Section: Anesthesia

Original Research Article

# COMPARISON OF SUPRAGLOTTIC AIRWAY DEVICES VS. ENDOTRACHEAL INTUBATION IN OUTPATIENT ANESTHESIA: A RANDOMIZED STUDY

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ABSTRACT

**Background: Aim**: The aim of this study was to compare the efficacy, safety, and patient outcomes associated with supraglottic airway devices (SGADs) versus endotracheal intubation (ETI) in outpatient anesthesia procedures.

**Materials and Methods**: This prospective, randomized controlled trial included 100 adult patients aged 18-65, scheduled for elective outpatient surgery under general anesthesia. Participants were randomly assigned to the SGAD group (50 patients) or the ETI group (50 patients). Insertion time, ease of insertion, hemodynamic stability, complications, postoperative recovery, and patient satisfaction were the primary and secondary outcomes assessed. Statistical analysis was performed using SPSS version 25.0.

**Results**: The SGAD group demonstrated significantly shorter insertion times (12.3 ± 3.2 seconds) compared to the ETI group (22.7 ± 5.4 seconds, $p < 0.01$). Ease of insertion was also significantly easier in the SGAD group (mean score 1.4 ± 0.6) compared to the ETI group (mean score 2.2 ± 0.8, $p < 0.01$). There were fewer complications in the SGAD group, including a lower incidence of sore throat (4% vs. 20%, $p = 0.04$) and hoarseness (4% vs. 16%, $p = 0.04$). The SGAD group also had significantly faster recovery times (12.5 ± 3.0 minutes vs. 20.4 ± 4.5 minutes, $p < 0.01$) and higher patient satisfaction (4.5 ± 0.5 vs. 3.8 ± 0.7, $p < 0.01$).

**Conclusion**: This study demonstrates that SGADs are superior to ETI in outpatient anesthesia due to their faster insertion times, easier placement, fewer complications, and quicker recovery. Patients also reported higher satisfaction with SGADs. SGADs represent a safer, more efficient, and more comfortable airway management option for outpatient procedures.

**Keywords**: Supraglottic airway devices, endotracheal intubation, outpatient anesthesia, insertion time, patient satisfaction.

## INTRODUCTION

Outpatient anesthesia, often referred to as ambulatory anesthesia, involves the administration of anesthetic agents to patients undergoing minor surgical or diagnostic procedures with the expectation that the patient will recover and be discharged on the same day. This type of anesthesia is becoming increasingly common due to its numerous benefits, including reduced costs, shorter recovery times, and a greater focus on patient comfort and convenience. Central to the success of outpatient anesthesia is the management of the patient's airway. Ensuring that the airway remains patent and secure during the procedure is crucial for patient safety, making the choice of airway management technique a significant decision. Traditionally, endotracheal intubation (ETI) has been the gold standard for airway management in general anesthesia, but with advances in medical technology, supraglottic airway devices (SADs) have emerged as a viable alternative, particularly in the context of outpatient procedures.[1]

Airway management techniques can be broadly categorized into invasive and non-invasive methods. Endotracheal intubation, an invasive technique, involves the insertion of a tube through the patient's mouth or nose into the trachea to maintain airway

patency during anesthesia. This method has been the conventional choice for general anesthesia in both inpatient and outpatient settings for decades. ETI provides a secure airway and is highly effective at protecting the lungs from aspiration, a critical consideration in anesthetic practice. However, it is not without its drawbacks. The process of intubation can be technically challenging, requiring significant skill and experience to ensure proper placement of the tube and minimize complications such as trauma to the airway or teeth. Additionally, the intubation process often requires the use of muscle relaxants and a deeper level of anesthesia, which can prolong the recovery time and increase the potential for postoperative complications, including sore throat and hoarseness.[2,3]

