ORIGINAL ARTICLE

Comparison of Sevoflurane and Propofol for Insertion of I-Gel in Patients Undergoing Minor Elective Surgical Procedures under General Anaesthesia

Rajesh Mahajan

Abstract .
A popular method of providing anaesthesia for I-Gel insertion is with the use of propofol. However, bolus propofol has been associated with adverse effects such as hypotension, apnea and pain on injection. Hence, time is needed to search an alternative. We aimed to compare the induction characteristics, ease of I-Gel insertion, hemodynamic changes and complications with inhalation of 8% sevoflurane vital capacity breath and propofol. A prospective randomized study of 60 American Society of Anaesthesiologists' Grade I and II patients was conducted and distributed among two groups with 30 each undergoing minor surgical procedures under general anaesthesia. Group P received the injection propofol and Group S received sevoflurane. At the end point of induction, the I-Gel insertion was attempted. Scoring systems were used to grade the conditions for insertion of the I-Gel. Induction, I-Gel insertion characteristics and hemodynamic changes were assessed. Data were recorded and analysed. Comparison among the study groups was done with unpaired *t*-test, Mann–Whitney test and Chi square test. Sevoflurane took a longer time for induction and for I-Gel insertion than propofol. There was no statistically significant difference between the two groups, with respect to I-Gel insertion characteristics, heart rate, and mean arterial pressure. It is concluded that sevoflurane is associated with good hemodynamic stability and may prove useful in cases where propofol is to be avoided. However, the ease of insertion provided with propofol is better.

Key words
Hemodynamic changes, I-Gel, Propofol, Sevoflurane

Introduction

A supraglottic airway device has gained extensive popularity for airway management during surgery. I-Gel is a new supraglottic airway device, consisting of a mask and a tube. One notable feature of the I-gel is that the rim of the mask is designed to conform to the anatomical shape of the larynx. This enables the device to provide an airtight seal without the cuff mechanism for spontaneous ventilation and allow controlled ventilation at modest levels (<20 cm H2O) of positive pressure (1,2,3).

I- Gel has been safely used in spontaneous and controlled ventilation. I- Gel can be inserted successfully after suppression of airway reflexes by deep anaesthesia (4). Ideal induction agent for I- Gel insertion would provide loss of consciousness, jaw relaxation, depression of upper airway reflexes without cardiorespiratory compromise. Propofol is probably the best intravenous agent and Sevoflurane is the best volatile agent (1).

Propofol is the induction agent of choice for I-Gel insertion (5). Sevoflurane is non pungent inhalational anaesthetic with low blood gas solubility coefficient (0.69) and minimal respiratory irritant characteristics. Mask induction with this agent is associated with low incidence of breathholding, coughing, and laryngospasm (4,6,7).

From the Department of Anaesthesiology and Critical Care, Chintpurni Medical College and Hospital, Bungal, Punjab- India
Correspondence to : Dr. Rajesh Mahajan, Assistant Professor, Department of Anaesthesiology and Critical Care, Chintpurni Medical College and Hospital, Bungal (Punjab)

Rapid insertion of I-Gel after vital capacity breath (VCB) induction may allow the use of sevoflurane as a single drug for the induction and maintenance of anaesthesia, which would ease the transition period and lead to cost saving (1).

The present study was undertaken to compare the induction characteristics, ease of I-Gel insertion and hemodynamic changes during I-Gel insertion following induction of anaesthesia with inhalation of sevoflurane and intravenous induction with propofol.

Material and Methods

This prospective randomized study was conducted at Chintpurni Medical College and Hospital, Bungal, Pathankot from January 2016 to December 2017. This study was approved by the Institutional Medical Ethics Committee and written informed consent was obtained from all the included patients. About 60 American Society of Anaesthesiologists' Grade I and II patients aged between 20 and 50 years, Mallampati Grade I and II, who were undergoing minor elective surgical procedures under general anaesthesia were distributed in two groups with 30 each, Group P– propofol group and Group S– sevoflurane group.

