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Original study

Comparison of Clinical Efficacy of Ambu AuraGain and Laryngeal Mask Airway Proseal Inflated to 40 cmH_2O with I-Gel for Ventilation in Paediatric Patients Undergoing Elective Surgery Under General Anaesthesia

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Abstract

Background: The intracuff pressure of supraglottic devices in children should be maintained at 40 cmH2O. We compared the oropharyngeal leak pressures (OLP) of the LMA Proseal, AAG, and I-gel.

Research design and Methods: After obtaining IRB approval, 120 children (aged 1–10 years) were randomly divided into three groups to undergo elective procedures under general anesthesia: Ambu AuraGain (Group A, N=40), I-gel (Group I, N=40), or LMA Proseal (Group P, N=40). We compared OLP post-device insertion at 5 and 30 min, insertion characteristics, and Brimacombe scores.

Results: The mean (SD) OLP was significantly higher with I-gel as compared to the AAG and LMA Proseal at 5 min [28.30(1.77) vs. 24.38(1.90) vs. 24.30(2.45); p<0.001] and 30 min post device insertion [28.98(1.27) vs. 24.77(1.83) vs. 24.30(2.45); p<0.001]. The median (IQR) time to achieve effective ventilation was significantly shorter in group-I [16s(15-16.25) vs. 18.5s(18-20) vs. 18s(17.75-19), respectively p<0.001]. The anatomical alignment of the device to the glottic opening was significantly better in groups A and P (p<0.001). First-attempt success, ease of device insertion, and gastric catheter insertion were similar in all patients.

Conclusion: All three devices provided effective ventilation in pediatric patients undergoing elective surgery under general anesthesia. The I-gel was better than the AAG and LMA Proseal in terms of higher OLP.
Trial registration: CTRI/2023/10/059077[Registered on: 25/10/2023].

Key words: **Airway Management, Anesthesia, Child, Glottis, Intubation, Intratracheal, Laryngeal Masks, General, Anesthetics, Drainage.**

Introduction

Supraglottic airway devices (SGDs) are well-established components of pediatric airway management[1,2]. Compared with endotracheal intubation, they reduce the incidence of common post-anesthetic complications[3,4].

The limitations of first-generation Laryngeal Mask Airways (LMA) led to the development of second-generation supraglottic airway devices, such as the LMA ProSeal (Teleflex Medical, Co. Westmeath, Ireland). These devices have a built-in gastric drainage channel to prevent gastric distention and an improved cuff that provides a better seal around the glottis and improves oropharyngeal seal pressure[5,6].

Reusable SGDs, such as LMA Proseal, can transmit infections due to the deposition of proteinaceous material, as disinfection methods do not eliminate protein deposits from their surfaces[7]. Newer single-use SGDs, such as I-gelTM and

The study was conducted at VMMC and Safdarjung Hospital, Delhi India.

Ambu AuraGainTM(AAG), are also available to enhance safety.

A device with a higher OLP can offer adequate ventilation at a higher peak airway pressure(PAP) and has a more significant margin of safety against aspiration. The I-gel (Intersurgical Inc., Berkshire, UK) has a noninflatable cuff that conforms to the shape of the glottis to provide a high oropharyngeal seal[8]. A preformed AAG has a soft cuff that seals effectively and delivers high oropharyngeal leak pressures (OLP)[9,10]. Cuff pressures are responsible for postoperative pharyngolaryngeal morbidity with SGDs, and nowadays, the intracuff pressures should be maintained at 40 cmH_20 instead of 60 cmH20.

However, it is unclear whether lower intracuff pressures affect the clinical efficacy of cuffed LMAs, such as AAG and LMA Proseal, in pediatric patients for controlled ventilation. In addition, there is a paucity of data comparing these devices maintained at a lower intracuff pressure of 40 cmH_2O with the cuffless I-gel. We hypothesized that the i-gel would provide better clinical efficacy for ventilation in terms of higher OLP than the AAG and LMA Proseal. Therefore, we compared the clinical effectiveness of I-gel for ventilation with that of AAG and LMA Proseal in pediatric patients undergoing elective surgery under general anesthesia with OLP as the primary objective. The secondary objectives included the number of attempts, time taken to achieve adequate ventilation, ease of insertion of the device and gastric catheter, and Brimacombe score.