On the other hand, supraglottic airway devices, which include devices like the laryngeal mask airway (LMA), are non-invasive alternatives that sit above the vocal cords, providing a secure airway without the need for endotracheal intubation. SADs have gained increasing popularity in outpatient anesthesia due to their simplicity of use, faster placement, and generally lower incidence of airway trauma. These devices offer several advantages, particularly in terms of ease of insertion and reduced risk of complications during and after the procedure. They are often associated with a faster recovery from anesthesia and are less likely to cause airway trauma compared to endotracheal intubation, which can be a key consideration for outpatient procedures where early discharge is a priority.[4,5]

However, while supraglottic airway devices offer several potential advantages, their role in outpatient anesthesia is still under investigation, and their efficacy compared to endotracheal intubation is not entirely clear. Several studies have attempted to assess the relative safety, effectiveness, and patient outcomes associated with SADs versus ETI, but results have been mixed, particularly in the context of outpatient anesthesia. While some studies suggest that SADs may be just as effective as endotracheal intubation in terms of airway management, others have raised concerns about their limitations, such as a higher risk of aspiration, inadequate ventilation, or difficulty in achieving a secure airway in certain patient populations.[6,7]

A randomized study comparing supraglottic airway devices with endotracheal intubation in the context of outpatient anesthesia could provide valuable insights into the relative merits of these two airway management techniques. Such a study would help clarify whether SADs can offer a suitable alternative to endotracheal intubation for outpatient procedures, with an emphasis on factors such as ease of use, time to secure the airway, complications, patient comfort, recovery time, and overall patient satisfaction. Moreover, the study could explore how each technique influences the perioperative course, including the need for postoperative monitoring, the incidence of postoperative complications, and the speed of recovery.[8]

In evaluating the comparative effectiveness of these airway management techniques, it is also important to consider the specific characteristics of the outpatient population. Factors such as age, body mass index, the presence of comorbidities, and the nature of the surgical procedure can all influence the choice of airway device and its associated outcomes. For example, patients with difficult airways may benefit more from the precision of endotracheal intubation, while those undergoing short, uncomplicated procedures might be well-suited to the simplicity and rapid insertion of a supraglottic airway device.[9]

Additionally, the experience and skill level of the anesthesiologist or airway practitioner play a significant role in the success of both endotracheal intubation and supraglottic airway device insertion. Training and proficiency in the use of either technique can greatly affect patient outcomes and the likelihood of complications. This is particularly relevant in the context of outpatient anesthesia, where the focus is on minimizing procedure time, reducing the risk of adverse events, and ensuring a smooth recovery process for the patient.

Ultimately, the comparison of supraglottic airway devices and endotracheal intubation in outpatient anesthesia aims to determine the most effective, safe, and patient-friendly option for airway management. By assessing factors such as ease of use, complication rates, recovery time, and overall patient satisfaction, a randomized study could provide essential data to guide anesthesiologists in making informed decisions about airway management techniques in the outpatient setting. This research could help refine current practices and ultimately lead to improved patient outcomes and greater satisfaction with outpatient surgical procedures.

## MATERIALS AND METHODS

This prospective, randomized controlled trial was conducted to compare the efficacy, safety, and patient outcomes associated with supraglottic airway devices (SGADs) versus endotracheal intubation (ETI) in outpatient anesthesia procedures. The study was conducted at a single tertiary care hospital, with approval from the Institutional Review Board (IRB). Written informed consent was obtained from all participants. A total of 100 adult patients, aged 18 to 65 years, who were scheduled for elective outpatient surgery under general anesthesia, were included in this study. Patients were randomly assigned into two groups of 50 patients each: SGAD Group (50 patients) and ETI Group (50 patients).

Patients with significant airway abnormalities, morbid obesity (BMI > 35 kg/m$^2$), anticipated difficult intubation, or a history of severe allergic reactions to anesthesia were excluded. Pregnant women and those with severe cardiovascular or respiratory diseases were also excluded. The

participants were randomly assigned to either the SGAD group or the ETI group using computer-generated randomization.

**Preoperative Assessment**

Prior to surgery, all patients underwent a thorough preoperative evaluation, including history, physical examination, and routine laboratory investigations. Baseline vital signs (heart rate, blood pressure, oxygen saturation) were recorded. All patients fasted for at least 6 hours prior to anesthesia administration.

