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Original Article

A Comparative Evaluation of Proseal Laryngeal Mask Airway and I-Gel in Adult Patients Undergoing Elective Surgery Under General Anaesthesia: A Randomised Controlled Study

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ABSTRACT

Background: Supraglottic airway devices have become an integral part of modern anaesthesia practice, offering an effective alternative to endotracheal intubation for elective surgical procedures. Among second-generation devices, the ProSeal Laryngeal Mask Airway (P-LMA) and I-gel are widely used due to their improved airway seal and safety profile. **Objective:** The present study was undertaken to compare the clinical performance of the ProSeal LMA and I-gel in adult patients undergoing elective surgery under general anaesthesia. **Methods:**This prospective, randomised controlled study was conducted in the Department of Anaesthesiology at MMIMSR, MULLANA, AMBALA, India, in adult patients undergoing elective surgery (general, gynaecology and orthopaedic surgeries) under general anaesthesia. Eighty adult patients aged 18–60 years, belonging to ASA physical status I and II, were randomly allocated into two groups of forty each. Group P received ProSeal LMA and Group I received I-gel for airway management. Parameters evaluated included ease and duration of insertion, number of insertion attempts, oropharyngeal seal pressure, hemodynamic responses, and postoperative airway-related complications. **Results;** Airway insertion was faster and technically easier with the I-gel compared to the ProSeal LMA. A higher first-attempt success rate was achieved with the I-gel (95% vs 85%), and ease of insertion was significantly better, with more cases graded as easy insertions (36 vs 28; $p = 0.01$). The time required for successful insertion was significantly shorter in the I-gel group, with 60% of insertions completed within 15 seconds and a lower mean insertion time (14.3 ± 3.4 seconds) compared to the ProSeal LMA (24.6 ± 4.8 seconds; $p < 0.001$). In contrast, the ProSeal LMA demonstrated a significantly higher oropharyngeal seal pressure than the I-gel (30.8 ± 3.4 vs 27.4 ± 2.6 cm H_2O; $p = 0.002$). Hemodynamic parameters remained stable and comparable between both groups throughout the perioperative period. Postoperative airway-related complications were infrequent in both groups, with blood staining observed in 7.5% of patients using ProSeal LMA and 2.5% using I-gel, postoperative nausea and vomiting in 5% and 2.5% of patients respectively, and no cases of hoarseness of voice or laryngospasm reported. Intraoperative heart rate, systolic and diastolic blood pressure, and peripheral oxygen saturation remained comparable between **Group P** and **Group I** at all measured time intervals, with no statistically significant differences observed ($p > 0.05$). Both groups demonstrated stable hemodynamic profiles and adequate oxygenation throughout the intraoperative period.**Conclusion:** Both ProSeal LMA and I-gel are safe and effective supraglottic airway devices for elective surgeries under general anaesthesia. I-gel offers advantages in terms of faster and easier insertion, while ProSeal LMA provides superior airway sealing pressure. Device selection should be individualised based on clinical requirements.

Keywords*: ProSeal LMA, I gel, supraglottic airway device, general anaesthesia, oropharyngeal seal pressure.*

INTRODUCTION

Airway management remains a core responsibility of the anaesthesiologist, with the overarching aim of ensuring reliable oxygenation and ventilation while minimizing airway trauma and physiological stress. Although tracheal intubation is a definitive technique, it may be associated with sympathetic stimulation, airway manipulation, and postoperative pharyngolaryngeal morbidity—particularly in elective, short-duration surgeries where a less invasive airway can provide adequate ventilation. In this context, supraglottic airway devices (SGAs) have become an essential component of contemporary anaesthesia practice, functioning both as primary airway devices in selected patients and as rescue devices in airway difficulty scenarios. Current difficult-airway guidance highlights the importance of continuous oxygen delivery and recognizes the role of **second-generation SGAs** as rescue options because they are designed to improve sealing and reduce aspiration risk compared with earlier designs. **Difficult Airway Society (DAS) adult guidelines** specifically emphasize the use of second-generation SGAs in failed intubation pathways and capnograph confirmed ventilation as a safety standard. [1] Similarly, Indian national guidance (All India Difficult Airway Association) recommends limiting attempts and supports SGA insertion as part of structured airway algorithms to reduce harm during failed airway management. [2]

