ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Comparison between sevoflurane and propofol induction in I-gel insertion in pediatric patients undergoing inguinal herniotomy

Harshita Singh[1], Harpreet Kaur[2], Shirin Parveen[3], Narendra Singh Bafila[4], Kirtika Yadav[5], Anam Rizwan[6], Dhruvraj Singh[7]

[1,6,7]Postgraduate Resident, [2,4]Assistant Professor, [3]Associate Professor, Department of Anaesthesiology, Era's Lucknow Medical College and Hospital, [5]Assistant Professor, Department of Anaesthesiology, King Georges Medical University, Lucknow, Uttar Pradesh, India

Submission: 07-11-2024 Revision: 30-12-2024 Publication: 01-02-2025

ABSTRACT

Background: Supraglottic airway devices are crucial in pediatric anesthesia for their ease of use, reduced trauma, and minimal hemodynamic disturbance. The I-gel device offers a secure airway seal without the need for an inflatable cuff, making it ideal for pediatric patients by minimizing airway trauma and postoperative sore throat. **Aims and Objectives:** The study was conducted to compare the induction characteristics of Propofol and Sevoflurane for I-gel insertion in pediatric patients. The primary objectives were to assess the ease of induction and hemodynamic changes. The secondary objective was to note complications such as laryngospasm, coughing, biting, and gagging with Sevoflurane and Propofol induction. **Materials and Methods:** The prospective observational study included 66 children aged 6 months–8 years with American society of anesthesiologists physical status I and II, scheduled for elective herniotomy. Participants were randomly divided into two groups. Group 1 was induced with Sevoflurane (4–6%), while Group 2 received intravenous Propofol (2.5 mg/kg). Induction ease, hemodynamic changes, and complications were assessed. **Results:** Demographic characteristics, such as age and sex, were comparable across both groups. Mean times to loss of eyelash reflex, jaw relaxation, and I-gel insertion were significantly shorter in Group 2 (Propofol) than in Group 1 (Sevoflurane) ($P<0.001$). Heart rate showed no significant differences between the groups ($P>0.05$). Mean arterial pressure was significantly lower in Group 2 at 5- and 10-min post-induction. The first attempt success rate was higher in Group 2, though not statistically significant ($P=0.073$). Group 1 exhibited a higher incidence of laryngospasm ($P=0.010$). **Conclusion:** Propofol demonstrates superior induction characteristics for I-gel insertion in pediatric patients, offering shorter induction times and fewer complications compared to Sevoflurane. Future research could explore the long-term outcomes and broader applications of these findings in diverse pediatric populations.

Key words: I-gel; Propofol; Sevoflurane; Inguinal herniotomy; Induction characteristics; Hemodynamic changes

Access this article online

Website: https://ajmsjournal.info/index.php/AJMS/index

DOI: 10.71152/ajms.v16i2.4296

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

Supraglottic airway devices (SADs) are particularly advantageous in pediatric anesthesia due to their ease of use, reduced trauma, and minimal hemodynamic disturbance compared to traditional intubation.[1] The I-gel perfectly fits the pharyngeal, laryngeal, and perilaryngeal structures without an inflatable cuff.[2] This device is suitable for the pediatric population as it provides a secure airway seal with minimal invasion, thus decreasing the risk of airway trauma and post-operative sore throat.[3] The I-gel also offers easy insertion, which is beneficial for quick and

Address for Correspondence:
Dr. Harpreet Kaur, Assistant Professor, Department of Anaesthesiology, Era's Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, India. **Mobile:** +91-9876323555. **E-mail:** harpreetk555.gill@gmail.com

efficient airway management in emergency and surgical settings.[4] Propofol, an intravenous anesthetic agent, is commonly used to facilitate the insertion of SADs due to its rapid onset and smooth induction characteristics.[5] Propofol ensures excellent jaw relaxation and suppression of airway reflexes, creating optimal conditions for I-gel insertion.[6] Sevoflurane, an inhalational anesthetic, is gaining popularity for SAD insertion due to its rapid and smooth induction with minimal airway irritation and favorable pharmacokinetic profile.[7]

