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Comparative evaluation of sevoflurane and propofol to facilitate insertion of supra glottic airway device

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ABSTRACT

Background and Aims: Propofol has been used since ages as induction agent to aid in insertion of Supraglottic airway devices however its side effects like hypotension, apnea and pain on injection do coexist. To avoid these side effects sevoflurane has been studied and well recognized because of its sweet smelling property. We conducted this study with primary aim to compare the insertion conditions such as no. of attempts for insertion, hemodynamic variations and awakening after surgery. The secondary aim was to note the adverse effects associated with Sevoflurane and propofol.

Materials and Methods: We included sixty female patients of age 18-65 years graded as ASA I and II undergoing short gynecological procedures. Patients were induced with Sevoflurane 8% or IV Propofol 2mg/kg. Attempts for I-gel insertion, jaw relaxation, biting, coughing, gagging, laryngospasm and hemodynamic pressor response and awakening after surgery were noted.

Result: Induction time with Propofol is less compared to Sevoflurane. I-Gel insertion time with Sevoflurane and Propofol is insignificant (p value= 0.93). 25 patients in Group S and 27 patients in group P had very easy insertion of I-gel. 23 patients in Group S and 27 patients in Group P had relaxed jaw. None of the patients in both groups experienced laryngospasm.

Conclusion: Propofol provided better conditions for I-gel insertion with manageable hypotension while the patients induced with Sevoflurane were hemodynamically more stable but the jaw relaxation was less as compared to that provided by propofol. Induction with 8% Sevoflurane by Vital Capacity Breath (VCB) technique can be an alternative for induction in high risk patients. Also the awakening from anaesthesia is faster with sevoflurane and is more suitable for patients demanding early discharge after day care surgeries.

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1. Introduction

I-gel is a 2nd generation cuffless Supraglottic airway device. Due to its non inflatable seal it avoids compression trauma that can occur with other supraglottic devices. It provides an anatomical seal of the pharyngeal, laryngeal, perilaryngeal structure.¹ With use of I-gel muscle relaxation and laryngoscopy is avoided and hemodynamic changes are minimised. In a non paralyzed patient insertion of I-gel needs sufficient depth of anaesthesia.

Propofol has been the preferred agent of choice for induction to facilitate I-gel insertion as it suppresses airway reflexes.² The awakening without any CNS residual effects is the principal characteristic of this drug. However Propofol is associated with certain adverse effects like painful injection, hypotension and Apnea.

Sevoflurane (Sevorane) is a clear, colourless, nonflammable liquid with low blood gas solubility co-efficient (0.69). Has a pleasant, non irritant, non pungent sweet smelling odour. It has minimal respiratory irritation and maintains hemodynamic stability. Preparations for Commercial use are free from additives or stabilisers.³

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Our study was primarily aimed to compare the insertion conditions for I-gel, hemodynamic changes and awakening with Sevoflurane and Propofol in females undergoing short gynaecological surgeries. The secondary aim is to study the side effects of both agents while using each agent for induction.

We hypothesize that propofol will provide better insertion conditions but at the cost of hemodynamic fluctuations and pain on injection while sevoflurane will provide comparable conditions without adverse effects.

2. Materials and Methods

We obtained institutional ethical committee clearance (2019/586) and written informed consent from all patients. Sixty females aged 18-65 years ASA Physical Status I, II undergoing GA for short gynaecological procedures were enrolled to participate in the study.

Patients were randomly allocated into two groups of thirty each Group 'S' for Sevoflurane and group 'P' for Propofol using an automated computer generated list. A sample size of 28 in each group was calculated with power of 80% and alpha value of 0.05. To consider dropouts 30 patients in each group were analysed and a sample size of 60 was considered.

Patients with reduced mouth opening, neck or facial burns, Modified Mallampatti grade >3, BMI >30 kg/m², Thyromental distance <6 cm, upper or lower airway obstruction or any other known allergies to the study drugs were excluded from the study.

The anesthesiologist introducing the I-gel and the person recording the data were blinded to the study group by placing a screen at the level of the neck so that the anesthesiologist introducing I-gel does not see the IV line.

