Original Article

A Comparison of Haemodynamic Stress Response During Insertion of LMA Supreme Versus I–Gel in Patients Undergoing Short Surgeries under General Anaesthesia in a Tertiary Care Hospital in Telangana

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Abstract

Background: Supraglottic airway devices are preferred because of their ease of insertion and minimal hemodynamic alterations, and they are used for short surgical procedures under general anesthesia. The commonly used devices are second-generation devices such as LMA Supreme and I-Gel. The current study aimed to compare the hemodynamic stress response and performance of these two devices for elective surgeries under general anesthesia. **Material and Methods:** This study utilized a sample size of 100 cases undergoing elective surgical procedures under general anesthesia. They were allotted to two groups of n=50 each, randomly, Group A (LMA Supreme) and Group B (I-Gel). Hemodynamic parameters were assessed at various time intervals. Ease of insertion and the number of attempts of insertion were analyzed. The Oxygen saturation SpO_2) and end-tidal carbon dioxide ($EtCO_2$) were recorded. The occurrences of complications in both groups were recorded and compared by appropriate statistical analysis. **Results:** The distribution of cases was comparable, as found by non-significant differences in the demographic profile of the cases. The insertion time was shorter in Group B compared to Group A (21.68 ± 4.02 seconds vs 26.7 ± 7.59 seconds), and the p-values were found to be significant. The rate of success in first attempt insertion was higher in I-Gel (96%) compared to LMA Supreme (90%), although not reaching statistical significance. The comparison of hemodynamic responses was similar between the two groups. The postoperative complication rates in both groups were minimal and comparable. **Conclusion:** The study concluded that both LMA Supreme and I-Gel are safe supraglottic devices for short surgical procedures. The hemodynamic responses were similar in both, and the incidence of postoperative complications was similar. However, I-Gel has the advantage of shorter insertion time and ease of placement, hence it can be preferred whenever feasible.

Keywords: LMA Supreme I-Gel, Haemodynamic Stress Response, Supraglottic Airway Device, General Anaesthesia.

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Introduction

The essential aim of airway management during general anesthesia is to establish adequate oxygenation and ventilation and decrease physiological stress responses. To obtain these goals, endotracheal intubation is one of the gold standards. But due to the fact that it is associated with hemodynamic fluctuations, including tachycardia, hypertension, and arrhythmias due to sympathetic stimulation, laryngoscopy, and tracheal manipulation. Such responses can be detrimental in patients with comorbidities such as hypertension and ischemic heart disease or arrhythmias.[1] To overcome these shortfalls, supraglottic airway devices (SADs) have been used as an alternative for airway management in elective surgical procedures. Because the positioning of these devices is to be placed above the glottis, it does not require laryngoscopy.[2] Therefore, there is a need for less invasive means of securing a patient's airway for anesthesia, such as endotracheal intubation. Recently, their popularity has increased due to ease of insertion and decreased requirement of specialized expertise, and favorable safety profiles.[3] Contemporarily, the second-generation devises are used, such as the I-Gel and the Laryngeal Mask Airway Supreme. The I-gel is a single-use noninflatable supraglottic airway device that conforms to the anatomical contours of the pharynx and laryngeal structure, thereby providing a good seal without the need for cuff inflation.[4] Since it has an integrated gastric channel for decompression of the stomach, it has been found to have minimal insertion complications and a reduced