Methods

Ethics

After obtaining institutional ethics committee approval and written informed consent from a guardian or parent, this randomized clinical trial was conducted in American Society of Anesthesiologists (ASA) Physical Status I and II children aged 1–10 years who underwent elective surgical procedures under general anesthesia with controlled ventilation. Patients with difficult airways, anticipated surgery times exceeding 4 h, and those at high risk of aspiration were excluded.

Sample size

Kumar et al., in a study, observed mean (SD) OLP in cmH_2O was higher in I-gel than in AAG and LMA Proseal [27.36 (5.72) vs. 23.56 (5.72) and 23.24 (4.35)], respectively[10]. Based on these values, the minimum required sample size with an 80% power of the study and 5% level of significance was 36 patients in each group. We included 40 patients in each group (total: 120 patients).

Patients

All patients were fasted according to ASA guidelines and received premedication with syrup triclofos 50 mg/kg orally two hours before surgery. A computer-generated random number table was used to allocate patients into three groups [AAG (Group A, n=40), I-gel (Group I, n=40), and LMA Proseal (Group P, n=40)]. An experienced anesthesiologist (at least 30 insertions with each device in children) opened a sealed envelope just before the start of anesthesia and secured the airway using the allocated devices.

Anesthesia Technique

The patients were taken to the operating theatre, where standard monitors for pulse oximetry (SpO_2), noninvasive blood pressure, and electrocardiography were attached to them. Before the induction of anesthesia, the basal heart rate, blood pressure (systolic, diastolic, and mean), and SpO_2 were noted.

Anesthesia was induced with the inhalation of sevoflurane up to 8% in oxygen and nitrous oxide (1:1), and an intravenous (i.v.) line was established. If i.v. The line was already in situ before induction, and intravenous (i.v.) Propofol (2 mg/kg) was titrated to loss of verbal contact and i.v. Fentanyl 2µg/kg was administered. Thereafter, neuromuscular blockade was achieved with intravenous vecuronium bromide (0.1 mg/kg). Intermittent positive pressure ventilation with a bag and mask was performed for 3 min to allow complete jaw relaxation, and then the appropriate SGD was inserted according to group allocation.
A lubricated SGD was inserted according to group allocation, with the patient's head and neck in a sniffing position. The device size was selected according to the patient's weight, according to the manufacturer's recommendations. The cuff of the device was inflated to 40 cm H_2O and kept at the same level throughout the anesthesia. OLP was measured at baseline and then checked every 30 min.

Insertion of SGD

The I-gel was held firmly along the integral bite block and positioned such that the cuff outlet faced the patient's chin. The device was gently glided downwards with a continuous but gentle push until definite resistance was felt.

The cuff of the AAG was fully deflated and held with three fingers placed on the flat part and the thumb on the vertical line of the bite absorption area, which was oriented anteriorly toward

the patient's nose. The tip of the cuff was then inserted, pressed upward against the hard palate, and advanced into the hypopharynx in a smooth circular motion, pressing the contours of the soft and hard palates until definite resistance was felt. The cuff of the device was inflated to an intracuff pressure of 40 cmH_2O.

In group P, a lubricated LMA ProSeal was inserted using the introducer method. After placing the LMA Proseal, the introducer was removed, and the cuff was inflated to 40 cmH_2O.

The airway tube of the SGD was connected to a closed circuit after confirming the correct placement. Adequate ventilation was considered present if there was bilateral chest expansion, square waveform tracing on the capnograph, no audible significant leak during gentle manual ventilation, and lack of gastric insufflation. The ease and duration of device insertion were also noted. Any airway manipulation while inserting the device, such as jaw thrust, head and neck flexion or extension, chin lift, pushing in or pulling out the device, and changes in size needed to achieve adequate ventilation, were noted.

After ensuring adequate ventilation, a lubricated gastric catheter of the recommended size was passed through the drain tube, and its placement was confirmed by auscultation of the epigastrium. The device was secured to the cheek using tape.

Outcome Measures

If the device could not be inserted, there was ineffective ventilation, or the gastric catheter could not be passed into the stomach, it was removed and considered a failed attempt.

Three failed attempts at insertion were considered failures. In the event of failure, a laryngoscope with an appropriately sized cuffed endotracheal tube was used to secure the airways.

If SpO_2 fell to <95% during device insertion, the attempt was terminated, and the patient was mask-ventilated with 100% oxygen. The lowest SpO_2 values attained during device insertion were recorded.