On arrival to the operating room, patient's baseline parameters were recorded (Heart rate, Mean arterial pressure, Respiratory rate, SpO₂). IV access was secured with 20G IV cannula and Ringers Lactate was started at 2 ml/kg.

Premedication comprising of Inj Glycopyrrolate 0.2 mg, Inj Midazolam 1 mg, Inj Ondansetron 4 mg, inj Fentanyl 2 mcg/kg was administered intravenously (IV). Size 3 (yellow) I-gel was used. Lignocaine jelly was applied to posterior surface of I-gel for lubrication.

Group P- Patients were induced with Propofol 2 mg/kg with 40 mg xylocaine IV (premixed). (It was used to reduce pain on injection of Propofol) Time to loss of consciousness was calculated from time of start of injection to loss of eyelash reflex and inability to open eyes to verbal commands. After loss of eyelash reflex ventilation was checked by bilaterally equal chest rise and ability to fill the reservoir bag. I-gel insertion was attempted after complete jaw relaxation.

Group S- Patients were induced with 2% sevoflurane (Sevorane by Abbott Company) by VCB technique and

100% oxygen via facemask for 30 secs and then the inspired concentration of Sevoflurane was increased to 8% with 100% oxygen and fresh gas flow of 6 L/min until the loss of consciousness. Patient was asked to breathe normally. Time from starting of breath after placing mask to inability to open eyes on verbal command was taken as time to loss of consciousness. After loss of consciousness inspired concentration of sevoflurane was again reduced to 2%. Insertion of i-gel was attempted after complete jaw relaxation.

A maximum of three attempts were given for i-gel insertion after which the study was abandoned in case of failed insertion and anesthesia was proceeded with endotracheal intubation. Heart rate, Blood pressure, were recorded successfully as mentioned in Figures 2 and 3. Ventilation of patients was noted. Adverse effects of bradycardia, coughing, laryngospasm, bronchospasm and fall in oxygen saturation if occurred were noted and managed accordingly.

After loss of consciousness following were noted-

1. Biting
2. Coughing
3. Ease of i-gel insertion
4. Gagging
5. Jaw relaxation
6. Laryngospasm

2.1. Scoring system

Excellent – No gagging, no coughing, no laryngospasm, no biting, easy i-gel insertion, easy jaw relaxation.

Good- Mild to moderate gagging or coughing, and no laryngospasm, mild to moderate difficulty in i-gel insertion and jaw relaxation.

Poor- Moderate to severe gagging or coughing and no laryngospasm, difficult jaw relaxation and impossible i-gel insertion.

2.2. Statistical analysis

Using SPSS16 (Statistical package for the Social Sciences, SPSS, Inc, Chicago, IL) statistical analysis was performed. Quantitative variables were compared by independent T-test/ Mann-Whitney (for non parametric data). Qualitative variables were compared using Chi-square test. The Kolmogorov-Smirnov test was used to show normal distribution of continuous data. A p value <0.05 was considered as significant.

3. Results

Table 1 demonstrates the Demographic details using variables Age, ASA, MPC, Weight and Sex comparing Propofol and Sevoflurane and the results are insignificant as the P value is more than 0.005.