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incidence of postoperative sore throat. The LMA Supreme is also a second-generation single-use device made of polyvinyl chloride. It combines features of ProSeal and Fastrach LMAs.[5] This device is found to have an inflatable cuff and a curved rigid contour to facilitate ease of insertion and enhanced airway sealing. The presence of a separate gastric drainage tube is a safety profile reducing the risk of gastric insufflation and aspiration. Studies have shown that both the I-Gel and LMA Supreme are effective in providing adequate ventilation during general anesthesia.[6] Although few studies have shown that parameters such as oropharyngeal seal pressure, ease of insertion, time required for placement, and success on first attempted insertion and incidence of postoperative complications have varying results.[7,8] Although there is a paucity of data for hemodynamic responses during the insertion of these devices, especially in short-duration surgical procedures. Because the hemodynamic response to stress associated with airway placement is a critical factor during the intraoperative period and abrupt changes in heart rate, blood pressure, and deleterious effects in medically compromised patients, supraglottic devices are considered safe because of their ability to achieve atraumatic insertion and reduced airway stimulation, and cause lesser sympathetic activation as compared to other tracheal intubation devices. Moreover, the degree of hemodynamic alteration varies among the SADS depending on the design, material, and insertion technique. Based on this background, we in the present study aimed to determine the hemodynamic stress response during insertion of the LMA Supreme versus the I-Gel in patients undergoing short surgical procedures under general anaesthesia.

Materials and Methods

This prospective observational study was conducted in the Department of Anesthesiology, Osmania Medical College and Hospital, Hyderabad, Telangana. Institutional Ethical approval was obtained for the study. The duration of the study was from Oct 2023 to March 2025 (18 months). Written consent was obtained from all the participants after explaining the nature of the study in the vernacular language.

Inclusion criteria

1. Patients undergoing elective surgeries under general anesthesia for a duration of less than one hour.
2. Age group of 18-60 years
3. Males and Females
4. ASA Grade I and II
5. BMI 20-30kg/m2
6. Mallampati grade 1 & 2

Exclusion criteria

1. Expected airway difficulty due to reduced cervical spine mobility
2. History of chronic alcoholism
3. Obstructive sleep apnoea
4. Patients on antihypertensives (Beta blockers)
5. Pregnant females
6. Head and Neck Surgeries

Based on the above inclusion and exclusion criteria, a total of n=100 cases were included based on a convenience sampling method. Randomization was achieved by allotting patients with a computer-generated random number, and the cases were allotted equally (n=50) to Group A (LMA Supreme) and Group B (I-GEL). The examiner was not blinded to the type of treatment.

After selection of the case and allotment of the patients' demographic details, which included age, sex, and BMI, which was calculated using height and weight measurements. Each patient underwent a detailed clinical examination for expected airway estimation (Mallampati grade). The parameters to be evaluated were ease of insertion and the number of attempts for insertion. Hemodynamic stability was assessed by measurement of heart rate, blood pressure, EtCO2, and Oxygen Saturation. The postoperative assessment was for the presence of blood in the LMA after removal and postoperative sore throat.

For patients with Group A (LMA Supreme), the supraglottic device was inserted, and for Group B (I-GEL), it was used. Airway manoeuvres such as head extension, neck flexion, jaw thrust, or chin lift were used as required. The size of LMA Supreme was selected based on the manufacturer's recommendations (size 3 for < 50 kg, size 4 for 50 – 70/90 kg, and size 5 for >70/90 kg). The devices were pre-tested for leaks and lubricated with 2% lignocaine jelly prior to insertion. The standard protocol was followed, and the cuff was inflated for LMA Supreme using the manufacturer's recommended air volume. The detection of a leak was performed by auscultation over the neck and epigastrium, and when observed, EtCO2 was more than 45mmHg. If the leak was detected, then the device was removed and replaced with a different size. Those devices requiring more than 4 attempts were considered unsuccessful and were replaced by endotracheal intubation without muscle relaxants.

Successful insertion was confirmed by bilateral air entry in the lungs on auscultation. Visible thoracoabdominal movement, presence of square wave capnograph, and EtCO2 between 30 – 45 mmHg, and the SpO2 was ≥95%. For general anesthesia, Sevoflurane 1 MAC mixed with 33% O2 and 67% N2O was used for maintenance via a circle breathing system. The hemodynamic parameters (heart rate, SBP, DBP, MAP), SpO_2, and $EtCO_2$ were measured at 1, 2, and 3 minutes after the insertion of the SAD. An additional bolus of 20 mg propofol was given to achieve hemodynamic stability when the MAP or HR was more than 20% of the baseline. After the last skin suture, nitrous oxide and volatile anesthetics were turned off, and fresh gas flow was increased to 6L/min of 100% O2 at the end of surgery. The devices were removed once patients regained airway reflexes and consciousness with oral cavity suctioning. After a period of time following airway reflex return and full patient consciousness, SADs were removed by oral cavity suctioning.