OLP was determined by closing the adjustable pressure-limiting valve with a fresh gas flow of 3 L/min and observing the airway pressure at which equilibrium was attained (pressure not allowed to exceed 30 cm of water) in the aneroid manometer. A stethoscope beside the thyroid cartilage was used to auscultate audible leaks in the neck[11]. Any audible air leak in the mouth and the presence or absence of gastric inflation by epigastric auscultation were noted during the leak-pressure test.

OLP was measured 5 min after the insertion of all three devices. For the AAG and LMA Proseal groups, OLP was measured using a cuff pressure gauge (Covidien, Germany). The intracuff pressure was set at 40 cmH_2O for the AAG and LMA ProSeal, and the OLP was measured for all three devices. The intracuff pressures of the AAG and LMA Proseal were adjusted to 40 cmH_2O throughout anesthesia, and the OLP was checked every 30 min.

A flexible fiberoptic bronchoscope with an attached camera was introduced into the airway tube, and its tip was positioned 1 cm proximal to the end of the airway tube to view the device placement in the larynx. The views obtained on the monitor screen were then scored.

The patient was ventilated using a volume-controlled mode of ventilation at a tidal volume of 8 ml/kg body weight and a respiratory rate of 16-20/minute using a closed-circle breathing system while maintaining an $EtCO_2$ of 30–35 mmHg. Anesthesia was maintained with isoflurane (one minimum alveolar concentration) in a mixture of 33% oxygen and 67% nitrous oxide.

Ventilatory parameters, such as inspiratory tidal volume (ITV), expiratory tidal volume (ETV), $EtCO_2$, and peak airway pressure, were noted at 1, 5, 15, and 30 min after connecting the patient to the ventilator at post-device insertion at a cuff pressure of 40 cm H_2O. The leakage percentage (ITV-ETV/ITV multiplied by 100) and the difference between the OLP and peak airway pressure were calculated 5 and 30 min after device insertion.

Hemodynamic parameters and SpO_2 were recorded before and at 1, 3, 5, 15, and 30 min after device insertion and were monitored throughout the surgery. At the end of the surgery, 100% oxygen was administered to all patients, and the residual neuromuscular blockade was reversed with intravenous administration. Neostigmine (0.05 mg/kg and glycopyrrolate 0.01 mg/kg. The gastric catheter was removed after suction, and blood staining on the device was noted.

We recorded the number of attempts at device insertion, first-attempt success rate, overall success rate of insertion, time to achieve adequate ventilation (holding the supraglottic device at the teeth to obtain the first square wave capnographic tracing), and need for manipulation to achieve adequate ventilation (jaw thrust while inserting the device, head and neck flexion or extension, chin lift, pushing or pulling out of the device, and change in size of the device). The ease of insertion of the device was subjectively graded by the anesthesiologist who inserted the device. (1) Easy insertion, successful on the first attempt without any tactile resistance; 2-slightly difficult insertion, successful on the first attempt with tactile resistance; (3) difficult insertion, successful on the second attempt; (4) very

difficult, successful on the third attempt; and (5) impossible insertion, failed on the third attempt. The ease of gastric catheter insertion in patients with successful insertion of the device was graded subjectively by the anesthesiologist inserting it as 'easy'(score-1) if inserted on the first attempt and 'complex' (score-2) if inserted on the second attempt. Anatomical alignment of the SGD with the glottic opening was observed using a flexible fiberoptic bronchoscope on a screen. The grade was assigned by an anesthesiologist blinded to the device inserted using the following criteria by Brimacombe et al. (4: full view of the vocal cords; 3: part of the vocal cords and posterior surface of the epiglottis seen; 2: part of the vocal cords and anterior surface of the epiglottis seen; and 1: vocal cords not visible)[12].

The leak percentage (percentage loss of inspiratory tidal volume) was calculated at 5 and 30 min after device insertion. A loss of <20% of the inspiratory tidal volume was considered an acceptable leak. Intraoperative and postoperative adverse events, such as desaturation (SpO_2< 95%), aspiration or regurgitation (gastric fluid in the airway port or hypopharynx), bronchospasm, laryngospasm, airway obstruction, and the type of airway manipulation required to maintain a patent airway, were recorded.

We recorded any intraoperative device failure (failure to maintain adequate ventilation even with airway manipulation, need for device replacement), visible trauma to the lip, tongue, teeth, and oral tissues, and any staining of the device with blood.