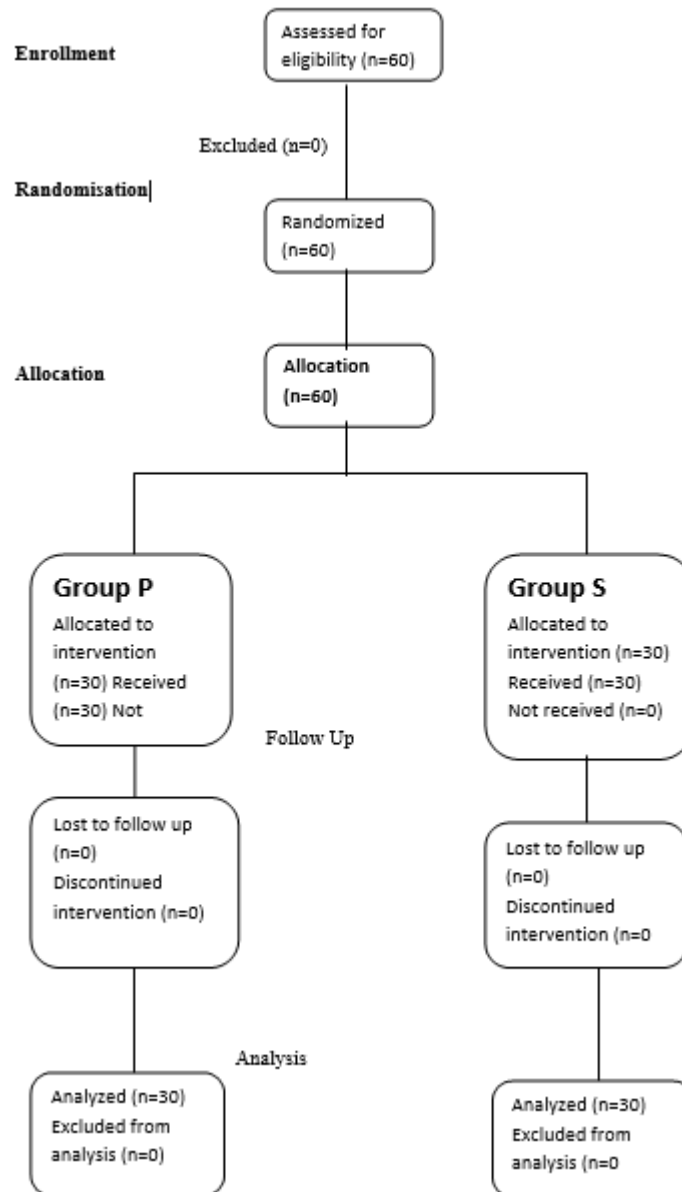


Fig. 1: Consort flow chart of the study

Table 1: Demographic data

Variables	Group S(n=30)	Group P(n=30)	P Values
Age(years)	34.9 ± 7.67	31.2 ± 7.80	0.068
Weight (kg)	64.23 ± 12.87	56.6 ± 13.58	0.115
ASA I, II	28% / 72%	73% / 26%	0.24
Modified Mallampatti class I/II/III	17/13/00	18/10/2	

Table 2: Induction time

	Group S(n=30)			Group P (n=30)		P value
MEDIAN (IQR)	MEAN ± SD	95% CI for MEAN	MEDIAN (IQR)	MEAN ± SD	95% CI for MEAN	
62 (20)	58.6± 11.12	55.23 to 63.57	37 (10)	37.48 ± 7.92	34.45 to 4.49	0.001

Table 3: I-Gel insertion time

MEDIAN	Group S(n=30)		MEDIAN	Group P (n=30)		P value
	MEAN± ISD	95% CI for MEAN		MEAN± ISD	95% CI for MEAN	
16(6)	16.68 ± 6.81	14.05 to 19.37	15 (9)	16.09 ± 4.76	14.31 to 18.06	0.93

Table 4: Grading of insertion conditions and adverse effects

Parameter	Grade	Description	Group S	Group P
Biting	3	Mild	25	25
	2	Moderate	3	5
	1	Severe	2	0
Coughing	3	Mild	27	30
	2	Moderate	3	0
	1	Severe	0	0
Ease of i-gel insertion	3	Very easy	25	27
	2	Easy	5	3
	1	Difficult	0	0
Jaw Relaxation	3	Relaxed	23	27
	2	Incompletely relaxed	6	3
	1	Tight	1	0
Gagging	3	Mild	26	26
	2	Moderate	2	4
	1	Severe	2	0
Laryngospasm	3	Mild	28	30
	2	Moderate	2	0
	1	Severe	0	0