Studies conducted at different age groups have shown that while propofol offers faster induction times and better jaw relaxation, Sevoflurane provides more stable hemodynamics and reduces the incidence of apnea. Hence, the present study was carried out to compare the induction characteristics of Propofol and Sevoflurane for I-gel insertion in pediatric patients by assessing the ease of induction, hemodynamic changes, and complications. We hypothesize that both Sevoflurane and Propofol are comparable in induction characteristics and insertion of I gel. Our study aims to compare the induction characteristics of Propofol and Sevoflurane for I-gel insertion in pediatric patients. The primary objectives are to assess the ease of induction (by observing jaw relaxation and the number of attempts for I-gel insertion) and hemodynamic changes with the insertion of I-gel under Sevoflurane and Propofol induction, respectively. The secondary objective is to note complications such as laryngospasm, coughing, biting, and gagging with Sevoflurane and Propofol induction.

Aims and objectives

The study was conducted to compare the induction characteristics of Propofol and Sevoflurane for I-gel insertion in pediatric patients. The primary objectives were to assess the ease of induction and hemodynamic changes. The secondary objective was to note complications such as laryngospasm, coughing, biting, and gagging with Sevoflurane and Propofol induction.

MATERIALS AND METHODS

The prospective observational study was carried out after approval from the institutional ethical committee with registration No. ELMC and H/R cell/2023/35. The sample size was calculated based on Mean arterial pressure (MAP) at 3 min.[8] Considering 95% confidence interval, the power of the study is 80%, and the final sample size calculation would be 66 (33 in each group). A total of 66 patients were included in the study. Patients were visited the evening before surgery, and their vitals were recorded. Written and informed consent was obtained from the parents for the study, and anesthesia for surgery was obtained.

Pediatric patients undergoing inguinal herniotomy were randomly divided into two groups: Group 1 (Sevoflurane group) and Group 2 (Propofol group). The patients were fasted for 6 h (solid) and 4 h (breast milk). Clear fluid was allowed until 2 h before taking the patient for anesthesia.

Inclusion criteria

Inclusion criteria were as follow; Children aged 6 months–8 years, with American society of anesthesiologists Physical status I and II, who were scheduled for elective herniotomy. Parents provided consent for inclusion in the study.

Exclusion criteria

Exclusion criteria were as follow: a history of allergy to the study drugs, upper respiratory infection in the preceding 2 weeks, syndromic children with facial deformities, and patients with difficult airways.

Patients were re-evaluated on the morning of surgery. Intravenous access was secured. Premedication was provided in the pre-operative ward by inj. Midazolam 0.05 mg/kg. Monitors for non-invasive blood pressure, electrocardiogram, and pulse oximeter were attached, and baseline vital parameters were recorded. Before induction, both groups received intravenous Lignocaine (1.5 mg/kg) followed by intravenous Fentanyl (2 mcg/kg).

Group 1 patients were induced by inhaling sevoflurane with a vaporizer dial setting between 4 and 6%, along with oxygen (100%) and Group 2 patients induced with propofol 2.5 mg/kg intravenously. The starting time of induction was considered the point at which intravenous propofol and inhaled sevoflurane were started. In both techniques, the desired endpoint for induction was the loss of eyelash reflex. Jaw relaxation was assessed every 10 s. Hemodynamic changes and complications were noted at baseline, 5 min, and 10 min.

The statistical analysis was done using SPSS (Statistical Package for the Social Sciences) Version 21.0 Statistical Analysis Software. The values were represented in number (%) and Mean±standard deviation. The Chi-square test was used to compare the proportional difference between the two groups, and the mean values of the two groups were compared using the Student's "t" test. The level of significance was kept at $P<0.05$.

RESULTS

Demographic characteristics such as age and sex of participants in both groups are comparable (Table 1). The patient's age ranged from 6 months to 8 years. The mean age of patients was 5.44±2.73and 4.22±2.80 years, respectively, in Groups I and II of the study. Although the mean age of patients in group I was higher as compared

to that of group II; yet, this difference was not significant statistically (P=0.080).

Mean time to loss of eyelash reflex, jaw relaxation, and insertion of I-gel tube was 34.61±5.55, 98.15±7.91, and 161.30±6.84 s, respectively, in Group II as compared to 54.64±3.81, 123.06±2.68, and 182.85±2.93 s in Group I. For all three landmarks, the mean time taken was significantly lower in Group II as compared to that in Group I (P<0.001) (Table 2).

Statistically, there was no significant difference in heart rate between the two study groups at any of these time intervals (P>0.05) (Table 3).