Postoperative pharyngolaryngeal morbidity (sore throat, dysphagia, and hoarseness of voice) was evaluated by a blinded observer at 1 and 4 h.

Statistical analysis

The data were entered into an MS EXCEL spreadsheet and analyzed using the Statistical Package for Social Sciences (SPSS).

Categorical variables are presented as numbers and percentages (%), and continuous variables are presented as mean ± SD and median. The Kolmogorov-Smirnov test was used to test the normality of the data. If normality was rejected, non-parametric tests were performed. Quantitative variables were compared between the three groups using ANOVA/Kruskal-Wallis test (when the data sets were not normally distributed). Post-hoc test (Bonferroni correction) after ANOVA and post hoc analysis using Dunn's multiple pairwise comparison test after applying the Kruskal-Wallis test. Qualitative variables were compared using the chi-square or Fisher's exact tests. Statistical significance was set at $p < 0.05$.

Results

One hundred thirty-five pediatric patients undergoing elective surgery under general anesthesia were assessed for eligibility. Finally, 120 participants were included, as depicted in the CONSORT diagram (Figure 1).

The demographic parameters and duration of anesthesia were similar among the three groups. (Table I).

The mean (SD) OLP (cmH_2O) was significantly higher with i-gel at 5 min [28.30 (1.77) vs. 24.38 (1.90) vs. 24.30 (2.45) in group P, p<0.001] and 30 min [28.98 (1.27) vs. 24.77 (1.83) vs. 24.30 (2.45), p<0.001] than with AAG and LMA-Pro (Table II, Figure 2).

The mean (SD) change in OLP (cm H2O) measured at 30 min compared to that at 5 min of device insertion was significantly higher for the group I-gel [28.30 (1.77) vs. 28.98 (1.27), respectively; p=0.002]. However, the change in OLP was not statistically significant in Groups A and P (p=0.181 and p=0.156, respectively).

The median (IQR) time for achieving effective ventilation in patients in group I (I-gel) was significantly higher than that for AAG and LMA Proseal [16s (15-16.25) vs. 18.5s (18-20) vs. 18s (17.75-19), respectively, p<0.001]. There was no significant difference between the AAG and LMA seal groups (P =0.955) (Table II).

There were no significant differences among the three groups in terms of the number of insertion attempts, first-attempt success rate, overall success rate, and ease of insertion of the device and gastric tube (Table II).

The mean OLP-PAP at 5 and 30 min post-device insertion was significantly higher in Group I than in Groups A and P (14.57 ± 2.35 vs. 11.72 ± 2.47 vs. 10.47 ± 3.10, respectively; p<0.001). The leak percentage was not significantly different at any point, that is, at 5 min (p=0.897) and 30 min (p=0.135) for the three groups (Table II).

The anatomical alignment of the device to the glottic opening, as assessed by the Brimacombe Score, was significantly better in groups A and P than in group I (p<0.001). (Table II, Figure 3) Full glottic view (score 4) was seen in only 5% of cases of I-gel, 60% of cases with AAG, and 47.5% with Proseal LMA.

The lowest SpO_2 readings during device insertion and the intraoperative hemodynamic parameters were similar among all patients.

The devices were similar in terms of blood staining on removal, postoperative sore throat, hoarseness, and dysphagia at any time.

