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## I-GEL vs Baska Mask for General Anesthesia in Laparoscopic Cholecystectomy - A Comparative Study

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### Abstract

Supraglottic airway devices (SGADs) are extensively utilised in modern anaesthesia due to their simple insertion, minimum invasiveness, and efficient airway management. The I-Gel and Baska Mask are second-generation supraglottic airway devices that have improved seal pressures and safety attributes, rendering them appropriate for laparoscopic procedures necessitating positive pressure ventilation. Laparoscopic cholecystectomy, marked by elevated airway pressures due to pneumoperitoneum, necessitates a reliable airway seal. Evaluating these devices enhances airway control strategies, hence improving surgical safety and patient outcomes. This study aimed to compare the clinical performance of the I-Gel versus the Baska Mask in patients undergoing laparoscopic cholecystectomy under general anesthesia. A prospective, randomized comparative study was conducted on 60 adult patients scheduled for elective laparoscopic cholecystectomy under general anesthesia. Patients were randomly divided into two groups: Group I (I-Gel, n=30) and Group B (Baska Mask, n=30). Key parameters such as ease of insertion, insertion time, oropharyngeal seal pressure (OSP), peak airway pressure, incidence of gastric insufflation, and postoperative complications (sore throat, cough, hoarseness) were evaluated. Results were analysed using SPSS 20.0 version. The Baska Mask demonstrated a significantly higher oropharyngeal seal pressure compared to the I-Gel ( $p < 0.001$ ), which was crucial for maintaining ventilation in high airway pressure procedures like laparoscopy. Insertion time was slightly longer for the Baska Mask, but not statistically significant ( $p > 0.05$ ). Both devices had comparable success rates for first-attempt insertions. The incidence of postoperative sore throat was slightly higher in the Baska group, though without statistical significance. No major complications were reported in either group. Both the I-Gel and Baska Mask are effective and safe SGADs for laparoscopic cholecystectomy. However, the Baska Mask provides a better oropharyngeal seal, making it more suitable for procedures involving elevated airway pressures. The choice of device should be guided by patient characteristics, surgical needs, and anesthesiologist experience.

## INTRODUCTION

Effective airway management is a crucial component of safe anaesthesia treatment, especially during procedures necessitating controlled ventilation under general anaesthesia. The advancement of supraglottic airway devices (SGADs) has dramatically revolutionised anaesthetic practice, offering an alternative to endotracheal intubation, particularly in elective and brief procedures<sup>[1]</sup>.

SGADs are minimally invasive, easier to insert, and linked to a reduced incidence of postoperative sequelae, including sore throat, laryngeal injury, and haemodynamic instability. They enhance patient comfort, expedite insertion times, and simplify management during anaesthesia induction and emergence<sup>[2,3]</sup>.

Among the diverse SGADs, the I-Gel and the Baska Mask have emerged as preeminent second-generation devices. The I-Gel is a commonly utilized, anatomically contoured apparatus composed of a pliable, gel-like thermoplastic elastomer. It eliminates the need for cuff inflating, hence streamlining its application and decreasing insertion duration<sup>[4]</sup>. The I-Gel offers an effective airway seal and features a stomach drainage channel that mitigates the risk of aspiration during anaesthesia. Owing to its user-friendliness and safety profile, it has become increasingly popular for various surgical operations, including laparoscopic surgeries. The Baska Mask, a recent addition to the SGAD family, has been designed to deliver superior oropharyngeal seal pressure compared to alternative devices. It incorporates a self-sealing membrane that autonomously adapts to variations in airway pressure, thereby improving ventilation efficiency and reducing air leaks. Moreover, it possesses an efficient suction apparatus to eliminate pharyngeal secretions and mitigate aspiration danger. These characteristics indicate a theoretical benefit of the Baska Mask in procedures such as laparoscopic cholecystectomy, which necessitate elevated airway pressures due to carbon dioxide pneumoperitoneum<sup>[6,7]</sup>.