All the patients were fasting from midnight and the nil per oral (NPO) status was confirmed before the induction of anaesthesia. A preanesthetic evaluation was done in the preoperative area. On arrival to operation room, intravenous access was secured. Monitors for electrocardiogram, non-invasive blood pressure, Pulse oximetery and ETCO2 were connected. Patients were randomly allocated into Group P and Group S. Patients were premedicated with injection ondansetron 4 mg, injection glycopyrrolate 0.2 mg. All patients were preoxygenated for 3 min with 100% oxygen with flow rate 8L/min using Magill circuit with 2 Ltr reservoir bag. Patients received injection butorphanol 0.02 mg/kg and injection midazolam 1 mg prior to induction. Patient's baseline vital data such as heart rate (HR), mean arterial blood pressure (MAP), SpO2 were recorded.

- ***Group P***: Propofol 2.5 mg/kg body weight at the rate of 40 mg every 10 s was given.
- ***Group S***: Sevoflurane 8% was introduced along with oxygen 50% and air 50% at flow rate of 8 L and patients were instructed to take and hold it as long as they could.

The point of start of injection of propofol or introduction of sevoflurane 8% was considered as the starting point of induction. Loss of verbal contact was assessed by the response to calling out the patient's name. Loss of eyelash reflex was considered as the desired end point for induction in both techniques. After this, jaw relaxation was assessed by an anaesthesiologist. If jaw relaxation was not adequate, it was reassessed after every 10 s. Once jaw relaxation was adequate, I-Gel insertion was attempted by an experienced anaesthesiologist blinded to the induction technique. He stayed outside the anaesthetic room during the initial induction period and was called after the loss of eyelash reflex for the insertion of the I-Gel.

If the first attempt was unsuccessful and there was a requirement for more anaesthetic agent, he left the room and was recalled for I-Gel placement after the repeat administration of either Propofol or Sevoflurane. The time for induction i.e. the time (in secs.) taken from induction of anaesthesia to the loss of eye lash reflex and the time for I-Gel insertion i.e. the time (in secs.) taken from loss of eye lash reflex to successful I-Gel insertion were recorded in both the groups.

The conditions of insertion of I-Gel were graded by an observer on a three-point scale using six variables as shown in *Table 1*. Scoring was done as excellent 18, satisfactory 16–17 and poor <16.

Heart Rate (HR), Mean arterial Pressure (MAP), and End-tidal CO2 (ETCO2) were monitored and recorded from the beginning of induction up to 5 min of induction.

Table 1: Grading of Conditions for I-Gel Insertion

Introduction of the I-Gel	3	2	1
Jaw opening	Full	Partial	Nil
Ease of insertion	Easy	Difficult	Impossible
Patient response	3	2	1
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		

Statistical analysis was performed using Student's unpaired t-test for demographic data and haemodynamic changes. Chi-square test incorporating Fishers exact test and the Mann Whitney test were used for the variables of induction, quality of I-Gel insertion. $P < 0.05$ was taken as statistically significant.

I-Gel was inserted by the method described by Dr. Muhammed A. Nasir. After insertion of I-Gel, anaesthesia was continued. The study ended after 5 minutes when the patient was considered to reach an adequate depth of anaesthesia.

Results

There was no significant difference between the groups with respect to age and body weight distribution. The mean age in Group P was 37.8 ± 7.16 (S.D.) and in Group S, it was 39.3 ± 5.92 (S.D.). The mean weight in Group P was 54.43 ± 5.54 (S.D.) and in Group S, it was 57.53 ± 6.46 (S.D.) as shown in *(Table 2).*

Induction was more rapid with IV Propofol. The mean time (in seconds) for induction in Group P was 27.9 ± 6.71 (S.D.) and in Group S, it was 43.8 ± 8.97 (S.D.) seconds. (p= 0.001)

There was no difference in the mean time to I-Gel insertion between the groups. The mean time (in seconds) for I-Gel insertion in Group P was10.7 ± 3.01 (S.D.) seconds and in Group S, it was11.33 ± 5.27 (S.D.) (p= 0.57) as shown in *(Table 3).*

I-Gel was placed successfully at the first attempt in all the patients.