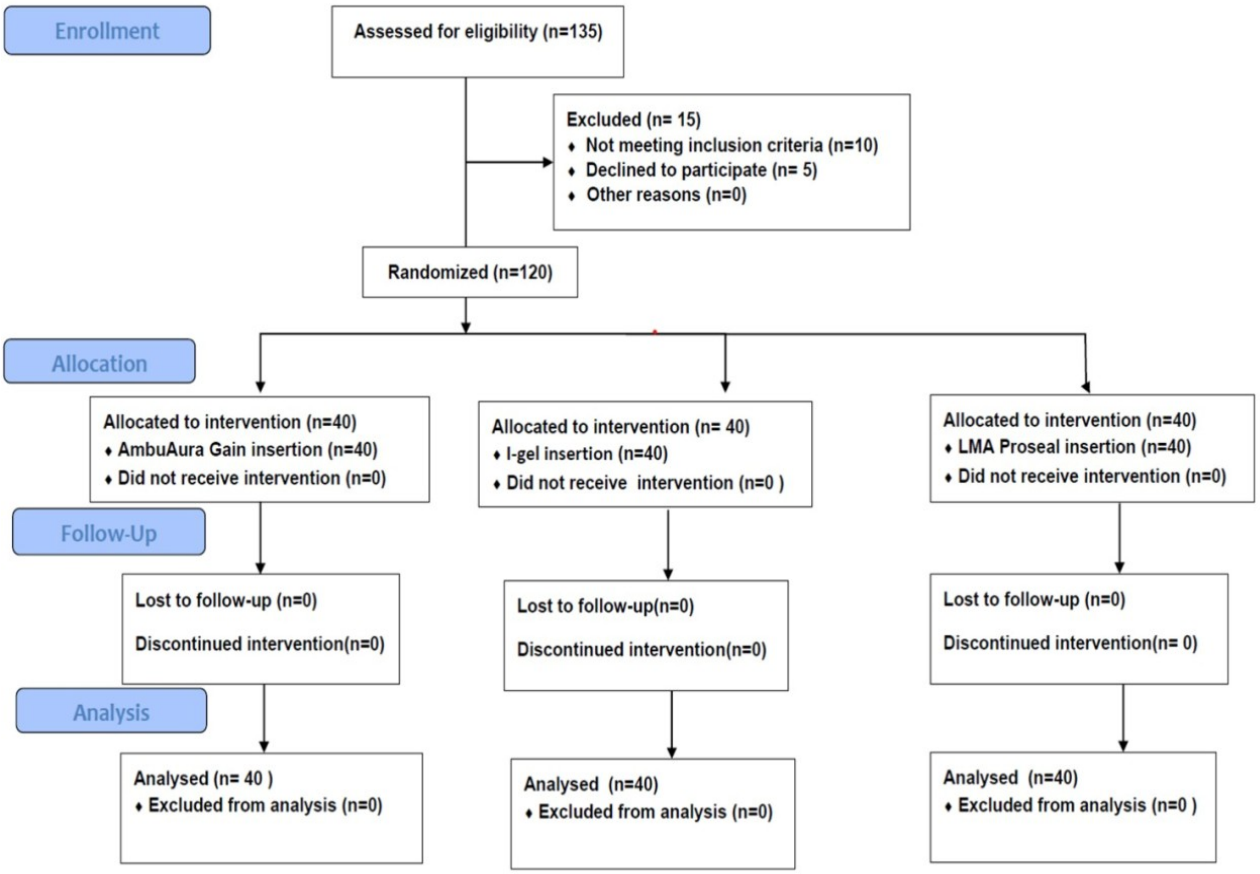

Fig. 1 — Consort Diagram.

Table I. — Demographic details; data is presented as mean (SD), number (%), or Median (IQR).

Variable	Group-I (n=40)	Group-A (n=40)	Group -P (n=40)
Age (Years)	6 (3)	4.5 (3)	5.5 (2.75)
Age Group, n(%) 1-5 years 6-10 years	 19 (47.5%) 21 (52.5%)	 26 (65.0%) 14 (35.0%)	 20 (50.0%) 20 (50.0%)
Gender M/F	34/6	34/6	38/2
ASA Grade I/II	40/0	40/0	40/0
Height (cm)	111.25(19.41)	103.58(16.02)	111.03 (21.21)
Weight (kg)	19.25(7.38)	16.95(5.54)	19.09 (6.72)
BMI (kg/m^2)	15.07(1.99)	15.43(1.68)	15.15 (1.93)
Duration of Anaesthesia (min)	64.75 (29.29)	77.38 (36.74)	86.75 (44.21)
Size of the device, n(%) 1.5 2 2.5	 9 (22.5%) 21 (52.5%) 10 (25.0%)	 4 (10.0%) 27 (67.5%) 9 (22.5%)	 5 (12.5%) 19 (47.5%) 16 (40.0%)

Discussion

In this randomized study, the I-gel exhibited a higher OLP than the AAG and LMA ProSeal in pediatric patients undergoing elective surgery under general anesthesia. The time required for successful device insertion was significantly shorter for the I-gel than for the LT.

AAG and LMA Proseal demonstrated better glottic alignment than I-gel. The first-attempt success rate of device insertion and ease of insertion were similar across the three groups.

The OLP measured at 5 and 30 min after device insertion was significantly higher in patients with I-gel than in those with AAG and LMA Proseal at an intracuff pressure of 40 cmH_2O at both time points ($p < 0.001$). A higher OLP indicates a better seal between the device and glottic structures, providing a more significant margin of safety against air leaks and aspiration during general anesthesia.