Postoperative Complications Monitored by examining the presence of blood staining on the SAD upon removal, and patient-reported sore throat was assessed in the recovery room and again at 24 hours postoperatively.

Statistical analysis: All the available data were refined, segregated, and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 26 in Windows format. The continuous variables were represented as mean, standard deviation, frequency, and percentages. The categorical variable was calculated by the student's t-test for differences between the

means of two groups. Chi-square test was applied to determine differences between the two groups. The values of p (<0.05) were considered significant.

Results

[Table 1] presents the baseline demographic and anthropometric characteristics of the patients included in the study. Analysis of the table showed that the mean age for Group A (LMA Supreme) was 29.40 ± 6.91 years and for Group B (I-Gel) was 28.36 ± 7.30 years, which was not statistically significantly different (p = 0.46). Similarly, BMI values were comparable between the groups (25.56 ± 2.37 kg/m² vs 26.06 ± 2.33 kg/m²; p = 0.30). There were also no significant differences in gender distribution between the groups (p = 0.68), which further suggests good randomization of participants. Both groups had comparable demographics at baseline, which makes the comparison of haemodynamic response between the two supraglottic airway devices more valid.

Table 1: Baseline demographic and anthropometric characteristics

Parameter	Group A LMA supreme (n=50)	Group B I-Gel (n=50)	P value
Age (years)	29.40 ± 6.91	28.36 ± 7.30	0.46
BMI (kg/m2)	25.56 ± 2.37	26.06 ± 2.33	0.30
Gender			
Male	30 (60%)	28 (56%)	0.68
Female	20 (20%)	22 (44%)	

The difference in insertion characteristics between the two groups is given in Table 2. The insertion time for the airway device was significantly less in the I-Gel group than in the LMA Supreme group. The time needed to insert the I-Gel (Group B) was 21.68 ± 4.02 seconds, while that needed for the LMA Supreme (Group A) was 26.7 ± 7.59 seconds and was statistically significant (p < 0.001). This showed that I-Gel was easier to place to establish the airway, which would seem likely due to the fact that it does not need to be inflated with a cuff. In terms of ease of insertion, the success rate of the first attempt was 96% with I-Gel and 90% with LMA Supreme. The difference between the two was not statistically significant (p = 0.241), although the I-Gel was slightly more successful. Both devices achieved good insertion rates, and I-Gel had a tendency to ease the insertion.

Table 2: Comparison of insertion characteristics between the two groups

Parameter	Group A LMA supreme (n=50)	Group B I-Gel (n=50)	P value
Insertion time (seconds)	26.7 ± 7.59	21.68 ± 4.02	<0.001*
Number of Attempts			
1 Attempt (easy)	45 (90%)	48 (96%)	0.241
2 Attempts (difficult)	5 (10%)	2 (4%)	
*Significant			

[Table 3] showed the comparison of heart rate between the two groups during different time intervals during the study. The heart rates were similar in both groups at each time interval measured. At baseline, Group A had a mean heart rate of 71.86 ± 4.71 beats/minute compared to 72.56 ± 1.90 beats/minute in Group B (p = 0.33). After insertion, there was a slight decrease in the heart rate for both of them, but statistically, there was no difference at insertion, 1 minute, 2 minutes, and 3 minutes after the insertion (all p > 0.05). The results indicate that LMA Supreme and I-Gel can be used to ensure stable haemodynamics without significant sympathetic stimulation during insertion. No clinically significant tachycardia or adverse cardiovascular responses were seen with either device.