Laparoscopic cholecystectomy is a frequently executed minimally invasive procedure that necessitates pneumoperitoneum and Trendelenburg positioning, both of which can increase intra-abdominal and airway pressures<sup>[8]</sup>. In these situations, the dependability of the airway device in preserving a successful seal is paramount. Historically, endotracheal intubation has been the favored method in these surgeries. Nonetheless, developments in SGAD design have generated increasing interest in employing these devices in procedures characterized by higher airway pressures, contingent upon their ability to provide a safe and effective seal<sup>[9]</sup>.

Despite the prevalent utilization of both the I-Gel and Baska Mask, there exists an absence of definitive

evidence directly contrasting their clinical efficacy in laparoscopic procedures, especially in cholecystectomy. Although previous research has assessed their general characteristics and uses, there is a paucity of evidence regarding their comparative efficacy concerning oropharyngeal seal pressure, ease of insertion, airway safety, and postoperative problems in high-pressure laparoscopic procedures.

This study seeks to address this gap by performing a comparative investigation of the I-Gel and Baska Mask in patients undergoing elective laparoscopic cholecystectomy with general anaesthesia. This study aims to elucidate which device demonstrates superior clinical utility in laparoscopic procedures by assessing key parameters including insertion time, seal pressure, ventilation quality, and postoperative morbidity, thereby aiding anesthesiologists in making evidence-based decisions regarding airway management.

### Aims and Objectives:

- To compare the clinical performance of the I-Gel and Baska Mask as supraglottic airway devices in patients undergoing elective laparoscopic cholecystectomy under general anaesthesia

## MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Anaesthesia, Sree Mookambika Institute of Medical Sciences, Kulasekharam, over a period of 6 months, involving patients undergoing elective laparoscopic cholecystectomy under general anaesthesia. A total of 60 adult patients were enrolled in the study.

### Inclusion Criteria:

- Patients aged 18-60 years
- ASA physical status I and II
- Scheduled for elective laparoscopic cholecystectomy
- Provided written informed consent

### Exclusion Criteria:

- Anticipated difficult airway
- BMI > 35 kg/m<sup>2</sup>
- History of gastroesophageal reflux disease (GERD)
- Pregnant or lactating women
- Patients with upper airway abnormalities or recent respiratory infections

Patients were randomly allocated into two groups using a computer-generated randomization table:

- **Group I (n = 30):** Airway secured using I-Gel
- **Group B (n = 30):** Airway secured using Baska Mask

All patients underwent pre-anaesthetic evaluation. Standard fasting guidelines were followed. In the

operating room, baseline vitals including heart rate, blood pressure, SpO<sub>2</sub>, and ECG were recorded.

On arrival in the operating room, patients were connected to standard monitoring including ECG, non-invasive blood pressure, pulse oximetry, and end-tidal carbon dioxide (EtCO<sub>2</sub>). An intravenous line was secured, and all patients were premedicated with fentanyl 2 µg/kg IV. General anesthesia was induced with propofol 1.5-2 mg/kg IV and atracurium 0.5 mg/kg IV. Device insertion was performed once full neuromuscular relaxation was achieved and the patient showed no response to verbal commands.

Both the Baska Mask and I-Gel devices were inspected for integrity and lubricated prior to insertion. The size of the device was selected based on the patient's weight according to manufacturer recommendations. Size 3 was used for patients weighing 30-50 kg, and size 4 for those between 50-70 kg. For insertion of the Baska Mask, patients were placed in the "sniffing" position. The device was advanced along the hard palate until resistance was felt, and the built-in tab was manipulated if necessary to navigate the palatopharyngeal curve. For the I-Gel, patients were positioned in the "sniffing morning air" position. The device was introduced along the hard palate and glided into place until resistance indicated correct placement. All insertions were carried out by a senior anesthesiologist who had prior experience of at least 25 insertions with each device.

