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A comparative evaluation of sevoflurane versus propofol for I-gel insertion in elective surgery under general anaesthesia

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Abstract
Aims: A study was performed to compare the efficacy of sevoflurane and propofol as an induction agent in providing I-gel insertion conditions like jaw relaxation, ease of insertion, patient movement, coughing, laryngospasm in patients undergoing general anaesthesia for elective surgical procedures.
Methods: Sixty patients of ASA grade I and II, aged between 18 and 60 years, of either sex, scheduled for elective surgeries under general anaesthesia, were randomly allocated into two equal groups of 30 patients each. In group S, induction was done by 8% sevoflurane in fresh gas flow of 8L O_2 and in group P, inj. propofol, 2.5 mg per kg intravenously used for induction. Induction time, jaw relaxation time, insertion time, insertion conditions, number of attempts, perioperative haemodynamic parameters and postoperative complications were assessed.
Results: Both groups were comparable with regard to demographic data. The induction time, jaw relaxation time, and I-gel insertion time were significantly rapid in group P compared to group S. The overall I-gel insertion conditions and jaw relaxation grading were better in group P compared to group S. Though heart rate and mean arterial pressure were significantly decreased in group P, however, patients were remained haemodynamically stable. No significant postoperative complications were observed in both groups.
Conclusion: Propofol is superior to sevoflurane for insertion of I-gel. However, propofol is associated with fall in mean arterial pressure and pulse rate. Therefore, induction with 8% sevoflurane can be considered as an alternative to intravenous propofol induction for I-gel insertion.

Keywords: sevoflurane, propofol, I-gel insertion

Introduction

Airway is secured and maintained using adequate oxygenation and ventilation as part of general anaesthesia. Bag and mask ventilation was used for airway management since decades. Airway management has revolutionized since the endotracheal tube developed by William Macewan in 1880 [1]. Endotracheal intubation is the gold standard method, requires skill and continuous training and practice for maintaining a patent airway during anaesthesia. Supraglottic airway devices are good alternative to intubation. I-gel, a new supraglottic airway device is composed of transparent soft gel like thermoplastic elastomer with a non-inflatable cuff [2]. The shape and contour of the cuff accurately matches with the peri-laryngeal structure to attain perfect seal.
Since introduction of supraglottic airway devices, various induction agents namely thiopentone [3], propofol [4-8], halothane [9] and sevoflurane [10, 11] have been used for induction of anaesthesia for laryngeal mask airway placement. An ideal induction agent for I-gel insertion would provide rapid loss of consciousness, jaw relaxation, provide sufficient depth for suppression of airway reflexes without cardio respiratory compromise. Many intravenous agents are available, though propofol is probably the best induction agent. On other side sevoflurane is best inhalational induction agent, though neither of one is ideal. Propofol [1] provides smooth induction and depresses the airway reflexes, permits easier insertion. However, it is associated with hypotension, apnoea and pain on injection. Hence, need of time is to search for an alternative. Sevoflurane, a halogenated volatile agent and non-irritant to the airways, is suitable for smooth inhalation induction, quick adjustments of anaesthetic depth, good haemodynamic stability and a predictably short recovery [14-15]. Thus sevoflurane as inhalational induction agent using single vital capacity breath is a good alternative to intravenous induction with propofol. On literature search, we could find only a single study comparing the use of sevoflurane and propofol as an induction agent for I-gel insertion. Thus to further confirm the results, we conducted this study to compare the efficacy of sevoflurane and propofol in providing insertion conditions for I-gel in patients undergoing elective surgery during general anaesthesia.

Methods

After obtaining approval from institutional ethical committee and written informed consent from the patients, randomized double blinded study was done on sixty patients of either sex, ASA grade I and II, aged between 18

and 60 years, who were scheduled for elective surgeries under general anaesthesia. The study drug was prepared and administered by an anaesthesiologist who was not a part of the study and the parameters were assessed by another anaesthesiologist who was blinded to the combination used. The I-gel was inserted by the blinded anaesthetist, who assessed and graded the conditions for I-gel insertion and noted any adverse responses. All patients were considered as healthy and not have history of medical treatment. Preoperatively patients were asked to keep nil by mouth for 6 hours. A intravenous access was obtained and infusion of ringer lactate solution started. All the monitors for ECG, SpO2, NIBP were attached to the patient and pre operative values were noted. All patients were premedicated using inj midazolam 0.02 mg/kg, inj glycopyrrolate 0.004mg/kg and inj fentanyl 2µg/ kg intravenously. Preoxygenation with 100% O2 for 3-5 minutes was done. Patients were randomized into one of the two groups of thirty patients each according to induction agent used.