Second-generation SGAs were developed to address limitations of first-generation devices by incorporating design features that improve positive pressure ventilation and provide a gastric drainage channel to reduce gastric insufflation and potentially mitigate aspiration risk. Contemporary reviews describe this evolution as a shift toward devices that combine improved sealing characteristics with gastric access, enabling safer ventilation during controlled ventilation and selected laparoscopic procedures. [3–5] Educational and practice-focused guidance continues to reinforce that second-generation SGAs are generally preferred in scenarios where higher airway pressures may be required, such as laparoscopy, and where aspiration risk assessment remains central to device choice. [6]

Among second-generation SGAs, the **ProSeal™ laryngeal mask airway (PLMA)** and the **i-gel™** are widely used in routine elective anaesthesia. The PLMA utilizes an inflatable cuff and an integrated gastric drainage tube, supporting higher oropharyngeal leak (seal) pressures and facilitating gastric tube placement. In contrast, the i-gel features a non-inflatable, anatomically contoured cuff intended to simplify insertion and reduce cuff-related tissue compression. These design differences suggest clinically relevant trade-offs: the i-gel may offer faster, simpler placement, while the PLMA may deliver a higher seal pressure—important for controlled ventilation and procedures associated with increased airway pressure requirements.

Evidence from randomized studies supports this general pattern. A randomized trial comparing i-gel and PLMA in short surgical procedures demonstrated **easier insertion and shorter insertion time** with i-gel, while overall performance and hemodynamics remained comparable. [7] In adult elective surgery comparisons that included PLMA and i-gel among other devices, PLMA has been shown to achieve **higher airway sealing pressures**, whereas i-gel often demonstrates favourable insertion characteristics. [8,9] More recent clinical comparisons in laparoscopic settings also report that both devices are effective and safe, with i-gel sometimes associated with fewer postoperative adverse effects, again reflecting the practical balance between insertion simplicity and seal performance. [10]

At the evidence-synthesis level, a meta-analysis (2022) comparing i-gel and PLMA concluded that both devices can provide an adequate seal for ventilation, with i-gel showing advantages such as **shorter insertion time**, **higher first-insertion success**, and **fewer minor complications** (e.g., blood staining, sore throat) in many included trials. [11] In parallel, a network meta-analysis (2024) examining a wide range of SGAs also highlights that different devices rank differently across outcomes—reinforcing that "best" depends on the clinical priority (e.g., seal pressure vs ease of insertion vs postoperative symptoms). [4]

Despite the growing literature, comparative performance can vary with anaesthetic technique, neuromuscular blockade, operator experience, and procedure type. Therefore, direct head-to-head evaluation of PLMA and i-gel under standardized conditions remains clinically useful—particularly for adult elective surgery where controlled ventilation is common and device selection often hinges on insertion dynamics, seal adequacy, hemodynamic stability, and postoperative airway morbidity. The present randomized study was designed to compare the PLMA and i-gel in adult patients undergoing elective surgery under general anaesthesia, focusing on insertion characteristics, oropharyngeal seal pressure, hemodynamic response, and postoperative airway-related complications.

MATERIALS AND METHODS

Study Design

This prospective, randomised controlled study was conducted in the Department of Anaesthesiology, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, Ambala, over a period of one year from November 2024 to November 2025. Prior to commencement of the study, approval was obtained from the Institutional Ethics Committee. Written informed consent was secured from all participants after explaining the nature, purpose, and potential risks of the study in their native language. The study adhered to the principles outlined in the Declaration of Helsinki.

Sample Size and Randomisation

A total of 80 adult patients scheduled for elective surgical procedures under general anaesthesia were enrolled. Sample size was determined based on previous similar studies comparing supraglottic airway devices, assuming a power of 80% and a significance level of 5%. Patients were randomly allocated into two equal groups of 40 each using a computer-generated random number table. Allocation concealment was achieved using sealed opaque envelopes opened just before induction of anaesthesia.