Table 3: Comparison of Heart Rate between the two groups at various intervals

Time Point	Group A (LMA Supreme)	Group B (I-Gel)	p-value
Baseline	71.86 ± 4.71	72.56 ± 1.90	0.33
Insertion	66.12 ± 1.78	67.36 ± 1.38	0.98
1 Minute	66.96 ± 1.95	65.96 ± 2.09	0.19
2 Minutes	67.02 ± 0.93	66.20 ± 1.82	0.16
3 Minutes	67.30 ± 2.20	66.22 ± 1.17	0.11

[Figure 1] shows the changes in the systolic blood pressure with time in both groups. There was a slight drop in SBP in both LMA Supreme and I-Gel groups immediately following insertion, and then a progressive rise towards the baseline level in the following few minutes. No clinically significant changes were noted in the pattern of the SBPs in either group. [Figure 2] shows that Diastolic blood pressure (DBP) increases after the placement of these supraglottic airway devices (SGA); changes in DBP over time are shown in [Figure 2]. Both groups had a small decrease in DBP immediately after insertion, which then slowly returned towards baseline levels. Compared between the two groups, there was little difference in the changes, suggesting that both LMA Supreme and I-Gel did not produce a significant haemodynamic stress response. These results validate the safety and haemodynamic stability of both devices when used for airway management in short-duration surgery.

[Table 4] depicts the Mean Arterial Pressure (MAP) between the two groups at different intervals. Analysis of the data showed that there was no difference in mean arterial pressure

between the two groups during the study. Baseline MAP was 79.72 ± 5.14 mmHg in Group A and 78.22 ± 4.24 mmHg in Group B (p = 0.62). After insertion, there was a slight decrease in MAP in both groups, which approached baseline values in 3 minutes or less. No differences between the groups were statistically significant for any time interval, however (all p>0.05). Both LMA Supreme and I-Gel showed good haemodynamic stability, as they did not cause substantial changes in arterial pressure during insertion and maintenance of anaesthesia in these observations.

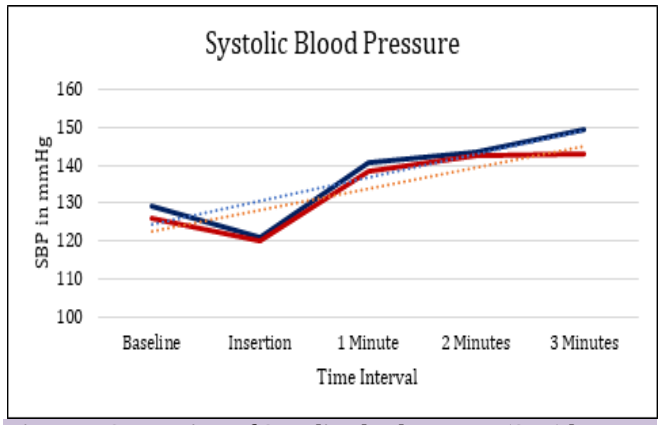

Figure 1: Comparison of Systolic Blood Pressure (SBP) between groups at various time intervals

[Table 5] shows a comparison of SpO_2 and $ETCO_2$ between the two groups. Analysis shows that the two groups had very good oxygen saturations during the study. Baseline SpO_2 values were similar between the groups (99.62 ± 0.75% vs 99.56 ± 0.64%; p = 0.67). Following insertion and throughout the intervals, there were no statistically significant differences in either group, with oxygen saturations close to 100%. Based on these results, it can be concluded that these two devices were effective for achieving oxygenation and maintaining an adequate patent airway during surgery. End-Tidal CO_2 ($ETCO_2$) During the study, there were no significant deviations from normal levels of $ETCO_2$ in either group. A statistically significant difference was not found between groups at baseline, insertion, or at follow-up (all p > 0.05). This shows that LMA Supreme and I-Gel had equal effectiveness in maintaining adequate ventilation and carbon dioxide elimination during the period of general anaesthesia.