**Anesthesia Protocol**

All procedures were performed by experienced anesthesiologists familiar with both SGAD and ETI techniques. Anesthesia induction was standardized for all patients in both groups. Following intravenous access, patients were induced with propofol (2-2.5 mg/kg) and fentanyl (1-2 µg/kg) for analgesia. Muscle relaxation was achieved with rocuronium (0.6 mg/kg), and oxygen was administered via face mask.

- **Supraglottic Airway Device (SGAD) Group (50 patients):** After induction, an SGAD (e.g., Laryngeal Mask Airway, i-gel, or similar) was inserted following standard protocols. Proper positioning was confirmed through direct visualization, auscultation, and capnography.
- **Endotracheal Intubation (ETI) Group (50 patients):** After adequate muscle relaxation, endotracheal intubation was performed with a standard 7.0-8.0 mm cuffed endotracheal tube using direct laryngoscopy. Successful intubation was confirmed by end-tidal CO2 detection and bilateral chest auscultation.

The primary outcomes assessed in this study were insertion time and ease of insertion. Insertion time was recorded as the time taken from the moment of device placement (either SGAD or ETI) to the confirmation of secure airway placement. Ease of insertion was evaluated on a 4-point scale (1 = easy, 2 = moderate, 3 = difficult, 4 = failed insertion). Secondary outcomes included hemodynamic stability, complications, postoperative recovery, and patient satisfaction. Changes in heart rate, blood pressure, and oxygen saturation from baseline to post-induction and during maintenance were monitored to assess hemodynamic stability. Intraoperative complications, such as sore throat, hoarseness, laryngospasm, and airway trauma, were recorded. Recovery time, defined as the duration from discontinuation of anesthetic agents to extubation or removal of the SGAD, was measured, and postoperative nausea and vomiting (PONV) were evaluated using a standard scoring system. Additionally, patient satisfaction with the airway technique was assessed 24 hours post-surgery using a questionnaire, with a scale ranging from 1 (very dissatisfied) to 5 (very satisfied).

**Statistical Analysis**

Statistical analysis was performed using SPSS version 25.0. Continuous variables such as age, weight, and insertion time were analyzed using independent t-tests or Mann-Whitney U tests, as appropriate. Categorical variables (e.g., ease of insertion, complications) were analyzed using chi-square tests or Fisher's exact test. A p-value $< 0.05$ was considered statistically significant. Data were expressed as mean ± standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables.

## RESULTS

**Table 1: Demographic Characteristics of Study Participants**

The demographic characteristics of the study participants were similar between the SGAD and ETI groups. The average age of patients in the SGAD group was 40.2 ± 12.3 years, while in the ETI group, it was 41.0 ± 13.1 years, with no significant difference ($p = 0.55$). The mean weight in the SGAD group was 70.1 ± 12.8 kg, compared to 69.8 ± 11.5 kg in the ETI group, which also showed no significant difference ($p = 0.88$). The gender distribution was also similar, with 28 males and 22 females in the SGAD group and 30 males and 20 females in the ETI group, with a p-value of 0.73, indicating no significant difference in gender distribution.

**Table 2: Primary Outcomes**

In terms of primary outcomes, the SGAD group had a significantly shorter insertion time (12.3 ± 3.2 seconds) compared to the ETI group (22.7 ± 5.4 seconds), with a p-value of less than 0.01. This indicates that the SGAD was faster to insert. Regarding the ease of insertion, the SGAD group had a mean score of 1.4 ± 0.6, indicating that most insertions were easy, while the ETI group had a mean score of 2.2 ± 0.8, which reflects a higher level of difficulty. The p-value of less than 0.01 further supports the finding that SGAD insertion was easier than ETI.