- Group P (n = 40): Airway managed using ProSeal Laryngeal Mask Airway
- Group I (n = 40): Airway managed using I-gel supraglottic airway device

Inclusion Criteria

- Patients aged between 18 and 60 years
- American Society of Anaesthesiologists (ASA) physical status I or II
- Patients undergoing elective surgical procedures under general anaesthesia
- Procedures requiring a supraglottic airway device for airway management

Exclusion Criteria

- ASA physical status III or IV
- Anticipated difficult airway (Mallampati grade III or IV)
- Body mass index (BMI) greater than 30 kg/m²
- Emergency surgeries
- Head and neck surgeries
- Patients with increased risk of aspiration (e.g., gastro-oesophageal reflux disease, pregnancy, full stomach)

Pre-anaesthetic Assessment

All patients underwent a thorough pre-anaesthetic evaluation a day prior to surgery, which included detailed medical history, general physical examination, airway assessment (Mallampati grading, mouth opening, neck mobility), and relevant laboratory investigations. Patients were kept nil per oral for at least six hours prior to surgery.

Anaesthetic Technique

Upon arrival in the operating room, standard monitoring was instituted, including electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry (SpO2), and capnography. Baseline heart rate and blood pressure were recorded.

All patients were premedicated intravenously with glycopyrrolate 0.2 mg and fentanyl 2 µg/kg. Pre-oxygenation with 100% oxygen was performed for three minutes. Anaesthesia was induced using intravenous propofol 2 mg/kg. After confirming adequate depth of anaesthesia, succinylcholine 2 mg/kg was administered to facilitate airway insertion.

The allocated supraglottic airway device was inserted by an anaesthesiologist experienced with both devices, following manufacturer-recommended techniques. Device size selection was based on patient body weight. Correct placement was confirmed by bilateral chest expansion, auscultation, square-wave capnography, and absence of audible air leak.

Anaesthesia was maintained with a mixture of oxygen and nitrous oxide (50:50), sevoflurane, and atracurium for neuromuscular blockade. Patients were mechanically ventilated to maintain end-tidal CO2 between 35–40 mmHg.

Outcome Measures

Primary Outcomes

- Duration of insertion: Time from picking up the device to appearance of first effective capnographic waveform
- Number of insertion attempts: Maximum of three attempts allowed
- Ease of insertion: Graded as easy or difficult based on resistance during insertion and need for manipulation
- Oropharyngeal seal pressure: Measured by closing the adjustable pressure limiting (APL) valve at a fixed gas flow and noting the equilibrium airway pressure at which audible leak occurred

Secondary Outcomes

- Hemodynamic parameters: Heart rate and blood pressure recorded at baseline, during insertion, immediately after insertion, intraoperatively, at removal, and after removal
- Postoperative airway-related complications: Blood staining on device, sore throat, hoarseness of voice, laryngospasm, and postoperative nausea and vomiting assessed in the recovery room.

Removal of Device and Postoperative Assessment

At the end of surgery, neuromuscular blockade was reversed using neostigmine and glycopyrrolate. The supraglottic airway device was removed once the patient was awake and responding to verbal commands. The device was inspected for blood staining, and patients were monitored for airway-related complications during the postoperative period.

Statistical Analysis

Data were compiled and analysed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation and compared using the student's t-test. Categorical variables were expressed as frequencies and percentages and analysed using the Chi-square test or Fisher's exact test as appropriate. A p-value less than 0.05 was considered statistically significant.

RESULTS

Baseline demographic characteristics were analysed to ensure comparability between the two study groups. Parameters such as age distribution, sex, weight, height, and ASA physical status were assessed, as these factors can influence airway management and insertion characteristics [Table 1].

Table 1: Demographic Profile of the Study Participants

Parameter	Group A (n = 40)	Group B (n = 40)	*P* value
Age (years)	36.8 ± 10.1	35.2 ± 9.8	0.48
Male / Female	30 / 10	29 / 11	0.88
ASA physical status (I / II)	24 / 16	25 / 15	0.82
Type of surgery			
— Laparotomy	8 (20.0%)	10 (25.0%)	0.76
— Hernioplasty	10 (25.0%)	8 (20.0%)	0.82
— Hysterectomy / Fibroid removal / Ligation	12 (30.0%)	13 (32.5%)	0.83
— Orthopaedic surgery	10 (25.0%)	9 (22.5%)	0.91

Table 2: Comparison of Insertion Characteristics

Variable	ProSeal LMA	I-gel	P value
First attempt success	34 (85%)	38 (95%)	0.19
Second attempt	6 (15%)	2 (5%)	
Ease of insertion (Easy/Difficult)	28 / 12	36 / 4	0.01*
<15 seconds	6 (15%)	24 (60%)	0.004*
16–30 seconds	28 (70%)	14 (35%)	
>30 seconds	6 (15%)	2 (5%)	
Mean insertion time (sec)	24.6 ± 4.8	14.3 ± 3.4	<0.001*