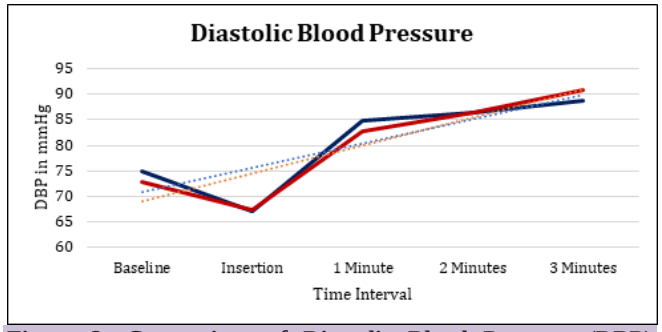

Figure 2: Comparison of Diastolic Blood Pressure (DBP) between groups at various time intervals

Table 4: Comparison of Mean Arterial Pressure (MAP) in mmHg between the two groups at various intervals

Time Point	Group A (LMA Supreme)	Group B (I-Gel)	p-value
Baseline	79.72 ± 5.14	78.22 ± 4.24	0.62
Insertion	73.42 ± 2.18	73.32 ± 2.02	0.99
1 Minute	75.02 ± 1.32	75.82 ± 1.13	0.91
2 Minutes	78.90 ± 2.01	80.36 ± 2.31	0.24
3 Minutes	79.98 ± 1.81	78.8 ± 2.11	0.85

Table 5: Comparison of Oxygen Saturation (SpO2) and End-Tidal CO2 (EtCO2) between two Groups

Parameter	Time Point	Group A (LMA Supreme)	Group B (I-Gel)	p-value
SpO2(%)	Baseline	99.62 ± 0.75	99.56 ± 0.64	0.67
	Insertion	98.90 ± 0.88	98.96 ± 0.88	1.00
	1 Minute	99.60 ± 0.61	100.00 ± 0.0	0.99
	2 Minutes	100.00 ± 0.0	100.00 ± 0.0	-
	3 Minutes	100.00 ± 0.0	100.00 ± 0.0	-
EtCO2 (mmHg)	Baseline	38.82 ± 0.98	36.82 ± 0.98	0.10
	Insertion	38.00 ±0.95	40.00 ± 0.95	0.21
	1 Minute	36.94 ±1.02	37.94 ± 1.02	0.19
	2 Minutes	37.02 ± 0.96	38.02 ± 0.96	0.87
	3 Minutes	38.20 ±1.17	38.22 ± 1.17	1.00
*Significant				

The postoperative complications of the two groups are compared in [Table 6]. The two groups had similar rates of postoperative complications (blood staining, sore throat) that occurred infrequently. There was no difference between the two groups with respect to the incidence of blood staining (6% in the LMA Supreme group vs. 4% in the I-Gel group; p = 0.65). Similarly, 10% of patients in both groups experienced postoperative sore throat (p = 1.00). Most of the patients were without any complications in both groups. The results imply that both types of airway devices are safe and well tolerated, with a low incidence of postoperative airway complications. The I-Gel provided slightly fewer cases of blood staining, but not a statistically significant difference.

Table 6: Comparison of postoperative complications between groups at various time points

Time Point	Group A (LMA Supreme) (n=50)	Group B (I-Gel) (n=50)	P-value
Blood staining			
Yes	3 (6.0%)	2 (4.0%)	0.65
No	47 (94.0%)	48 (96.0%)	
Sore throat			
Yes	5 (10.0%)	5 (10.0%)	1.00
No	45 (90.0%)	45 (90.0%)	

