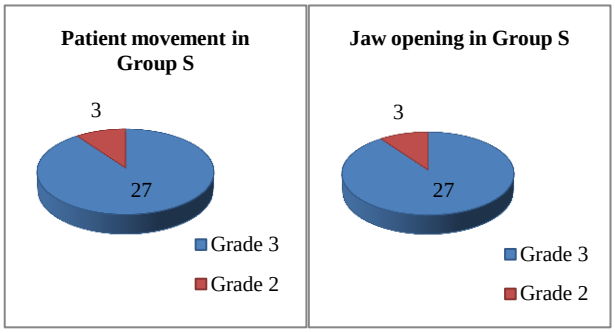

Figure 2: Conditions for LMA insertion in Group S (Grade 3 and 2).

Table 5: Number of attempts.

No. of Attempts	Group P (n-30)		Group S (n=30)	
	No	%	No	%
1	30	100.0	26	86.7
2	0	0.0	4	13.3
Total	30	100.0	30	100.0

Table 6: Analysis of the haemodynamic parameters.

	Time after the start of anaesthetic induction (minutes)				
	Baseline	Induction	1minute	2 minute	5 minute
MAP (Mean±SD)					
Group P	93.77±6.95	90.93±6.19	82.76±4.85	80.17±5.06	75.33±8.41
Group S	97.13±7.13	95.53±7.95	88.76±7.54	85.76±6.67	81.47±6.29
P value	>0.05	<0.05	<0.05	<0.05	<0.05
Pulse rate (Mean±SD)					
Group P	83.60±8.18	81.10±7.89	79.53±5.53	77.57±6.19	75.93±7.35
Group S	85.10±7.45	84.73±7.62	81.90±7.23	79.90±7.30	77.53±6.84
P value	>0.05	>0.05	>0.05	>0.05	>0.05

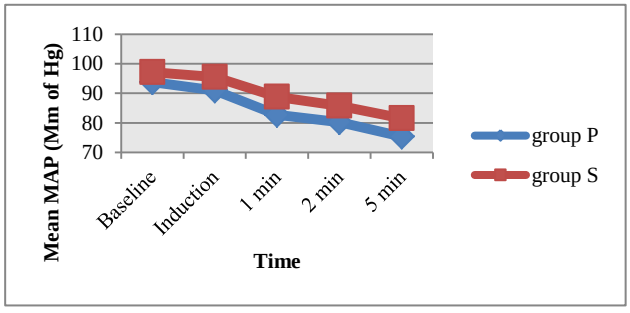

Figure 3: Comparison of MAP between two groups.

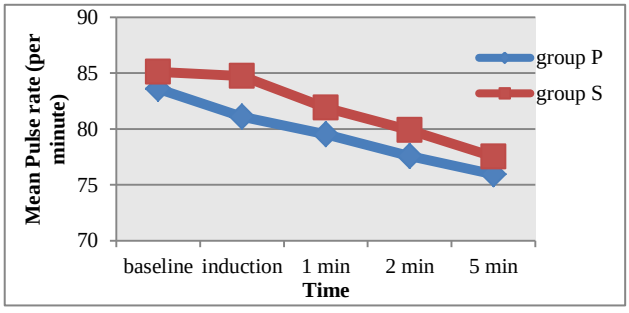

Figure 4: Comparison of pulse rate between two groups.

Baseline mean arterial pressure was comparable between the two groups. A statistically significant fall in the mean arterial pressure in group P was noted as compared to group S at induction, one minute, two minutes and five minutes. The pulse rate at baseline and at the time of induction was comparable between two groups. Pulse rate at one minute, two minutes and five minutes showed a fall in both groups and the difference between the two groups were statistically insignificant (p>0.05). (Table 6, Figure 3 and 4).

DISCUSSION

In this study we compared the quality and speed of LMA insertion in adult patients after sevoflurane vital capacity breaths with N_2O inhaled induction and propofol intravenous induction with N_2O. Fentanyl was used as a co- induction agent because of known synergistic effect of opioids with both sevoflurane and propofol.[12]

The induction time was longer with sevoflurane than with propofol which was statistically significant, similar to a study by Hall et al and A Thwaites et al.[7,8] Mean time taken from start of induction to successful laryngeal mask insertion was significantly shorter (p<0.001) with propofol (88±7.61 seconds) compared with sevoflurane (126.83±15.05 seconds) which may due to relaxant action of propofol on jaw muscles while prolonged jaw tightness was associated with sevoflurane which is seen in present study also.[4,9]

Lian et al. in their study achieved insertion of LMA with sevoflurane in 127 sec almost similar to the time taken in our study (126 sec).[4] Occurrence of complications like coughing, gagging and laryngospasm during LMA insertion were not noticed in both the groups of this study which may be due to adequate depth of anaesthesia with depression of laryngeal reflexes by both agents. Jaw opening was partial in three patients in group S (p=0.24). Moderate patient movement were noticed in three patients of group S (p=0.24) while no patient movement were noticed in group P.

The overall insertion was excellent with propofol with all 30 patients (100%) scoring 18. With sevoflurane, 25 patients (83.33%) had excellent conditions for LMA insertion and five patients (16.16%) had satisfactory conditions. The difference of excellent conditions between the two groups was almost equal to significant level (p=0.052) however jaw opening and patients movement were statistically comparable. (p=0.24). Thus the Conditions for Laryngeal Mask Airway insertion were superior with propofol when compared with sevoflurane. All patients in propofol group had LMA inserted in first attempt. 26 patients of group S (sevoflurane+N_2O) had successful LMA insertion in first attempt and four patients had successful LMA insertion in the second attempt (p=0.11). Lian et al in their study found that more attempts at insertion of LMA were required in patients in sevoflurane group than in propofol group because of inadequate mouth opening.[4] These findings are comparable to our study also. Priya et al found no difference in number of attempts required to insert LMA.[9]

In a similar study conducted by Priya et al, excellent conditions were obtained in a significantly greater number of patients in Group P (p=0.02) with statistically significant better jaw opening (p=0.047) in group P.[9] Propofol is known to have a relaxant effect on jaw muscles whereas inhalational anaesthetics may cause an increased muscle tone and spasticity.[9]

Ganatra SB et al and Rajiv Dwiwedi et al in their study found similar results and was comparable with present study.[10,11] Significant fall in MAP was noted in propofol group at baseline, 1 minute, 2 minutes, and 5 minutes after induction. Pulse rates were comparable in both groups in this study.[4,8] A Thwaites et al and Lian et al in their studies noted a significant fall in MAP in propofol group while heart rate changes were insignificant which is comparable to our study.

CONCLUSION

Sevoflurane with vital capacity breath inhalational induction is associated with good haemodynamic stability but conditions for LMA insertion provided with i.v. propofol are better. Prolonged time for jaw relaxation with sevoflurane may delay laryngeal mask airway insertion but successful LMA insertion in first attempt is almost identical with both sevoflurane and propofol. Thus we conclude that Sevoflurane is an acceptable alternative to propofol for LMA insertion.

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