Conditions of I-Gel insertion were not statistically significant between groups. Condition of I-Gel insertion

Table 2: Patients Demographics

Parameter	Group P		Group S		Unpaired	*p*
	Mean	SD	Mean	SD	t-test	
Age(years)	37.8	7.16	39.3	5.92	-0.885	0.38
Weight (kg)	54.43	5.54	57.53	6.46	-1.994	0.051

Table 3: Induction and I-Gel Insertion Variables

Variables	Propofol	Sevoflurane	*p*
Induction time (sec.)	27.9 ± 6.71	43.8 ± 8.97	0.001
I Gel insertion time (sec.)	10.7 ± 3.01	11.33 ± 5.27	0.57

Table 4: Grading of Condition for I Gel Insertion

	Propofol Group	Sevoflurane Group	*p*
Excellent	28(93.3)	24(80)	0.24
Satisfactory	2(6.7)	6(20)	0.17

Table 5: Analysis of the Haemodynamic Parameters

	Time after start of anaesthetic induction (minutes)					
	Base line	At 1min	2 min	3 min	4 min	5 min
Mean Arterial Pressure						
Group S	99.2	80.9	79.7	77.7	77.8	77
Group P	92.2	78.1	79.7	68.8	67.5	67.5
p- value	0.2	0.41	0.25	0.13	0.3	0.03
Heart Rate						
Group S	94.1	83.8	81.1	80.8	81.8	79.5
Group P	87.7	76.5	74.3	74.3	74	74.1
p- value	0.36	0.17	0.76	0.19	0.14	0.07

in 24 (80%) patients were excellent (score=18) and in 6 (20%) patients were satisfactory (Score between 16 to17) in S group, while condition of I-Gel insertion was excellent in 28 (93.3%) subjects and was satisfactory in 2(6.7%) patients in group P as shown in *(Table 4)*

Comparison of the Haemodynamic parameters (Mean Arterial Pressure, Heart Rate) between the two groups showed a statistically significant difference in the Mean Arterial Pressure. Propofol group showed a larger transient decrease in Mean arterial pressure compared to sevoflurane groups (p=0.007). Compared with base line, both groups showed a statistically significant decline in mean arterial pressure every minute after I-Gel insertion (Table 5). There was no statistically significant difference in heart rate between groups (p=0.09). However, within the groups, there was a statistically significant decline in heart rate every minute after LMA insertion compared to base line MAP.

Discussion

I-gel was invented by Dr Muhammed A. Nasir in cooperation with Intersurgical Ltd. after almost 19 years of research and was introduced into clinical practice in 2007. It is now very popular in airway management and is used extensively in different types of surgeries (8). Satisfactory insertion of I-Gel after induction of anaesthesia requires sufficient depth of anaesthesia and adequate blunting of airway reflexes (9). Insertion of I-Gel is said to be associated with less hemodynamic changes than endotracheal intubation (4,8,10).

One of the most common intravenous induction agents used for I-Gel insertion is propofol due to its greater depressant effect on airway reflexes (9) and excellent jaw relaxation. It is however associated with adverse effects such as pain on injection, hypotension, hypersensitivity and apnea. Among the inhalational induction agents, sevoflurane is more suitable due to its pleasant smell, smooth and rapid induction and minimal respiratory irritant effect. The vital capacity induction technique with sevoflurane is comparable to that of bolus injection of propofol. This is associated with good hemodynamic stability and high patient acceptance (11). Administration of butorphanol before I-Gel insertion gives synergistic effect with propofol and sevoflurane (12).

In present study conditions for I-Gel insertion were superior with Propofol than with Sevoflurane. Excellent conditions were 93.3% in propofol group and 80% in sevoflurane group which was not a big difference to reach statistical significance between the groups. Similar results were shown by Chavan *et al*. in a study using the same end point of induction which was the loss of eye lash reflex in both the groups. However, sevoflurane has been compared favourably with propofol for the I-Gel insertion in several studies where they concluded that the quality, safety and reliability of sevoflurane make it an alternative to propofol for I-Gel insertion in adults (13).

In the present study I-Gel was successfully placed in all the patients in first attempt. Induction time was significantly longer with Sevoflurane 8%, than with propofol. Our results are comparable to those achieved by Kannaujia *et al.* (8).

In our study the hemodynamic responses were stable for both the groups. There was statistically significant difference in MAP and HR in propofol group, 3 min after induction.

Ahmeduddin et al. (4) also observed similar results that the hemodynamic responses were stable with both groups.