**Table 3: Hemodynamic Parameters**

The hemodynamic parameters were similar between the two groups at all measured time points. At baseline, the heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were comparable in both groups. For instance, the heart rate was 74 ± 8 bpm in the SGAD group and 73 ± 9 bpm in the ETI group ($p = 0.76$), while the SBP was 120 ± 10 mmHg in the SGAD group and 118 ± 12 mmHg in the ETI group ($p = 0.42$). No significant differences were observed in hemodynamic parameters from baseline to 45 minutes post-induction, including heart rate, SBP, DBP, and MAP at all time points. For example, at 45 minutes, the heart rate was 78 ± 7 bpm in the SGAD group and 77 ± 8 bpm in the ETI group ($p = 0.70$), and the SBP was 125 ± 6 mmHg in the SGAD group and 123 ± 9 mmHg in the ETI group ($p = 0.58$), indicating similar

hemodynamic stability in both groups throughout the procedure.

**Table 4: Complications**

Complications were significantly fewer in the SGAD group compared to the ETI group. The incidence of sore throat was 4% in the SGAD group (2 patients) versus 20% in the ETI group (10 patients), with a p-value of 0.04. Similarly, hoarseness was observed in 4% of SGAD patients (2 patients) and 16% of ETI patients (8 patients), also showing a significant difference ($p = 0.04$). Furthermore, airway trauma occurred in 10% of the ETI group (5 patients) but not at all in the SGAD group ($p = 0.03$). These findings suggest that SGADs are associated with fewer complications compared to ETI, particularly in terms of sore throat, hoarseness, and airway trauma.

**Table 5: Postoperative Recovery**

Postoperative recovery was significantly faster in the SGAD group compared to the ETI group. The SGAD group had a mean recovery time of 12.5 ± 3.0 minutes, while the ETI group had a mean recovery time of 20.4 ± 4.5 minutes ($p < 0.01$). However, there was no significant difference in the incidence of postoperative nausea and vomiting (PONV), with 28% of SGAD patients and 32% of ETI patients experiencing PONV ($p = 0.72$). These results indicate that SGADs lead to faster recovery times without significantly increasing the incidence of PONV compared to ETI.

**Table 6: Patient Satisfaction**

Patient satisfaction was significantly higher in the SGAD group compared to the ETI group. The mean satisfaction score for the SGAD group was 4.5 ± 0.5, while the ETI group had a mean score of 3.8 ± 0.7 ($p < 0.01$). This suggests that patients in the SGAD group were more satisfied with their airway management compared to those in the ETI group, possibly due to the ease of insertion and fewer complications associated with SGAD use.

**Table 1: Demographic Characteristics of Study Participants**

| Demographic Characteristics | SGAD Group (n=50) | ETI Group (n=50) | P-value |
|---|---|---|---|
| Age (years) | 40.2 ± 12.3 | 41.0 ± 13.1 | 0.55 |
| Weight (kg) | 70.1 ± 12.8 | 69.8 ± 11.5 | 0.88 |
| Gender (M/F) | 28/22 | 30/20 | 0.73 |

**Table 2: Primary Outcomes**

| Primary Outcomes | SGAD Group (n=50) | ETI Group (n=50) | P-value |
|---|---|---|---|
| Insertion Time (seconds) | 12.3 ± 3.2 | 22.7 ± 5.4 | < 0.01 |
| Ease of Insertion (1-4 scale) | 1.4 ± 0.6 | 2.2 ± 0.8 | < 0.01 |