In group P, propofol and in group S, sevoflurane was used for induction of anaesthesia. Patients in sevoflurane group were asked to take a deep breath then exhale to residual volume. The mask is placed firmly over the patient's face and connected to primed circuit. The patients were then asked to inhale a vital capacity breath (VCB) and hold it as long as possible. The starting point of induction was taken when the patients VCB is completed. While holding their breath, the patients were asked to open their eyes every 10sec. Unable to open their eyes taken as loss of consciousness (LOC). Confirmation was done by testing for loss of eyelash reflex. Patients in the propofol group breathed oxygen for 3 min via face mask and were anaesthetized with propofol 2.5 mg/kg intravenously given over 30 seconds. Time to loss of consciousness was determined, confirmed by testing for the loss of eyelash reflex; interval from the start of induction to loss of eyelashes reflex considered as induction time in both groups. After the induction, jaw relaxation was assessed; time from induction of anaesthesia to relaxation of jaw was considered as jaw relaxation time and it was recorded in both groups. If jaw relaxation achived, I-gel insertion was attempted, if jaw relaxation not achived another attempt was made every 30 seconds upto, a maximum of three tries in both groups. Number of attempts in each group were noted. Correct placement of I-gel was confirmed by square waveform on capnography. Time taken from the start of induction to successful insertion of I-gel was considered as insertion time. Insertion conditions were graded on three point scale (Table 1). Haemodynamic parameters pulse rate, systolic blood pressure, diastolic blood pressure were recorded before and after premedication, after induction, after I-gel insertion at 1,3, 5,10,15 minutes. Following I-gel insertion, anaesthesia was maintained with inj atracurium and sevoflurane 1-2% in O2 on controlled ventilation. At the end of operation, anaesthetic agent was discontinued and residual neuromuscular block was reversed with inj neostigmine 0.04-0.08 mg/kg and inj glycopyrolate 0.008 mg/kg intravenously. After removal of I-gel, patients were observed for any laryngospam and coughing. All the collected data were tabulated and expressed in form of Mean ± Standard deviation. Statistical analysis was done using Graphpad instat 3.0 software for windows. Quantitative data were compared using unpaired t-test and Chi-Square test was used for qualitative data. A P-value < 0.05 was considered significant.

Table 1: Insertion Conditions

Criteria	**Grading (Score)**		
	3	**2**	**1**
Jaw relaxation	Full	Partial	Nil
Ease of insertion	Easy	Difficult	Impossible
Coughing/gagging	Nil	Minor	Severe
Patient movement	Nil	Moderate	Vigorous
Laryngospasm	Nil	Partial	Total
Adequacy of ventilation	Adequate without audible leak	Adequate with audible leak	Inadequate which requires re placement of I-gel
Total score: 18 – Excellent 16-17 – Satisfactory <16 - Poor			

Table 2: Patients variables

Parameter	**Group S**	**Group P**
Age (years)	34.9±8.40	35.73 ±10.33
Weight (kg)	57.66±3.87	56.33±4.58
Sex (M:F)	12: `18	14: 16
Induction time (seconds)	85.3±4.80	59.66±7.93*
Jaw relaxation time (seconds)	101.26± 4.21	81.36± 6.12*
I-gel Insertion time (seconds)	119.86±4.43	99.36±5.78*

Values are Mean±SD or number

*P- value <0.05 significant; Group S vs Group P

Table 3: I-gel insertion conditions

Parameters	Group S n=30		Group P n=30		p value
	n	%	n	%	
Jaw relaxation Grade					
Full	20	66.66	27	90	0.0283*
Partial	10	33.33	3	10	
Nil	0	0	0	0	
Ease of insertion					Ease of insertion
Easy	24	80	27	90	0.2781
Difficult	6	20	3	10	
Impossible	0	0	0	0	
Cough Grade					Cough Grade
Nil	26	86.66	28	93.33	0.3894
Minor	4	13.33	2	6.66	
Severe	0	0	0	0	
Laryngospasm Grade					Laryngospasm Grade
Nil	30	100	30	100	0
Partial	0	0	0	0	
Total	0	0	0	0	
Movement Grade					Movement Grade
Nil	28	93.33	29	96.66	0.5536
Moderate	2	6.66	1	3.33	
Vigorous	0	0	0	0	
Adequacy of ventilation					Adequacy of Ventilation
Adequate Without leak	30	100	30	100	0
With leak	0	0	0	0	
Inadequate	0	0	0	0	