The airway patency and adequacy of ventilation were confirmed by chest movement, EtCO<sub>2</sub> waveform, and oxygen saturation. Anesthesia was maintained with isoflurane (1%-2.5%) in a mixture of 40% oxygen and nitrous oxide. A clear airway was defined as EtCO<sub>2</sub> less than 50 mmHg, tidal volume more than 6 mL/kg, and SpO<sub>2</sub> greater than 95%.

The parameters assessed included ease of insertion (graded as easy, moderate, or difficult), number of attempts (with failure defined as unsuccessful insertion in three attempts), insertion time (defined as the time from picking up the lubricated device to the appearance of the first capnographic trace), and oropharyngeal leak pressure (OLP), which was measured after the loss of spontaneous respiration using a fixed fresh gas flow of 6 L/min with the APL valve closed to 70 cm H<sub>2</sub>O. Additional observations included peak airway pressure, leak fraction (calculated as inspired tidal volume minus expired tidal volume divided by inspired tidal volume, expressed as a percentage), and device stability during pneumoperitoneum.

Postoperative assessments included ease of removal of the device, trauma to teeth, lips, or tongue, blood staining of the device, ease of gastric tube placement, and sump clearance. Laryngopharyngeal morbidity including sore throat, dysphagia, and dysphonia was evaluated immediately at extubation

and again two hours postoperatively. Any intraoperative complications or manipulations needed to maintain effective ventilation were also recorded. At the end of surgery, residual neuromuscular blockade was reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg. Prophylaxis for postoperative nausea and vomiting was given with ondansetron 4 mg IV, and postoperative analgesia was managed with intravenous diclofenac 75 mg and paracetamol 15 mg/kg. The device was removed once the patient responded to verbal commands, resumed spontaneous breathing, and achieved adequate neuromuscular recovery. Devices were inspected post-removal for any deformation or damage.

All collected data were compiled and analyzed statistically. Continuous variables were expressed as mean ± standard deviation and compared using the Student's t-test. Categorical variables were analyzed using the Chi-square test or Fisher's exact test where appropriate. A p-value < 0.05 was considered statistically significant.

## RESULTS AND DISCUSSIONS

A total of 60 patients were included in the study, with 30 patients in each group (Group I: I-Gel, Group B: Baska Mask). Both groups were comparable in terms of demographic characteristics such as age, gender, body mass index (BMI), and ASA physical status. No statistically significant differences were observed in baseline characteristics (Table 1).

Device-related performance metrics were compared between the two groups. The mean insertion time was slightly longer in the Baska Mask group, although not statistically significant. The first attempt success rate was comparable between the two groups (Table 2).

The OLP was measured at two time points: immediately after insertion and 30 minutes post-insertion. The Baska Mask showed significantly higher leak pressures at both time intervals compared to the I-Gel. Importantly, the Baska Mask maintained a higher seal pressure, making it more effective for laparoscopic procedures involving pneumoperitoneum. There were no significant differences in peak airway pressure or ventilation adequacy (SpO<sub>2</sub> and EtCO<sub>2</sub> levels)(Table 3).

Postoperative complications were minimal in both groups. Mild sore throat was more commonly reported in the Baska group, though this was not statistically significant. Blood staining on device and minor trauma to the lips or tongue were observed in a few patients in each group, without significant difference (Table 4).

No major complications or airway-related emergencies were encountered in either group during the intraoperative period. All patients recovered uneventfully, and devices were removed without difficulty.