Group II patients had significantly lower mean MAP values at 5-min and 10-min follow-up intervals than Group I patients (Table 4).

The first attempt success rate was 78.8% in group I compared to 93.9% in group II. In group I, as many as 7 (21.2%) patients required a second attempt compared to only 2 (6.1%) in Group 2. Statistically, there was no significant difference between the two groups in terms of the number of attempts (P=0.073) (Table 5).

All the patients had adequate jaw opening in both groups. Cough and laryngospasm were seen as adverse effects in 24.2% and 18.2% of Group I patients, respectively. In Group II, only cough was reported as an adverse effect in 42.4% of patients. Statistically, the incidence of laryngospasm was significantly higher in Group I than in Group II (P=0.010) (Table 6).

DISCUSSION

The present study included children aged 6 months–8 years with an overall mean age of <5 years. The two studies

Table 1: Comparison of age and sex profile of the study population

S. No.	Characteristic	Group I (n=33)		Group II (n=33)		Statistical significance	
1.	Mean age±standard deviation (Range) in years	5.44±2.73 (6 months–8 years)		4.22±2.80 (6 months–8 years)		t=1.777; P=0.080	
2.	Sex	No.	%	No.	%	χ^2	"P"
	Male	32	97.0	33	100	1.015	0.314
	Female	1	3.0	0	0		

Table 2: Comparison of time taken to achieve different landmarks in two study groups

S. No.	Characteristic	Group I (n=33)		Group II (n=33)		Statistical significance	
		Mean	SD	Mean	SD	"t"	"P"
1.	Loss of eyelash reflex (sec)	54.64	3.81	34.61	5.55	17.085	<0.001
2.	Jaw relaxation (s)	123.06	2.68	98.15	7.91	17.125	<0.001
3.	Insertion time (s)	182.85	2.93	161.30	6.84	16.636	<0.001

SD: Standard deviation

Table 3: Comparison of heart rate at baseline and different follow-up intervals in two study groups (bpm)

S. No.	Time interval	Group I (n=33)		Group II (n=33)		Statistical significance	
		Mean	SD	Mean	SD	"t"	"P"
1.	Baseline	101.48	12.08	107.48	15.61	−1.746	0.086
2.	3 min	102.12	13.87	103.48	14.74	−0.387	0.700
3.	5 min	106.82	12.63	101.85	14.59	1.479	0.144
4.	10 min	101.24	18.26	101.42	13.84	−0.046	0.964

SD: Standard deviation

Table 4: Comparison of mean arterial pressure at baseline and different follow-up intervals in two study groups (mmHg)

S. No.	Time interval	Group I (n = 33)		Group II (n = 33)		Statistical significance	
		Mean	SD	Mean	SD	"t"	"P"
1.	Baseline	67.31	6.99	66.07	9.43	0.589	0.558
2.	5 min	65.63	6.71	56.38	8.40	4.770	<0.001
3.	10 min	66.41	7.09	58.10	8.07	4.276	<0.001

SD: Standard deviation

Table 5: Comparison of the number of attempts for insertion of device between two study groups

S. No.	Number of attempts	Group 1 (n=33)		Group 2 (n=33)		Statistical significance	
		No.	%	No.	%	χ^2	"P"
1.	One	26	78.8	31	93.9	3.216	0.073
2.	Two	7	21.2	2	6.1		

Table 6: Comparison of insertion conditions and complications between two study groups

S. No.	Condition	Group 1 (n=33)		Group 2 (n=33)		Statistical significance	
		No.	%	No.	%	χ^2	"P"
1.	Adequate jaw opening	33	100	33	100	-	-
2.	Cough	8	24.2	14	42.4	2.455	0.117
3.	Biting	0	0	0	0	-	-
4.	Gagging	0	0	0	0	-	-
5.	Laryngospasm	6	18.2	0	0	6.600	0.010

that included pediatric patients included patients aged 3–12 years and 4–12 years.[9,10] As such, no study has compared the efficacy of Propofol with Sevoflurane for I-gel insertion in a population as young as 6 months.

In this study, the mean time for loss of eyelash reflex, jaw relaxation, and I-gel insertion time was significantly shorter in Propofol group as compared to the Sevoflurane group (P<0.001), which is similar to the results found by Moore et al.[11] Contrary to our study, Lopez Gil et al.,[12] found Sevoflurane better for induction time, but they use higher (7%) concentration of Sevoflurane as compare to our study.