Thus, it can be concluded that induction and insertion of I-Gel is faster and easier with propofol. Sevoflurane is associated with good hemodynamic stability and may prove useful in cases in which cardiovascular system compromise is to be avoided. Using VCB technique, sevoflurane 8% is comparable to intravenous propofol for insertion of I-Gel in adults undergoing short surgical procedures under general anaesthesia. Although more time is required for jaw relaxation with sevoflurane than propofol which may delay I-Gel insertion (14), success rate is same for I-Gel insertion during the first attempt in both the induction techniques.

Sevoflurane can serve as an effective substitute to intravenous induction in critically ill patients with cardiovascular decompensation or wherever the use of propofol is contraindicated. Sevoflurane is an acceptable alternative to the more commonly used propofol for I-Gel insertion (15).

References

1. Hagberg C, Artime C. Airway management in the adult. Miller's Anesthesia. 8th ed. Philadelphia. Churchill Livingstone 2015;1647-58.
2. Beylacq L, Bordes M, Semjen F, Cros AM. The I-gel, a single-use supraglottic airway device with a non-inflatable cuff and an esophageal vent: An observational study in children. *Acta Anaesthesiol Scand* 2009;53:376-79.
3. Liew GH, Yu ED, Shah SS, Kothandan H. Comparison of

the clinical performance of i-gel, LMA Supreme and LMA ProSeal in elective surgery. *Singapore Med J* 2016;57:432-37.

4. Ahmeduddin S, Amjad A, Sadqa A. Comparison of propofol and sevoflurane for laryngeal mask airway insertion. *J Rawalpindi Medical College (JRMC)*; 2013;17(2):268-70.
5. Rustagi PS, Nellore SS, Kudalkar AG, Sawant R. Comparative evaluation of I-gel insertion conditions using dexmedetomidine-propofol versus fentanyl-propofol - A randomised double-blind study. *Indian J Anaesth* 2019;63:900-07.
6. Dwivedi R, Dwivedi S, Chourasia HK. A comparative study of sevoflurane and propofol for laryngeal mask airway insertion in adults. *Int J Sci Study* 2015;3:67-71.
7. El Radaideh KM, Al Ghazo MA. Single breath vital capacity induction of anesthesia with 8% sevoflurane versus intravenous propofol for laryngeal tube insertion in adults. *Saudi Med J* 2007;28:36 40.
8. Kannaujia A, Srivastava U, Saraswat N, Mishra A, Kumar A, *et al*. A preliminary study of I-gel: a new supraglottic airway device. *Ind J Anaesth* 2009;53(1):52-56.
9. Sengupta J, Sengupta M, Nag T. Agents for facilitation of laryngeal mask airway insertion: A comparative study between thiopentone sodium and propofol. *Ann Afr Med* 2014;13:124 29.
10. Sukhupragarn W, Leurcharusmee P, Sotthisopha T. Cardiovascular effects of volatile induction and maintenance of anesthesia (VIMA) and total intravenous anesthesia (TIVA) for laryngeal mask airway (LMA) anesthesia: A comparison study. *J Med Assoc Thai* 2015;98:388 93.
11. Negargar S, Peirovifar A, Mahmoodpoor A, Parish M, Golzari SE,Molseqi H, *et al.* Hemodynamic parameters of low flow isoflurane and low flow sevoflurane anesthesia during controlled ventilation with laryngeal mask airway. *Anesth Pain Med* 2014;4:e20326.
12. Topuz D, Postaci A, Sacan O, Yildiz N, Dikmen B. A comparison of sevoflurane induction versus propofol induction for laryngeal mask airway insertion in elderly patients. *Saudi Med J* 2010;31:1124-29.
13. Shirishkumar GC, Surita M, Sandhya HG, Gourish PS. Comparison of sevoflurane and propofol for laryngeal mask airway insertion and pressor response in patients undergoing gynecological procedures. *J Anaesth Clini Pharma* 2017;33(1):97-101.
14. Ravi S, Krishnamoorthy K, Ganesan I. Comparison of sevoflurane and propofol for laryngeal mask airway in children. *Indian J Clin Anaesth* 2015;2:137-40.
15. Vora KS, Shah VR, Patel D, Modi MP, Parikh GP. Sevoflurane versus propofol in the induction and maintenance of anaesthesia in children with laryngeal mask airway. *Sri Lanka J Child Health* 2014;43:77-83.