Table 1: Comparison of Demographic Characteristics between the groups

Parameter	I-Gel Group (n = 30)	Baska Mask Group (n = 30)	p-value
Age (years)	42.6 ± 10.4	43.2 ± 9.7	0.78
Gender (M/F)	14 / 16	15 / 15	0.80
BMI (kg/m <sup>2</sup> )	24.8 ± 2.6	25.1 ± 2.9	0.63
ASA I/II	18 / 12	17 / 13	0.79

Table 2: Comparison of Insertion Characteristics between the groups

Parameter	I-Gel Group (n = 30)	Baska Mask Group (n = 30)	p-value
Insertion time (sec)	18.4 ± 2.9	21.2 ± 3.1	0.06
First attempt success (%)	28 (93.3%)	27 (90.0%)	0.64
Ease of insertion (Easy %)	26 (86.7%)	24 (80.0%)	0.51
No. of insertion attempts	1.1 ± 0.4	1.2 ± 0.5	0.48

Table 3: Comparison of Ventilation and Seal Characteristics between the groups

Parameter	I-Gel Group (n = 30)	Baska Mask Group (n = 30)	p-value
OLP at insertion	27.4 ± 2.3	31.6 ± 2.7	<0.001
OLP at 30 minutes	26.9 ± 2.1	31.2 ± 2.5	<0.001
Peak Airway Pressure (cm H2O)	19.8 ± 2.9	20.4 ± 3.1	0.38
Leak fraction (%)	9.2 ± 2.1	6.1 ± 1.9	<0.001
SpO2 maintained (%)	98.2 ± 0.9	98.0 ± 1.0	0.61
EtCO2 (mmHg)	36.4 ± 2.7	36.7 ± 2.5	0.68

Table 4: Comparison of Postoperative Outcomes between the groups

Parameter	I-Gel Group (n = 30)	Baska Mask Group (n = 30)	p-value
Sore throat at 2 hrs (%)	4 (13.3%)	6 (20.0%)	0.49
Blood staining on device (%)	2 (6.7%)	3 (10.0%)	0.64
Lip/tongue trauma (%)	1 (3.3%)	2 (6.7%)	0.55
Coughing during emergence (%)	2 (6.7%)	3 (10.0%)	0.64
Gastric tube insertion success	30 (100%)	30 (100%)	–
Device displacement (%)	0 (0%)	0 (0%)	–

This study assessed and compared the efficacy and safety profiles of two supraglottic airway devices, the I-Gel and the Baska Mask, in adult patients undergoing general anaesthesia. Both groups were equivalent at baseline for age, gender distribution, BMI, and ASA physical state, thus minimising bias from demographic heterogeneity.

The Baska Mask group exhibited a marginally longer mean insertion time (21.2 ± 3.1 sec) compared to the I-Gel group (18.4 ± 2.9 sec), although this difference was not statistically significant (p = 0.06). The success rate of initial tries, the simplicity of insertion, and the number of attempts needed were similar between the two groups. This discovery indicates that both devices are accessible and efficient for prompt airway formation. The slightly prolonged insertion time of the Baska Mask may indicate its design intricacy, especially the self-sealing membrane cuff that necessitates more accurate alignment.

Chaudhary UK *et al.*<sup>[10]</sup> observed that the insertion time was 12.33 ± 2.61 seconds with the Baska mask and 11.31 ± 1.84 seconds with the I-gel (p = 0.02). Insertion was straightforward in 58% of patients using the Baska mask and 76% of patients using the I-gel (P = 0.03). The leak fraction of the Baska mask was markedly lower than that of the I-gel (3.56 ± 3.6 vs. 7.16 ± 2.45, p = 0.01).

In the study conducted by Sidhu GK *et al.*<sup>[11]</sup> the initial insertion success rate was superior in the I-gel group compared to the Baska mask group; nevertheless, the difference was statistically insignificant (p = 0.137). No patients in either group necessitated a third try or tracheal intubation. The

insertion of the device was notably easier in the I-gel group compared to the Baska mask group; however, the results lacked statistical significance (p = 0.203).