Kale et al.,[13] also found induction time to be significantly lower in the Propofol group than in the Sevoflurane group but did not find a significant difference between the two groups for I-gel insertion time.

In two studies comparing insertion characteristics for laryngeal mask airway (LMA), Vora et al.,[9] found that Sevoflurane had a shorter insertion time (1.26±0.36 min) compared to Propofol (1.56±0.22 min). Conversely, Ravi et al.,[10] reported that Sevoflurane had a quicker induction time, but Propofol excelled in jaw relaxation and faster insertion.

Our findings for I-gel insertion show discrepancies with these LMA results. Sevoflurane's longer insertion time in our study could be attributed to factors like the younger age of our patients, anesthesiologist experience, mask handling technique, and the use of carrier gases like nitrous oxide during induction.

Our study aligns with adult studies showing Propofol's superiority over Sevoflurane in terms of induction and insertion time. The IV route for Propofol limits patient involvement, unlike Sevoflurane's inhalational route, which demands child cooperation and leads to longer insertion times.

The present study shows no statistically significant difference in heart rate between both groups at the observed time intervals. The MAP recorded in the Propofol group was significantly lower compared to the Sevoflurane group at 5-min and 10-min follow-up intervals, respectively (P<0.001). Similar results were obtained for MAP in studies conducted by Rajan et al.[14]

In the present study, the first attempt success rate was 78.8% in the Sevoflurane group as compared to 93.9% in the Propofol group, but this difference was not significant statistically. Compared to the present study, Vora et al.,[9] in their study reported the first attempt success rate to be higher in Sevoflurane (93%) as compared to that in the Propofol group (83%), while Ravi et al.,[10] found both the drugs to be comparable concerning first attempt success rate. Our study found a few practical difficulties in young children, such as acquainting them with the vital breath holding required for adequate Sevoflurane inhalation, which could have resulted in the need for multiple attempts and/or longer insertion times.

We observed a few complications, such as coughing and laryngospasm, on I-gel insertion in both study groups. The incidence of cough was higher in the Propofol group (42.4%) than in the Sevoflurane group (24.2%) but was not statistically significant. The incidence of laryngospasm was significantly higher in Sevoflurane (18.2%) as compared to that in the Propofol group (0%) (P<0.05). There was no incidence of biting and gagging in any of the groups. Similar to our finding, Moore et al.,[11] also found laryngospasm in the sevoflurane group in four patients.

A higher frequency of partial laryngospasm in Sevoflurane could be due to inadequate induction and depth of anaesthesia at the time of SAD insertion. A higher incidence of laryngospasm observed in the present study could be due to the younger age group of patients.

Limitations of the study

The study's limitations include a potentially small sample size, which may impact the generalizability of the findings. Being a single-center study limits its applicability to other settings and the variability in practitioners' skills, might have influenced results. Addressing these limitations in future studies would provide a more comprehensive understanding.

CONCLUSION

The present study's findings showed that Propofol, compared to Sevoflurane, is a more effective drug for I-gel insertion as it offers faster insertion, takes fewer attempts, and has fewer complications like laryngospasm. The only problem associated with Propofol was a transient drop in blood pressure. On the other hand, Sevoflurane was found to be feasible with a favorable hemodynamic profile. Nevertheless, the choice of induction agent for SAD insertion should depend on the patient profile, associated comorbidities, and anesthesiologist preference. Our study was the first study comparing Sevoflurane and Propofol for I-gel insertion in pediatric patients aged 6 months–8 years.

ACKNOWLEDGMENT

Nil.