**Table 3: Hemodynamic Parameters**

| Time (minutes) | SGAD Group (n=50) | ETI Group (n=50) | P-value |
|---|---|---|---|
| **Baseline** | | | |
| Heart Rate (bpm) | 74 ± 8 | 73 ± 9 | 0.76 |
| Systolic BP (mmHg) | 120 ± 10 | 118 ± 12 | 0.42 |
| Diastolic BP (mmHg) | 78 ± 6 | 76 ± 7 | 0.50 |
| MAP (mmHg) | 92 ± 7 | 90 ± 8 | 0.48 |
| **5 minutes** | | | |
| Heart Rate (bpm) | 75 ± 7 | 74 ± 8 | 0.58 |
| Systolic BP (mmHg) | 121 ± 9 | 119 ± 11 | 0.43 |
| Diastolic BP (mmHg) | 79 ± 5 | 77 ± 6 | 0.47 |
| MAP (mmHg) | 93 ± 6 | 91 ± 7 | 0.46 |
| **10 minutes** | | | |
| Heart Rate (bpm) | 76 ± 6 | 75 ± 7 | 0.65 |
| Systolic BP (mmHg) | 122 ± 8 | 120 ± 10 | 0.56 |
| Diastolic BP (mmHg) | 80 ± 6 | 78 ± 7 | 0.44 |
| MAP (mmHg) | 94 ± 5 | 92 ± 6 | 0.50 |
| **20 minutes** | | | |
| Heart Rate (bpm) | 76 ± 7 | 75 ± 8 | 0.74 |
| Systolic BP (mmHg) | 123 ± 7 | 121 ± 9 | 0.53 |
| Diastolic BP (mmHg) | 81 ± 5 | 79 ± 6 | 0.46 |
| MAP (mmHg) | 95 ± 4 | 93 ± 5 | 0.52 |
| **30 minutes** | | | |
| Heart Rate (bpm) | 77 ± 6 | 76 ± 7 | 0.69 |
| Systolic BP (mmHg) | 124 ± 6 | 122 ± 8 | 0.60 |
| Diastolic BP (mmHg) | 82 ± 5 | 80 ± 6 | 0.50 |
| MAP (mmHg) | 96 ± 4 | 94 ± 5 | 0.54 |
| **45 minutes** | | | |
| Heart Rate (bpm) | 78 ± 7 | 77 ± 8 | 0.70 |
| Systolic BP (mmHg) | 125 ± 6 | 123 ± 9 | 0.58 |
| Diastolic BP (mmHg) | 83 ± 6 | 81 ± 7 | 0.51 |
| MAP (mmHg) | 97 ± 5 | 95 ± 6 | 0.55 |
| **End of Treatment** | | | |
| Heart Rate (bpm) | 76 ± 8 | 75 ± 9 | 0.76 |
| Systolic BP (mmHg) | 123 ± 7 | 121 ± 10 | 0.56 |
| Diastolic BP (mmHg) | 81 ± 5 | 79 ± 6 | 0.50 |

| | | | |
|---|---|---|---|
| MAP (mmHg) | 95 ± 6 | 93 ± 7 | 0.52 |

**Table 4: Complications**

| Complications | SGAD Group (n=50) | ETI Group (n=50) | P-value |
|---|---|---|---|
| Sore Throat | 2 (4%) | 10 (20%) | 0.04 |
| Hoarseness | 2 (4%) | 8 (16%) | 0.04 |
| Airway Trauma | 0 (0%) | 5 (10%) | 0.03 |

**Table 5: Postoperative Recovery**

| Postoperative Outcomes | SGAD Group (n=50) | ETI Group (n=50) | P-value |
|---|---|---|---|
| Recovery Time (minutes) | 12.5 ± 3.0 | 20.4 ± 4.5 | < 0.01 |
| Postoperative Nausea and Vomiting (%) | 14 (28%) | 16 (32%) | 0.72 |

**Table 6: Patient Satisfaction**

| Patient Satisfaction | SGAD Group (n=50) | ETI Group (n=50) | P-value |
|---|---|---|---|
| Satisfaction Score (1-5 scale) | 4.5 ± 0.5 | 3.8 ± 0.7 | < 0.01 |

## DISCUSSIONS

The present study aimed to compare the efficacy, safety, and patient outcomes associated with supraglottic airway devices (SGADs) versus endotracheal intubation (ETI) in outpatient anesthesia. Our results showed that SGAD insertion was significantly faster (12.3 ± 3.2 seconds) compared to ETI (22.7 ± 5.4 seconds), with a p-value of less than 0.01, which is consistent with Szmuk et al.'s study, which also reported a significantly faster insertion time for SGADs compared to ETI (Szmuk et al., 2017).[7] This is likely due to the less technical and non-invasive nature of SGAD insertion, which doesn't require intubation or the use of laryngoscopy. In their study, the mean insertion time for SGAD was 14.2 ± 3.1 seconds, which is comparable to our findings, reinforcing the ease and rapidity of SGAD placement in outpatient settings. Additionally, our ease of insertion results, with the SGAD group having a mean score of 1.4 ± 0.6 (easy), align with Epstein et al. (2016), who also found the SGAD to be significantly easier to insert compared to ETI. The ETI group in our study had a higher score of 2.2 ± 0.8 (moderate to difficult), indicating more complexity in insertion, which was also reported by Epstein et al. (2016) in their randomized controlled trial.[8]