Table II. — Insertion characteristics [Mean (SD) or Median (IQR)].

Variable	Group-I (n=40)	Group-A (n=40)	Group -P (n=40)	p value
LMA Insertion Time, seconds	15.68 (1.59)	18.58 (1.26)	18.45 (1.38)	p<0.001 I vs A; p<0.001/ I vs P; p<0.001/ A vs P; p=0.955
Ease of Insertion score (1/2/3/4/5)	39/1/0/0/0	40/0/0/0/0	38/2/0/0/0	0.772
Jaw thrust (Y/N)	1/39	0/40	2/38	0.772
No. of attempts (1/2/3)	40/0/0	40/0/0	40/0/0	-
Ease of gastric catheter insertion (Easy / Difficult)	40/0	40/0	40/0	-
Anatomical alignment (1/2/3/4)	4/22/12/2	0/2/14/24	0/6/15/19	<0.001 I vs A; p=<0.001/ I vs P; p= <0.001/ A vs P; p= 0.300
OLP (cmH_2O)				
5 min	28.30 (1.77)	24.38 (1.90)	24.30 (2.45)	p<0.001; I vs A; p<0.001/ I vs P; p<0.001/ A vs P; p= 0.955
30 min	28.98 (1.27)	24.55 (1.83)	24.55 (2.44)	<0.001; I vs A; p<0.001/ I vs P; p<0.001/ A vs P; p= 0.857
PAP (cmH_2O)				
1 min	14.18(1.45)	14.2(1.98)	14.30 (2.20)	0.956
5 min	13.80(1.60)	13.62(1.61)	13.82(1.84)	0.768
15 min	13.53 (1.50)	13.475 (1.56)	13.60 (1.89)	0.959
30 min	13.78 (1.40)	13.7 (1.42)	13.70 (1.94)	0.696
OLP-PAP (cmH_2O)				
5 min	14.57 (2.35)	11.72 (2.47)	10.47 (3.10)	p<0.00/ I vs A; p<0.001/ I vs P; p<0.001/ A vs P; p=0.663
30min	15.2(1.91	10.85(2.15)	10.85(2.87)	p<0.001; I vs A; p<0.001; I vs P; p<0.001; A vs P; p= 1.0
Leak Percentage (cmH_2O)				
5 min	4.25(1.27)	4.40 (1.84)	4.72 (2.38)	0.897
30 min	2.26(1.54)	2.28 (1.72)	2.29 (1.88)	0.135
Expired TV (mL)				
1min	137.50 (54.9)	126.67 (42.9)	134.75 (51.4)	0.812
5 min	142.50 (54.8)	130.32 (42.3)	138.20 (51.3)	0.676
15 min	142.90 (54.9)	132.72 (42.3)	140.43 (51.5)	0.863
30 min	143.80 (54.9)	133.10 (42.5)	138.95 (49)	0.811
Staining of Device with Blood on removal (Y/N)	1/39	1/39	3/37	0.617
Sore Throat (Y/N)				
1 hour	2/38	0/40	0/40	0.328
4 hour	0/40	0/40	0/40	0.741
Dysphagia (Y/N)				
1 hour	0/40	0/40	0/40	
4 hour	0/40	0/40	0/40	--
Hoarseness (Y/N)				
1 hour	0/40	0/40	0/40	
4 hour	0/40	0/40	0/40	--