*P-value<0.05, significant; Group S vs P

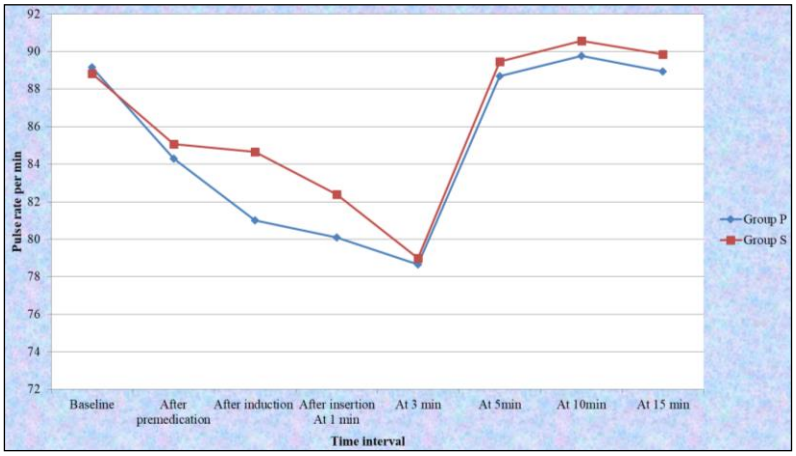

Fig 1: Pulse rate

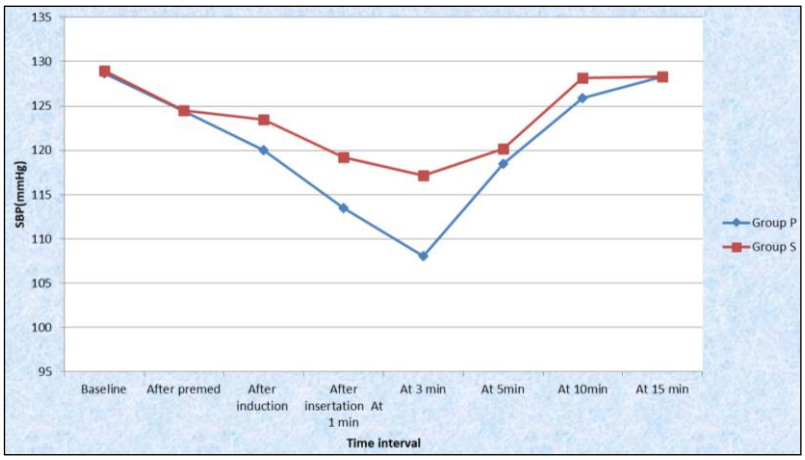

Fig 2: Systolic Blood Pressure

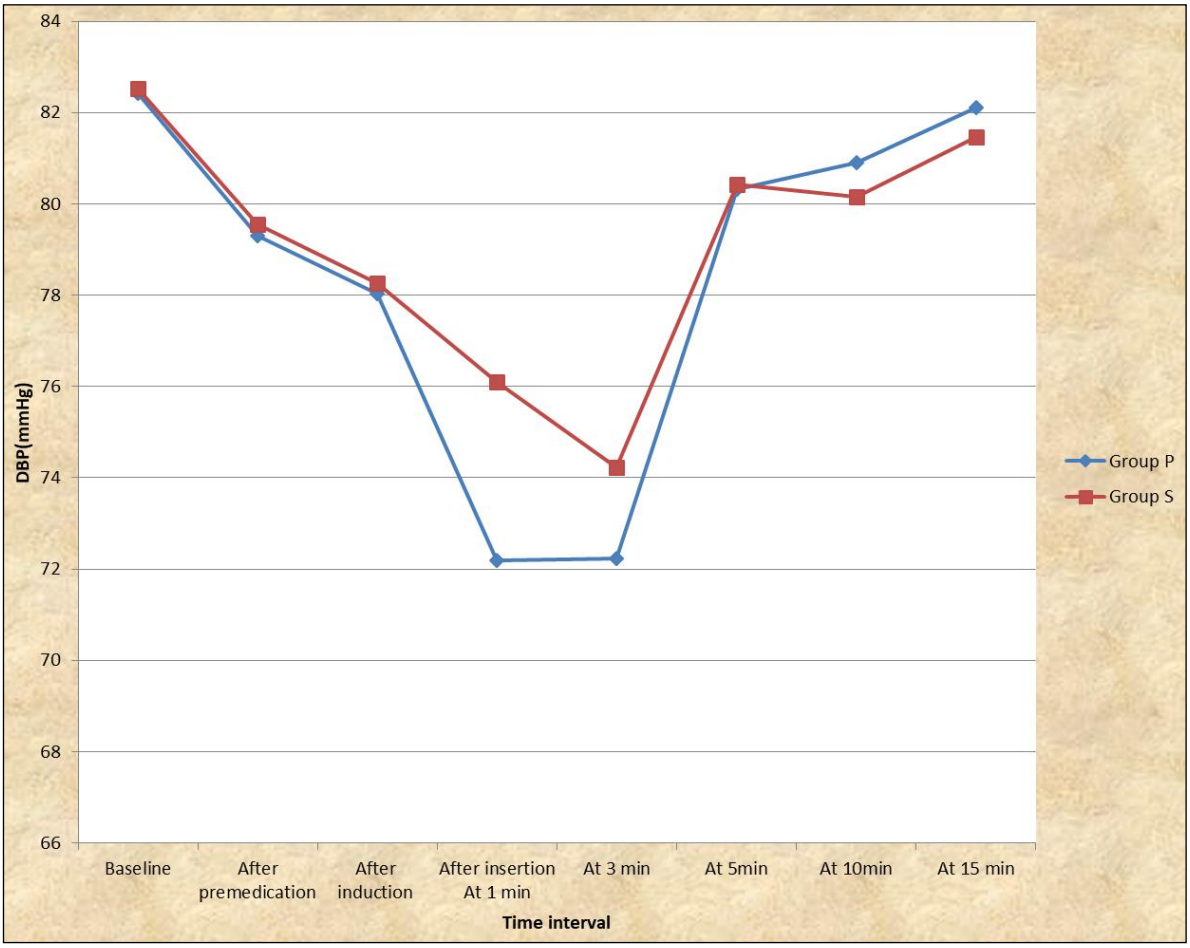

Fig 3: Diastolic Blood Pressure

Results

The demographic data were comparable between the two groups (Table 2). The induction time, jaw relaxation time, and I-gel insertion time were significantly rapid in patients in propofol group in comparison to patients in sevoflurane group (Table 2). I-gel was inserted in first attempt in 28 patients in propofol group, as compared to 25 patients in sevoflurane group, however the difference was statistically insignificant. I-gel insertion required fewer attempts with propofol when compared to Sevoflurane The overall I-gel insertion conditions were better in the propofol group as compared to sevoflurane group. Jaw relaxation grading was significantly superior in propofol group (Table 3). Both group were comparable with regard to ease of I-gel insertion, coughing, laryngospasm, movements and adequacy of ventilation. Overall conditions for insertion of I-gel were assessed as excellent, satisfactory or poor on basis of total score obtained by summing up the individual scores of each components. Maximum score was 18. In propofol group 76.66% patients had score 18 indicating excellent insertion condition, in comparison to 63.33% of patients in sevoflurane group (Table 3). However, difference was insignificant. Pulse rate was comparable between the two groups (Fig 1) The decrease in arterial pressure was significantly more in group P in comparison to group S (Fig 2,3). However, patients were remained haemodynamically stable in both groups. Post device removal cough was observed in 3 patients in group S as compared to 2 patients in group P. No other complication was observed in any patient.

Discussion

The common method of anaesthetic induction for I-gel insertion is the use of intravenous propofol which has the advantage of smooth, rapid onset, short duration of action and depression of airway reflexes. However, adverse effects have been associated with propofol including hypotension, greater respiratory depression (apnoea) and pain on injection [16]. Sevoflurane has been widely used as an agent for inhalational induction. It is suitable for quick inhalational induction because of its low blood gas solubility and minimal respiratory irritant effect. Recently single breath vital capacity breath inhaled induction of anaesthesia with sevoflurane has been used as an alternative to IV induction in adults. This is associated with high patient acceptance and good haemodynamic stability [16-17].