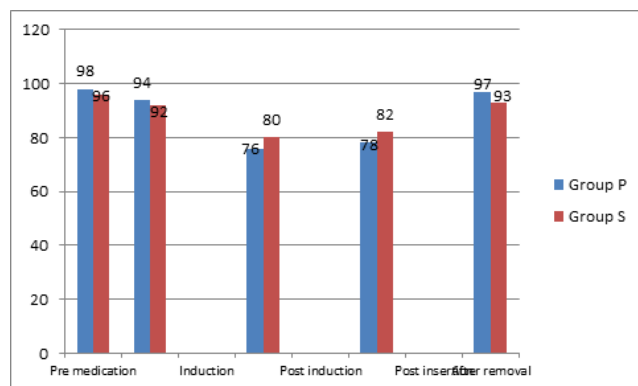
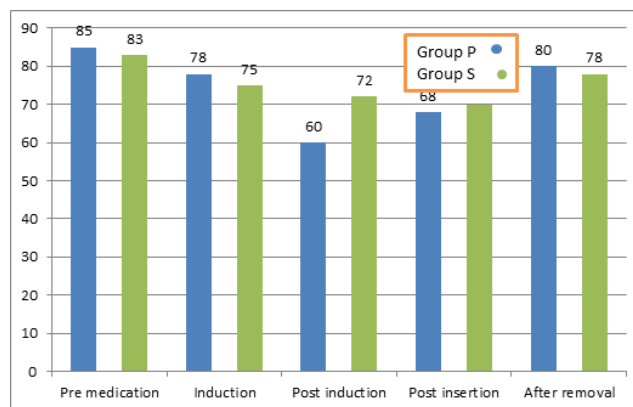
**Fig. 2:** Heart rate variability**Fig. 3:** Mean arterial pressure variability Mann Whitney U= 57.5
IQR=Inter Quartile Range
CI=Confidential Interval

Table 2 compares the Induction time with Propofol and Sevoflurane which gives us the result that time taken for induction using Propofol is less as compared to Sevoflurane.

Table 3 compares the I-gel insertion time with Propofol and Sevoflurane which shows that time taken for I-gel insertion is less with Propofol as compared to sevoflurane.

Table 4 depicts the grading for insertion conditions, jaw relaxation and complications in both groups.

4. Discussion

I-gel has been used increasingly over a last few years for administering General Anaesthesia as an alternative to tracheal intubation in short surgical procedures. Propofol is the preferred agent for induction since long to aid i-gel insertion but the effects of hypotension and pain on injection obviates the need to look for other agents which would avoid the pain and maintain hemodynamic stability. In this

attempt we conducted this study comparing sevoflurane and propofol and found that propofol remains the better drug of choice though sevoflurane can be considered an effective alternative in cases where hemodynamic stability needs strict maintenance.

The insertion conditions for supraglottic devices using propofol and sevoflurane have been compared earlier but the majority of reports are using LMA and varieties of LMAs. Only limited material is available regarding i-gel. The conditions for i-gel insertion are different than those for LMA and definitely needs a different discussion.⁴

The non inflatable seal of i-gel is known to cause less compression trauma which is more commonly encountered in LMAs and its varieties. Also the self adjusting cuff better seals the glottis aperture than that with LMA. Which in turn causes fewer hemodynamic fluctuations.⁵

Though the mouth opening required for i-gel insertion is more than that needed for LMA as it has a preinflated cuff. Hence insertion of i-gel needs better jaw relaxation.

Earlier studies^{6–8} conducted, comparing propofol and sevoflurane for LMA insertion in adults and concluded that induction time and insertion time was lesser with propofol. The number of attempts required for I-gel insertion and incidence of complications were similar in both groups. Hemodynamic responses were stable for both groups. They also mentioned that propofol is much superior in suppressing airway reflexes hence better facilitates I-gel insertion. In our study we could derive similar results while the haemodynamic profile was much better with sevoflurane

Propofol provides adequate jaw relaxation and less time for induction as compared to Sevoflurane which is associated with insufficient jaw relaxation and hence more number of attempts for i-gel insertion.

Ganatra SB, D'Mello et al.⁶ studied the conditions for insertion of laryngeal mask airway between sevoflurane and propofol using fentanyl as a co-induction agent in adults. Excellent or satisfactory conditions were observed in all 30 patients in propofol group and 29 out of 30 patients in sevoflurane group. The time taken for LMA insertion is shorter with propofol. Systolic and diastolic pressures were lower in propofol group. They concluded that although there was a faster induction with propofol-fentanyl, conditions for insertion were similar in both groups. Hemodynamic stability was better with sevoflurane-fentanyl while the propofol-fentanyl combination was more cost-effective. Though we did not study the cost effectiveness rest of our study results were similar to the above study.