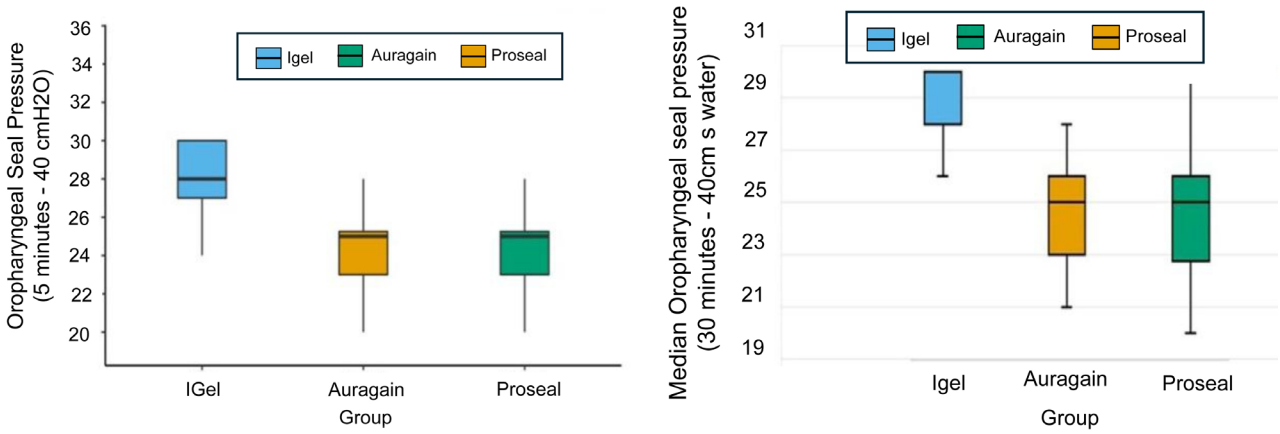

Fig. 2 — Comparison of oropharyngeal seal pressure at 5 min and 30 min after device insertion.

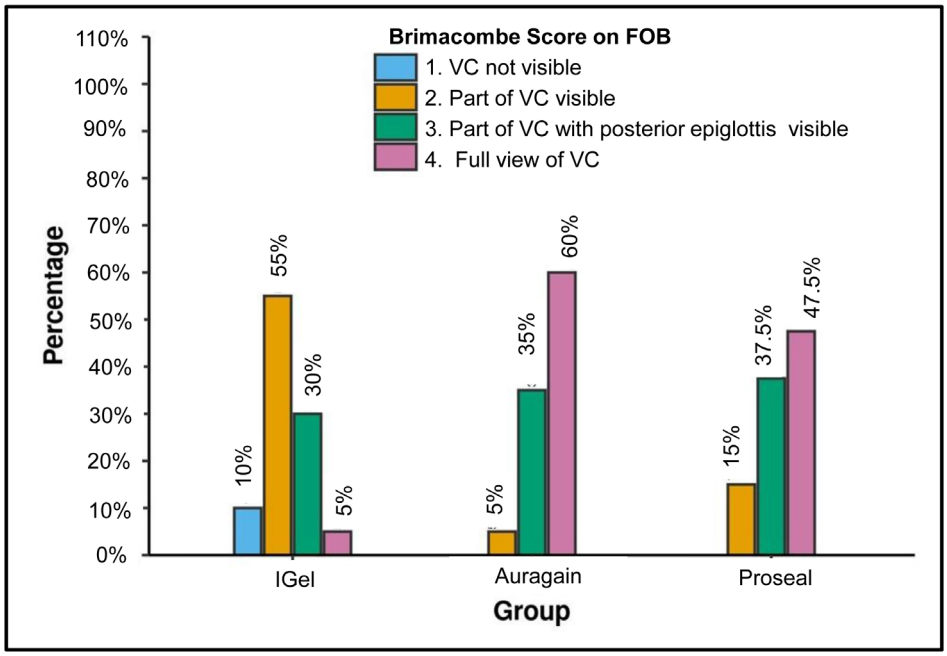

Fig. 3 — Comparison of anatomical alignment of the device to the glottic opening by the Brimacombe score between group I, group A, and group P.

This suggests that all three devices are suitable for routine controlled ventilation. However, the i-gel may be preferred when patients require ventilation with high peak airway pressures, such as during laparoscopic surgeries, in obese patients, or in the Trendelenburg position.

The higher OLP with the I-gel can be attributed to its gel-like soft cuff made of a thermoplastic elastomer. It warms to the body temperature and conforms to the shape of the peri-glottic and glottic structures, providing a more effective laryngeal seal over time. In contrast, both the AAG and LMA Proseal feature inflatable cuffs. As the intracuff pressure of AAG and LMA Proseal was maintained at 40 cmH_2O, no increase in OLP was observed over time in these devices. Kumar et al. Similarly, the OLP (cmH_2O) of the i-gel was significantly higher than that of both the AAG [27.3 (5.7) vs. 23.5 (5.7), p = 0.021] and LMA Proseal [27.4 (5.7) vs. 23.2 (4.3), p = 0.011] groups. However, the authors did not measure cuff pressure for the AAG and LMA ProSeal[10].