REFERENCES

1. Saikia P. Use of supraglottic airway devices in paediatric patients in the Indian context - some we know, some we need to know and march ahead. Indian J Anaesth. 2018;62(4):249-253. https://doi.org/10.4103/ija.IJA_241_18
2. Pratheeba N, Ramya GS, Ranjan RV and Remadevi R. Comparison of I-gel™ and laryngeal mask airway Classic™ in terms of ease of insertion and hemodynamic response: A randomized observational study. Anesth Essays Res. 2016;10(3):521-525. https://doi.org/10.4103/0259-1162.180780
3. Jain RA, Parikh DA, Malde AD and Balasubramanium B. Current practice patterns of supraglottic airway device usage in paediatric patients amongst anaesthesiologists: A nationwide survey. Indian J Anaesth. 2018;62(4):269-279. https://doi.org/10.4103/ija.IJA_65_18
4. Jagannathan N, Ramsey MA, White MC and Sohn L. An update on newer pediatric supraglottic airways with recommendations for clinical use. Paediatr Anaesth. 2015;25(4):334-345. https://doi.org/10.1111/pan.12614
5. Ashay NA, Wasim S and Anil TB. Propofol requirement for insertion of I-gel versus laryngeal mask airway: A comparative dose finding study using Dixon's up-and-down method. J Anaesthesiol Clin Pharmacol. 2015;31(3):324-328. https://doi.org/10.4103/0970-9185.161666
6. Cho SA, Sung TY, Cho CK, Jee YS and Kang PS. Optimal propofol dosage for I-gel® insertion in healthy paralyzed patients. Korean J Anesthesiol. 2018;71(1):22-29. https://doi.org/10.4097/kjae.2018.71.1.22
7. Dave NM. Premedication and induction of anaesthesia in paediatric patients. Indian J Anaesth. 2019;63(9):713-720. https://doi.org/10.4103/ija.IJA_491_19
8. Chavan SG, Mandhyan S, Gujar SH and Shinde GP. Comparison of sevoflurane and propofol for laryngeal mask airway insertion and pressor response in patients undergoing gynecological procedures. J Anaesthesiol Clin Pharmacol. 2017;33(1):97-101. https://doi.org/10.4103/joacp.JOACP_313_15
9. Vora KS, Shah VR, Patel D, Modi MP and 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(2):77-83. https://doi.org/10.4038/sljch.v43i2.7004
10. Ravi S, Krishnamoorthy K and Ganesan I. Comparison of sevoflurane and propofol for laryngeal mask airway insertion in children. Indian J Clin Anaesth. 2015;2(3):137-140. https://doi.org/10.5958/2394-4994.2015.00015.3
11. Moore JK, Moore EW, Elliott RA, St Leger AS, Payne K and Kerr J. Propofol and halothane versus sevoflurane in paediatric day-case surgery: Induction and recovery characteristics. Br J Anaesth. 2003;90(4):461-466. https://doi.org/10.1093/bja/aeg098
12. Lopez Gil M, Brimacombe J and Clar B. Sevoflurane versus propofol for induction and maintenance of anaesthesia with the laryngeal mask airway in children. Pediatr Anesth. 1991;9(6):485-490. https://doi.org/10.1046/j.1460-9592.1999.00404.x
13. Kale J, Khondalay PP and Panse NA. Comparative evaluation of sevoflurane and propofol to facilitate insertion of supra glottic airway device. Indian J Clin Anaesth. 2021;8(4):521-526. https://doi.org/10.18231/j.ijca.2021.113
14. Rajan S, Gotluru P, Andrews S and Paul J. Evaluation of endotracheal intubating conditions without the use of muscle relaxants following induction with propofol and sevoflurane in pediatric cleft lip and palate surgeries. J Anaesthesiol Clin Pharmacol. 2014;30(3):360-365. https://doi.org/10.4103/0970-9185.137268

Authors' Contributions:
HS- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **HK-** Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **SP-** Design of study, statistical analysis and interpretation, manuscript preparation and editing; **NSB-** Review manuscript; **KY-** Review manuscript; **AR-** Literature survey and preparation of tables; **DS-** Coordination and manuscript revision.

Work attributed to:
Era's Lucknow Medical College and Hospital, Department of Anaesthesiology, Lucknow, Uttar Pradesh, India.

Orcid ID:
Harshita Singh - https://orcid.org/0009-0004-4761-4533
Harpreet Kaur - https://orcid.org/0000-0001-6865-747X
Shirin Parveen - https://orcid.org/0000-0002-4052-412X
Narendra Singh Bafila - https://orcid.org/0009-0003-6687-929X
Kirtika Yadav - https://orcid.org/0000-0001-6288-0099
Anam Rizwan - https://orcid.org/0009-0007-7647-0788
Dhruvraj Singh - https://orcid.org/0000-0001-5794-9119

Source of Support: Nil, **Conflicts of Interest:** None declared.