Assessment of Insertion Characteristics

Ease of insertion was assessed using criteria commonly employed in recent studies comparing supraglottic airway devices.[12-14]**Easy insertion** was defined as successful placement on the first attempt without the need for additional airway manoeuvres and with an insertion time ≤30 seconds, along with immediate effective ventilation confirmed by chest expansion and capnography. Insertions requiring more than one attempt, additional manoeuvres, or taking longer than 30 seconds were classified as **difficult**. Insertion time was recorded from introduction of the device into the mouth until effective ventilation was achieved.

Oropharyngeal seal pressure was measured to evaluate the effectiveness of the airway seal provided by each supraglottic airway device during positive pressure ventilation [Table 3].

Table 3: Oropharyngeal Seal Pressure

Parameter	ProSeal LMA	I-gel	P value
Seal pressure (cm H_2O)	30.8 ± 3.4	27.4 ± 2.6	0.002*

The overall incidence of complications was low in both groups. Blood staining on the device and postoperative nausea and vomiting were slightly more frequent in the ProSeal LMA group, while sore throat was observed in only one patient in this group. No cases of hoarseness of voice or laryngospasm were reported in either group. The differences between the two groups were not statistically significant, indicating comparable postoperative safety profiles of both supraglottic airway devices [Fig a].

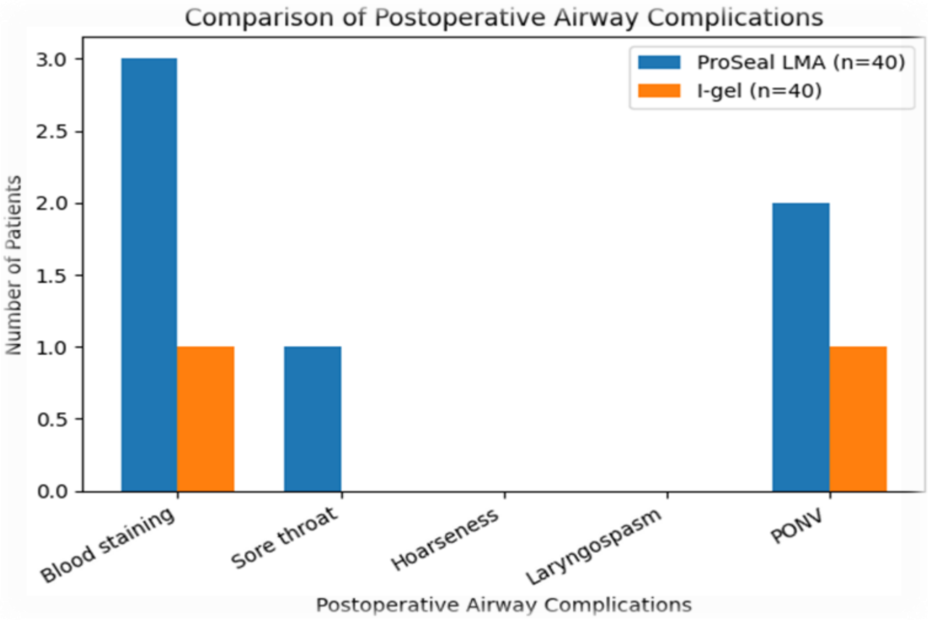

Figure a: Comparison of postoperative airway complications between ProSeal LMA and I-gel

Hemodynamic parameters (Figures 1–4)

Figures 1–4 depict the comparison of perioperative heart rate, systolic blood pressure, diastolic blood pressure, and peripheral oxygen saturation between Group P and Group I at predefined time intervals. Heart rate and blood pressure parameters showed mild perioperative fluctuations following airway insertion and during pneumoperitoneum; however, these changes were comparable between the two groups at all time points, with no statistically significant differences observed ($p > 0.05$).

Peripheral oxygen saturation remained stable and within normal physiological limits throughout the perioperative period in both groups, with no episodes of clinically significant desaturation. Overall, the analysis of Figures 1–4 demonstrates that both groups exhibited similar hemodynamic responses and oxygenation profiles during the study period.