The results of our study indicates that patients in propofol group had significantly lower induction time, took less time for jaw relaxation and significantly less time for I-gel insertion than sevoflurane group. Similar results were reported by Thwaites A, *et al* [12] who also observed similar time of anaesthetic induction i.e 57±11 seconds in propofol group and 84±24 seconds in sevoflurane group. Nandakumar MN [1] Priya V *et al* [5], Siddik-Sayyid SM, *et al* [7], and Paneerselvam S and also observed faster induction with propofol than with sevoflurane. In

contrast to our results Sivalingam P, *et al* [6], and Koppula R and Shenoy A [13] noted that the time to loss of eyelash reflex and verbal contact was faster with sevoflurane when compared to propofol. While Sarkar M, *et al* [14], in their study found no difference in induction time between two groups. Siddik-Sayyid SM, *et al* [7] and Sarkar M, *et al* [16], also observed faster jaw relaxation time in propofol group probably due to relaxant effect of propofol on jaw muscles while sevoflurane associated with increased muscle tone and spasticity. Koppula R and Shenoy A [13] also found a rapid jaw relaxation time as 93.75±16.34 seconds with propofol group as compared to 98.2±10.34 seconds with sevoflurane group. In contrast to our results, Paneerselvam S and Nandakumar MN [1], and Priya V, *et al* [5], found a shorter device insertion time for both group, with earlier device insertion in propofol group as comared to sevoflurane group. However, longer device insertion time was noted in the study conducted by Sivalingam P, *et al* [6], and Koppula R and Shenoy A [13]. In our study, I-gel insertion required fewer attempts with propofol when compared to sevoflurane probably due to inadequate jaw relaxation with sevoflurane as compared to propofol. In study conducted by Priya V, *et al* [5], 4 patients each in either group required a second attempt for insertion of LMA. In the remaining 21 patients each in both groups, LMA was placed successfully at the first attempt. I-gel insertion conditions, were superior in propofol group as compared to sevoflurane group and the difference was statistically significant for jaw relaxation grade. However, both groups were comparable with regard to ease of insertion, coughing, laryngospasm, movement and adequacy of ventilation. Sivalingam P, *et al* [6], reported that in propofol group, 12% patients had cough as compared to sevoflurane group, where 20% patients had cough. In a similar study conducted by Priya V, *et al* [5], features like coughing, gagging and patient movements could not reach statistical significance. Paneerselvam S and Nandakumar MN [1] noted overall conditions for LMA insertion as excellent in 88% patients and satisfactory in 12% patients in Group P, whereas in Group S it was excellent in 80% and satisfactory in 20% patients.

In present study, decrease in pulse rate was more in propofol group as compared to sevoflurane group after induction and after I-gel insertion. In contrast to our results, Thwaites A, *et al* [12] and Sarkar M, *et al* [16] noticed a increased in pulse rate, However, Sivalingam P, *et al* [6] found a significant decrease in pulse rate in sevoflurane-alfentnyl group. Fall in systolic and diastolic blood pressure and pulse rate was more in propofol group as compared to sevoflurane group. In contrast to our study Ti LK, *et al* [4], Priya V, *et al* [5] and Koppula R and Shenoy A [13] found that haemodynamic responses were stable in propofol and sevoflurane groups. Both sevoflurane and propofol seem to produce a small and comparable decrease in systolic and mean arterial pressure. While comparing propofol and sevoflurane, Paneerselvam S and Nandakumar MN [1] found statistically significant fall in MAP at induction. In our study no hypoxic episode observed in any of the patient in both groups. Post I-gel removal cough was present in 6.7 % patients in group P as compared to10% patients in group S. However no other post-operative complications were noted. In contrast to our study Paneerselvam S and Nandakumar MN [1] and Priya V, *et al* [5] noticed laryngospasm in one patient in sevoflurane group.

Conclusion

In conclusion, we found that propofol is superior to sevoflurane for insertion of I-gel, using loss of eye lash reflex as the end point for induction. However, propofol is associated with fall in systolic and diastolic blood pressure and pulse rate, which is unfavourable for haemodynamically unstable patients. The clinical conditions of insertion of I-gel obtained with inhalational induction using 8% sevoflurane is satisfactory and is comparable to that with 2.5 mg kg-1 of intravenous propofol. Therefore, induction with 8% sevoflurane can be considered as an alternative to intravenous propofol induction for I-gel insertion.

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