Discussion

The present study was done for the comparison of hemodynamic stress response during insertion of supraglottic airway devices in cases of elective surgical procedures of short duration. We randomized the cases into two groups for comparison: Group A receiving the LMA Supreme device and Group B receiving the I-Gel device. The assessment of demographic variables for the population and comparison of age, BMI, and gender is depicted in [Table 1]. The analysis of the table showed that there were no significant differences between groups, which highlights the homogenous distribution of cases for unbiased comparison. Similar randomization for comparison has been reported in other studies conducted in this field for assessment of supraglottic airway devices. [9,10] The current study found that the insertion time was lesser in Group B compared to Group A. This could be because I-Gel devices are made of elastomer compounds, which facilitate easy placement without the requirement for cuff inflation. Similar findings have been reported by Radhika et al,[11] where they observed that faster insertion was in the I-Gel compared to the LMA Supreme. In a similar study, Chauhan et al,[12] and Keijzer et al,[13] have also reported similar findings that the I-Gel is easier to place and requires less time because of its simplified design and reduced adjustments for placement. Another study by Singh et al,[14] has also reported similar findings for supraglottic airway devices. We found that the first attempt for placement was highly successful in the I-Gel group (96%) compared to the LMA Supreme group (90%), although the differences did not reach the level of significance. The findings highlight that both devices are reliable and easy to place in clinical practice. Studies by Liew et al,[10] and Kang et al,[15] were suggestive that both devices showed high first-pass insertion success rates, concluding that both are effective for airway management in short-duration surgical procedures. The I-Gel success was attributed to the anatomical contour and design, which helps in ease of insertion.

The assessment of hemodynamic variables in this study showed that the heart rate, systolic blood pressure, diastolic pressure, and mean arterial pressure were similar throughout the perioperative period. There was no statistically significant difference between the two groups at any time interval of the study. We found there was no incidence of tachycardia or hypertension in the cases in both groups following insertion, which showed minimal sympathetic stimulation. These findings are in concordance with the observations of Helmey et al,[16] who demonstrated that I-Gel insertions caused minimal alteration in hemodynamics as compared to conventional laryngeal masks. Jindal et al,[17] also reported that there was minimal alteration in hemodynamic responses with supraglottic airway devices for short-duration surgical procedures in general anesthesia. Interestingly, there was a slight decrease in hemodynamic parameters soon after insertion, which could be because of the effects of the induction agent propofol used in this study rather than the airway manipulation. Sharma et al,[18] concluded that both the devices with I-Gel and LMA Supreme are most suitable for patients where cardiovascular stability is required. The parameters of oxygen saturation remained close to 100% in the cases of this study [Table 5]. This shows that adequate ventilation was achieved by both devices. Chauhan et al,[12] and Verghese et al,[19] found that both I-Gel and LMA Supreme devices were able to achieve excellent airway sealing pressure, providing adequate ventilation as observed in the current study. The incidence of postoperative complications in our study is given in [Table 6]. The overall postoperative complications in this study remained minimal in both groups. Although there was a slightly higher incidence of blood staining in the I-Gel group, the differences were not statistically significant. The noninflatable cuff of the I-Gel device can produce some amount of mucosal trauma, although it is made of soft material. Similar findings have been reported by Keijzer et al,[13] and Gatward et al,[20] who reported a slightly higher incidence of airway complications such as blood staining and sore throat in the I-Gel group. The softer noninflatable cuff of I-Gel may contribute to reduced mucosal trauma and postoperative airway morbidity. Similar observations were reported by Keijzer et al. and Gatward et al., who found fewer airway-related complications with I-Gel. [13,20] The findings of this study highlight the fact that both devices are safe and effective for short-duration surgical procedures under general anesthesia. The limitations of the current study were due to a modest sample size, which was due to the duration of the study constraints, and not comparing the results based on the difficulty of intubation for the patients. The study was also conducted in a single center, which could lead to potential bias in patient selection. Therefore, all these facts must be kept in mind before generalizing the observations of the present study.

Conclusion

This study found that the supraglottic airway devices LMA Supreme and I-Gel were effective and safe for patients undergoing short surgical procedures under general anesthesia. The results showed that there were minimal alterations in hemodynamic stress responses in the two groups at the time of insertion and at different intervals following insertion. The devices were able to achieve the required physiological levels of oxygen saturation and ventilation, and the incidence of postoperative complications was minimal. A few advantages were shown by I-Gel because of its ease of insertion and successful first-attempt placement. Therefore, I-Gel may be a

more preferable supraglottic airway device for short-term surgeries under general anesthesia.

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Conflicts of interest
There are no conflicts of interest.

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