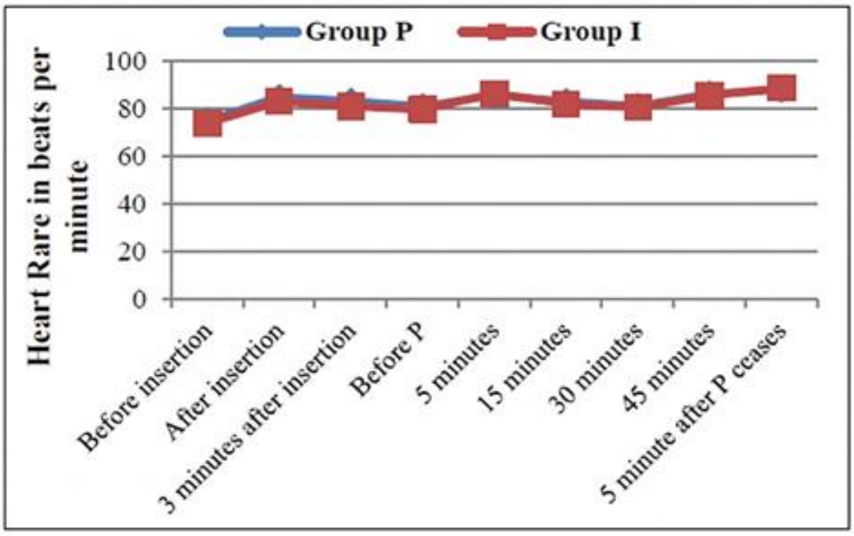

Figure 1: Comparison of HR between the group across the time period

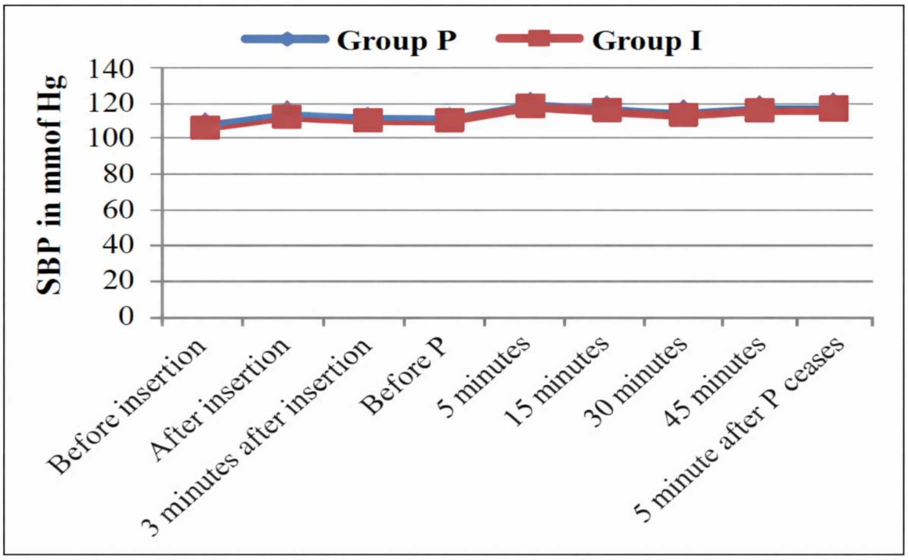

Figure 2: Comparison of SBP between the groupsacross the time periods.

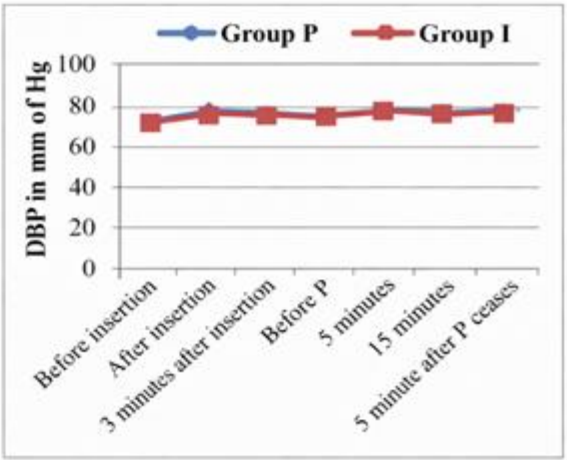

Figure 3: Comparison of DBP between the groups P and Group I across the time periods.