Gupta AK *et al.*<sup>[12]</sup> also noted that the duration for device insertion was somewhat extended in the Baska mask Group (27.73 ± 10.87 sec) compared to the i-gel Group (23 ± 8.29 sec), however this difference did not reach statistical significance. Insertion of the device was more straightforward in Group II patients (93.33%) compared to Group I patients (66.66%). Device insertion difficulties were experienced in 5 patients (33.33%) of Group I and 2 patients (13.33%) of Group II.

The Baska Mask was effectively inserted on the first attempt in 38 out of 40 patients in the Baska group, compared to 35 out of 40 patients in the I-gel group, according to the study by Jain P *et al.*<sup>[13]</sup> Sachidananda R *et al.*<sup>[14]</sup> similarly noted that the initial insertion success rate of the Baska mask was 21 out of 24 (88%), in contrast to the I-gel, which had a success rate of 23 out of 25 (92%) (p=0.585). The insertion time for the Baska mask was 14.9±6.2 seconds, while for the I-gel it was 14.7±4.4 seconds (p=0.877).

The Baska Mask exhibited a markedly higher OLP at both measurement intervals (p < 0.001), corroborating existing data that indicates its dynamic sealing mechanism provides improved airway protection. An elevated OLP is particularly advantageous during procedures necessitating increased airway pressures, such as laparoscopic surgeries that involve pneumoperitoneum. Moreover, the Baska Mask demonstrated a reduced leak fraction, hence reinforcing its enhanced sealing efficacy.

The study conducted by Chaudhary UK *et al.*<sup>[10]</sup> demonstrated that the Mean OLP was considerably elevated in the Baska mask group compared to the I-gel group at insertion ( $29.54 \pm 1.41$  cm H<sub>2</sub>O vs.  $23.16 \pm 3.07$  cm H<sub>2</sub>O,  $p = 0.02$ ) and 30 min post-insertion ( $33.54 \pm 1.16$  cm H<sub>2</sub>O vs.  $25.97 \pm 2.25$  cm H<sub>2</sub>O,  $p = 0.001$ ). This was comparable to the present study.

Gupta AK *et al.*<sup>[12]</sup> determined that the OSP in the Baska mask group was  $34.80 \pm 2.90$  cmH<sub>2</sub>O, while in the i-gel group it was  $34.53 \pm 2.44$  cmH<sub>2</sub>O, with the difference being statistically insignificant. This contrasted with the current study.

The mean OLP in Baska Mask compared to I-gel immediately post-insertion was ( $29.24 \pm 4.20$  cm H<sub>2</sub>O vs  $26.33 \pm 2.51$  cm H<sub>2</sub>O,  $P=0.003$ ), whereas after 5 minutes of pneumoperitoneum, it was ( $29.42 \pm 2.70$  cm H<sub>2</sub>O vs  $26.18 \pm 2.54$  cm H<sub>2</sub>O) in the study by Jain P *et al.*<sup>[13]</sup>

Sachidananda R *et al.*<sup>[14]</sup> also noted that the average sealing pressure of the Baska mask was much greater than that of the I-gel ( $28.9 \pm 3.5$  vs.  $25.9 \pm 2.5$  cmH<sub>2</sub>O) ( $p=0.001$ ).

Ramya BN *et al.*<sup>[15]</sup> noted that the OSP was markedly elevated in Group B compared to Group I ( $29.4 \pm 6.01$  vs.  $26.32 \pm 4.26$  cmH<sub>2</sub>O, respectively) ( $P = 0.042$ ). There was no statistically significant difference in the number of attempts, mean duration, and ease of insertion grade between the two groups. There were no significant differences in haemodynamic parameters between the two groups.

Choi SR *et al.*<sup>[16]</sup> observed no significant differences between the two groups for demographic data, insertion time, fiber-optic visualisation of the glottis, and the use of airway manipulation. The OLP was significantly greater in the Baska Mask group compared to the i-gel group ( $29.6 \pm 6.8$  cmH<sub>2</sub>O versus  $26.7 \pm 4.5$  cmH<sub>2</sub>O;  $p = 0.014$ ).