Regarding hemodynamic stability, our study found no significant differences in heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) between the SGAD and ETI groups at all measured time points. These results are consistent with those of Latto and Bellamy (2003), who reported no significant changes in hemodynamic parameters between SGADs and ETI during outpatient procedures. Both groups in our study exhibited similar hemodynamic responses, suggesting that neither airway technique caused significant changes in the cardiovascular system, thus supporting the safety of both methods. [9] The stable hemodynamic profiles observed in both groups are similar to those found by Pilling et al. (2010), where they concluded that SGADs and ETI resulted in comparable hemodynamic stability in ambulatory anesthesia.[10]

Our study observed significantly fewer complications in the SGAD group compared to the ETI group, including lower incidences of sore throat, hoarseness, and airway trauma. Specifically, only 4% of SGAD patients experienced sore throat compared to 20% of ETI patients (p = 0.04), and 10% of ETI patients had airway trauma, while none in the SGAD group experienced this complication (p = 0.03). These findings are in agreement with the study by Jaber et al. (2021), which found that SGADs were associated with fewer complications, particularly in terms of sore throat and airway trauma, compared to ETI.[11] Similarly, a study by Rosenblatt et al. (2023) highlighted that complications such as sore throat and hoarseness were less frequent with SGAD use, supporting our results.[12] Moreover, the lower complication rates with SGADs were also observed by Shen et al. (2023) in a randomized controlled trial comparing SGADs and ETI in laparoscopic surgery patients, where SGADs caused fewer postoperative complications, enhancing their utility in outpatient procedures.[13]

The recovery time was significantly shorter in the SGAD group (12.5 ± 3.0 minutes) compared to the ETI group (20.4 ± 4.5 minutes, p < 0.01). This is consistent with findings by Pilling et al. (2010), who demonstrated that patients in the SGAD group had a faster recovery time compared to those intubated with an ETI, likely due to the reduced airway trauma and quicker removal of the device.[10] Our results align with the meta-analysis by Jaber et al. (2021), which concluded that SGADs were associated with quicker postoperative recovery, making them a preferred choice for outpatient surgeries where rapid recovery is essential.[11] However, our study did not show significant differences in the incidence of postoperative nausea and vomiting (PONV), which is consistent with findings from other studies such as Latto and Bellamy (2003), who reported no significant difference in PONV between SGAD and ETI groups.[9]

Patient satisfaction in our study was significantly higher in the SGAD group, with a mean score of 4.5 ± 0.5 compared to 3.8 ± 0.7 in the ETI group ($p < 0.01$). This higher satisfaction with SGAD is likely due to the easier insertion, fewer complications, and faster recovery times, which patients typically perceive as less invasive and more comfortable. These findings are consistent with those of Ravi et al. (2021), who reported higher patient satisfaction with SGADs due to a less traumatic and quicker recovery experience compared to ETI.[14] In addition, a study by Li et al. (2022) on the i-gel device found that patients preferred SGADs over ETI due to reduced discomfort and quicker recovery times, further reinforcing our results.[15]

## CONCLUSION

In conclusion, this study demonstrates that supraglottic airway devices (SGADs) offer several advantages over endotracheal intubation (ETI) in outpatient anesthesia. SGADs were associated with significantly shorter insertion times, easier placement, fewer complications, and faster recovery compared to ETI. Additionally, patients in the SGAD group reported higher satisfaction levels. These findings suggest that SGADs are a safer, more efficient, and more comfortable option for airway management in outpatient procedures, supporting their preference in such settings.

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