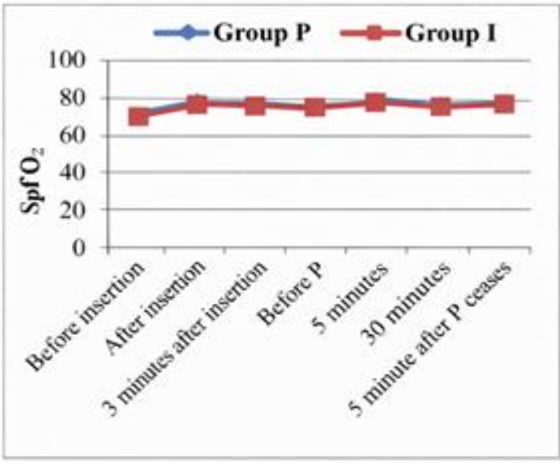

Figure 4: Comparison of SpO_2 berween the groups P and Group I across the time periods.

DISCUSSION

Supraglottic airway devices (SGAs) have undergone significant evolution since the introduction of the classic laryngeal mask airway. Although the ProSeal LMA, I-gel, and Supreme LMA have been evaluated previously, most studies have assessed these devices either individually or in pairwise comparisons, often using heterogeneous study designs, thereby limiting direct comparison. Baseline demographic characteristics in the present study were comparable between Group P and Group I with respect to age, sex distribution, and ASA physical status, which is consistent with findings from earlier randomized studies comparing ProSeal LMA and i-gel [15]. Although statistically significant differences were observed in weight and height between the two groups, similar baseline variations have been reported previously and are unlikely to have a clinically significant impact on supraglottic airway performance when other perioperative factors are comparable [16].

In the present study, first-attempt insertion success was higher with i-gel compared to ProSeal LMA (95% vs 85%), although this difference did not reach statistical significance. Singh et al. similarly reported high first-attempt success rates with second-generation supraglottic airway devices under controlled ventilation, supporting the reliability of these devices [15]. Comparable findings were also reported by Jadhav et al., who demonstrated first-attempt success rates of 96% with i-gel and 93% with ProSeal LMA [16].

Ease of insertion was significantly better with i-gel in the present study, with a greater proportion of insertions graded as easy compared to ProSeal LMA. This observation is consistent with earlier reports attributing the improved ease of insertion of i-gel to its non-inflatable cuff and anatomically contoured design [16]. Chauhan et al. also reported similar findings, highlighting the user-friendly nature of the i-gel device [17].

Insertion time was significantly shorter with i-gel in the present study (14.3 ± 3.4 seconds) compared to ProSeal LMA (24.6 ± 4.8 seconds). Similar observations were reported by Jadhav et al. and Chauhan et al., both of whom demonstrated significantly faster insertion with i-gel, reinforcing its advantage in situations requiring rapid airway establishment [16,17].

In contrast, ProSeal LMA demonstrated a significantly higher oropharyngeal seal pressure than i-gel in the present study (30.8 ± 3.4 cm H_2O vs 27.4 ± 2.6 cm H_2O). Singh et al. reported a similar trend, with ProSeal LMA achieving higher seal pressures than i-gel [15]. These findings are supported by a systematic review by Tan et al., which concluded that ProSeal LMA generally provides superior sealing pressures, although i-gel offers clinically acceptable seal pressures for controlled ventilation [18].

Intraoperative hemodynamic parameters and postoperative outcomes in the present study demonstrated comparable safety profiles between Group P and Group I. Heart rate, systolic blood pressure, diastolic blood pressure, and peripheral oxygen saturation remained stable and comparable between groups throughout the perioperative period, and the incidence of airway-related complications was low. Similar findings regarding hemodynamic stability, effective oxygenation, and low pharyngolaryngeal morbidity with second-generation supraglottic airway devices have been consistently reported in previous studies [15–19].

CONCLUSION

Both ProSeal LMA and i-gel are effective and safe supraglottic airway devices for airway management during general anesthesia. I-gel offers significantly faster and easier insertion with a higher first-attempt success rate, making it advantageous when rapid airway establishment is required. In contrast, ProSeal LMA provides a significantly higher oropharyngeal seal pressure, which may be beneficial in situations requiring higher airway pressures, such as controlled ventilation and laparoscopic procedures. Importantly, intraoperative hemodynamic parameters and oxygenation remained comparable between the two devices, and the incidence of postoperative complications was low and similar. Therefore, while neither device can be considered universally superior, the choice should be guided by specific clinical requirements, operator experience, and procedural demands.

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