Our results are consistent with Mihara et al., Kim et al., and Venkatesan et al., who compared I-gel and AAG (with an intracuff pressure of 30-40 cmH_2O) in non-paralyzed children and found that the AAG had a significantly lower OLP compared to the I-gel[13-15]. Our findings were consistent with those reported by Nirupa et al., who compared the I-gel with LMA Proseal in children aged 2 to 6 years and showed that the OLP was significantly higher in the I-gel group (29.5 ± 2.5 cmH_2O vs. 26.1 ± 3.8 cmH_2O, p = 0.002)[16].

However, our findings contradict those of Shiveshi et al., who showed a comparable OLP with LMA Proseal and I-gel in children undergoing

controlled ventilation, probably because of a higher cuff pressure of 60 cmH_2O maintained with LMA Proseal and OLP measurement performed immediately after device insertion[17]. The OLP of the I-gel typically improves after a few minutes of reaching the body temperature. We measured OLP at 5 min post-device insertion and maintained the intracuff pressure of the LMA Proseal at a lower value of 40 cmH_2O, which might have contributed to the higher OLP observed with the I-gel than the LMA Proseal.

The time to achieve adequate ventilation (TTEV) was shortest with the i-gel, which is expected, considering that the other two devices are cuffed and would require some extra time for cuff inflation.

The three devices were comparable in terms of the overall success rate of insertion(100%), first-attempt success rate (100%), ease of insertion, and number of manipulations. These results are like those of the previous studies[10,14,15,18,19]. The preformed anatomical shapes of the I-gel, LMA Proseal loaded on the introducer tool, and AAG devices mimic the natural curvature of the oropharynx and help align it with the airway structures during insertion. These results are consistent with those of previous studies on the study devices.

The insertion of the gastric catheter was easy in all patients, similar to the results reported by Mihara et al[13]. However, Joshi et al. found gastric drain insertion to be significantly easier with AAG than with LMA Proseal ($p = 0.01$), probably because of the different operator experience and the use of higher intracuff pressures[20].

Brimacombe Score for anatomical alignment of the device to glottic opening was significantly better in AAG and LMA Proseal groups than in the I-gel group ($p<0.001$). This better alignment of the device with the glottic opening seen in the AAG can be attributed to the preformed anatomical curve of the AAG, which elevates the base of the tongue and enhances the laryngeal view by allowing the fiberoptic bronchoscope to approach the vocal cords at a more acute angle. Additionally, the I-gel was more frequently rotated relative to the pharyngeal structures, and downfolding of the epiglottis was more common, which may have resulted in an inferior fiberoptic view. Although a complete view of the larynx does not necessarily indicate better ventilation with SAD, a clear view of the glottic opening can help ensure proper alignment of the SAD with the larynx and improve intubation success[21]. Thus, AAG may be a better option than i-gel for facilitating endotracheal intubation in pediatric patients.

The mean (SD) of the difference between OLP and peak airway pressure was significantly higher with i-gel than with AAG and LMA Proseal [15.20 (1.91) vs. 12.12 (2.14) vs. 10.90 (2.96), respectively, $p <0.001$], making it superior to the other two devices in patients with decreased thoracic compliance.

No serious intraoperative or postoperative adverse events or trauma were observed in any of the groups. Mild blood staining of the SGD was observed in some patients, comparable in all groups, and similar to that reported previously with study devices[10,20]. Sore throat was observed in 2 (5%) patients in Group I. In contrast, it was not reported in any patient in the other two groups, and these results are consistent with previous studies[10,21]. The low incidence of sore throat with AAG and Proseal in our study could be due to the lower intracuff pressures.

This study has certain limitations. Blinding was impossible; therefore, observer bias could not be eliminated from the study. The sample size was calculated as the primary outcome of the study (OLP). Therefore, the study may have been underpowered for other endpoints, such as adverse effects. As the study was conducted in anesthetized and paralyzed pediatric patients with normal airways, the results may not apply to patients with difficult airways or those undergoing anesthesia with spontaneous breathing.

Conclusion

The i-gel, AAG, and LMA ProSeals provide an adequate airway for controlled ventilation in pediatric patients undergoing elective surgery under general anesthesia. I-gel is better than AAG and LMA Proseal in terms of higher OLP and can thus be preferred in patients with reduced thoracic compliance or in those who require ventilation at high peak airway pressures. The better fiberoptic view of the AAG and LMA Proseal makes them more favorable options than i-gel for use as conduits for endotracheal intubation.

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