No significant changes were seen in peak airway pressure, oxygen saturation (SpO<sub>2</sub>), or end-tidal CO<sub>2</sub> (EtCO<sub>2</sub>), demonstrating that both devices effectively maintained adequate ventilation during the procedure. Consequently, although the Baska Mask provides a more secure seal, it does not diminish ventilation efficiency relative to the I-Gel.

Similarly, Kara D *et al.*<sup>[17]</sup> found that the mean (SD) airway pressures differed considerably between the two groups, with values of  $15.8 [1.9]$  cm/H<sub>2</sub>O for Baska and  $14.9 [1.7]$  cm/H<sub>2</sub>O for I-gel;  $t=3.668$ ;  $p<0.001$ . The seal pressure did not differ substantially between the groups, with values of  $0.08 [0.2]$  cm/H<sub>2</sub>O for the Baska group and  $0.07 [0.2]$  cm/H<sub>2</sub>O for the I-gel group ( $t=1.35$ ;  $p=0.194$ ).

Postoperative problems were rare and insignificant in both groups in the present study. The incidence of mild sore throat was higher in the Baska Mask group (20.0%) compared to the I-Gel group (13.3%), however the difference lacked statistical

significance. The stiffer material and more intricate insertion procedure of the Baska Mask could be the cause of this development. Other minor problems, including blood staining, damage to the lip or tongue, and coughing during emergence, were evenly distributed across the two groups, with no significant adverse events documented.

Sidhu GK *et al.*<sup>[11]</sup> noted that blood staining of the device upon removal occurred in 6 patients in the Baska mask group and 3 patients in group G; however, the difference was statistically insignificant ( $P=0.284$ ). During the immediate postoperative period, sore throat was observed in 7 patients from the Baska mask group and 2 patients from the group I gel. At 2 hours postoperatively, 3 patients in the Baska mask group and 1 patient in the group I gel reported sore throat. However, the change was statistically negligible. At 24 hours postoperatively, none of the patients in any group reported a sore throat.

Gupta AK *et al.*<sup>[12]</sup> observed that upon admission at the PACU, sore throat was noted in 5 patients from Group I and 2 patients from Group II. Four hours after surgery, only two patients in Group I and one patient in Group II experienced a sore throat. Unlike the current investigation, Ramya BN *et al.*<sup>[15]</sup> reported no postoperative problems in either group.

In the study conducted by Meena S *et al.*<sup>[18]</sup> the removal features including blood staining on devices, injuries to the tongue, lip, or mouth, signs of regurgitation and aspiration, coughing, bronchospasm, and laryngospasm are analogous in both groups. Post-operative problems, such as sore throat, were observed in 10% (3/30) of patients in the Baska Group and 10% (3/30) in the I gel Group, with a statistically non-significant  $p$ -value of 0.66. No evidence of dysphasia or dysphonia was observed in either group. Both devices enabled successful gastric tube insertion in all patients, with no occurrences of device displacement noted. These results corroborate the overall safety of both devices when utilised by proficient anaesthesiologists.

## CONCLUSION

This study shows that both the I-Gel and Baska Mask are effective supraglottic airway devices for patients having elective laparoscopic cholecystectomy under general anesthesia. The Baska Mask demonstrated markedly enhanced oropharyngeal leak pressures at both insertion and 30 minutes post-placement, signifying a superior airway seal, especially beneficial during procedures involving pneumoperitoneum and increased airway pressures. While both devices exhibited comparable insertion success rates, ease of insertion, and overall ventilation efficacy, the Baska Mask shown superior sealing capability and a reduced leak fraction without

markedly elevating insertion-related problems. In conclusion, although both devices are safe and effective, the Baska Mask may provide a clinical advantage in laparoscopic operations necessitating elevated airway pressures due to its superior and persistent oropharyngeal sealing efficacy. Device selection must also take into account operator proficiency, patient anatomy, and the particular procedure necessities.

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