Siddik SM et al.⁷ conducted the study using sevoflurane-propofol and sevoflurane and propofol alone for laryngeal mask airway in adults and stated that the co-induction technique was the most reliable one with successful LMA insertion in first attempt and incidence of complications like apnea, PONV was reduced to a great extent. This

might be attributed to the synergistic action of sevoflurane and Propofol and also the reduced requirement of Propofol which may cause reduced incidence of PONV.

In our study, 2 patients in sevoflurane group had laryngospasm while none in propofol group. Four patients in each group had gag reflex after removal of I-gel. Twenty eight out of thirty patients, in both propofol and sevoflurane groups, witnessed successful insertion of i-gel in first attempt. No patients complained of PONV in either groups.

Sarkar Mahajan et al.⁸ conducted a study to compare Vital capacity breath inhalation with 8% Sevoflurane and Propofol for LMA insertion in adults. And stated that a vital capacity induction with sevoflurane resulted in faster loss of consciousness and also the time for successful LMA insertion in 1st attempt and the incidence of side effects were similar in both the group ($P > 0.05$). While we conclude that I-gel insertion though better with propofol, Sevoflurane provides comparable conditions for I-gel insertion. The Sevoflurane when used using vital capacity induction technique provides comparable results to that of bolus injection of propofol. Hence provides minimum haemodynamic variability and better acceptance by the patient due to sweet odour.

Takashi Kondo et al.⁹ compared Desflurane, propofol and sevoflurane and found that desflurane causes narrowing of the glottic opening and increased Peak inspiratory pressures when compared to Sevoflurane and Propofol during GA. So LMA insertion was more successful with the use of Propofol compared to Sevoflurane and Desflurane. Also this study summarises that among the inhalational induction agents sevoflurane provides the most optimal conditions as induction agent.

Kalapana S Vora et al.¹⁰ in their study for sevoflurane versus Propofol in the induction and maintenance of anaesthesia in children with laryngeal mask airway hypothesized that Sevoflurane provided shorter time for LMA insertion, removal and recovery than IV propofol in children undergoing minor surgeries in below umbilicus, patients induced with Sevoflurane were more agitated. In our study we found that though hemodynamic stability is more with sevoflurane compared to Propofol. Also we can infer from this study that sevoflurane is a better alternative for induction agent in pediatric population.

The above mentioned study has been conducted using LMA and further studies can be conducted using I-gel.

Chhabra A et al.¹¹ in their study for use of I-gel for day care diagnostic laproscopic gynecological surgery to compare two regimens of IV Propofol with Dexmedetomidine or Butorphanol concluded that use of propofol with Dexmedetomidine provided better conditions for I gel insertion. This studies implies that Propofol when used in adjunction with opioids or alpha 2 agonists provides better conditions for insertion of supraglottic devices.

In our study we also studied the awakening after anaesthesia in both groups and found that sevoflurane provided better recovery in terms of early awakening, without complains of PONV and stable haemodynamics. Patients also were comfortable in terms of no dizziness and were fully awake at the time of discharge. Thus I-gel insertion with sevoflurane induction seems to be a very good regimen for day care surgeries and fits well into ERAS protocol.¹²

There are certain limitations to our study, such as ASA III and IV were not included in the study. Also only one size i-gel was considered in all patients. Smaller sizes can be tried and used in patients with limitations in mouth opening. The data should also be confronted in pediatric population with studies having a larger sample size.

5. Conclusion

Insertion of I-gel is much easier when Propofol is used as induction agent but at the cost of hemodynamic instability. Sevoflurane provides comparable conditions while maintaining hemodynamics. Sevoflurane is a good alternative as induction agent for i-gel insertion in cases where cardiovascular stability needs to be maintained.

Patients who are susceptible to hypotension and bradycardia caused by propofol induction adequate preloading with crystalloids can increase the margin of safety and propofol can be safely used as inducing agent while maintaining hemodynamics.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

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