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ORIGINAL ARTICLE

Clinical Evaluation of LMA Gastro™ in Upper Gastrointestinal Procedural Endoscopy: A Prospective Observational Study

Malini Perumal,[1] Sudarsan Kasthuri,[2] Dinesh Nalliah[3] and Jeevithan Shanmugam[4,*]
[1]*Junior Consultant, Dept of Anaesthesiology, GEM Hospital, Coimbatore.*
[2]*Associate Professor, Department of Anaesthesiology, KMCH Institute of Health Sciences and Research, Coimbatore*
[3]*Junior Consultant, Dept of Anaesthesiology, Kovai Medical Center and Hospital, Coimbatore.*
[4]*Professor in Community Medicine, KMCH Institute of Health Sciences and Research, Coimbatore – 14*

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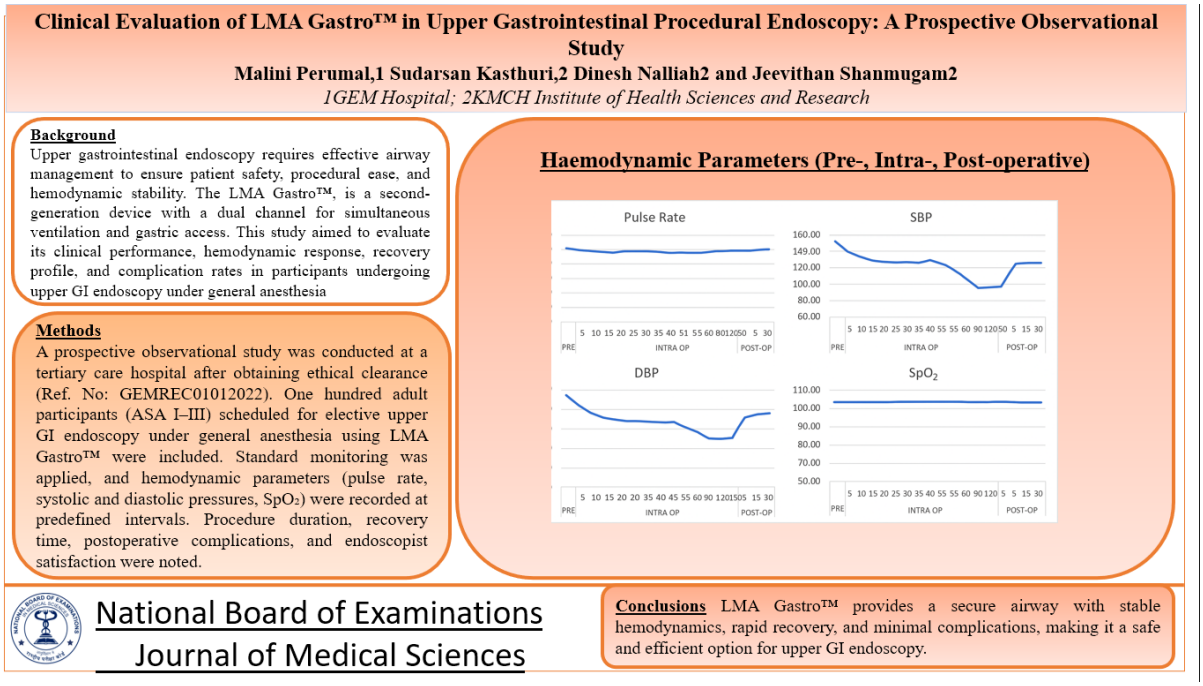
Abstract

Introduction: Upper gastrointestinal endoscopy requires effective airway management to ensure patient safety, procedural ease, and hemodynamic stability. The LMA Gastro™, is a second-generation device with a dual channel for simultaneous ventilation and gastric access. This study aimed to evaluate its clinical performance, hemodynamic response, recovery profile, and complication rates in participants undergoing upper GI endoscopy under general anesthesia. **Materials and Methods:** A prospective observational study was conducted at a tertiary care hospital after obtaining ethical clearance (Ref. No: GEMREC01012022). One hundred adult participants (ASA I–III) scheduled for elective upper GI endoscopy under general anesthesia using LMA Gastro™ were included. Standard monitoring was applied, and hemodynamic parameters (pulse rate, systolic and diastolic pressures, SpO_2) were recorded at predefined intervals. Procedure duration, recovery time, postoperative complications, and endoscopist satisfaction were noted. Data were analyzed using SPSS v27, applying Friedman, Chi-square, and non-parametric tests, with $p < 0.05$ considered significant. **Results:** The mean age of participants was 56.15 ± 16.16 years. Successful LMA insertion was achieved on the first attempt in 90% of participants. Significant but clinically acceptable reductions were noted in pulse rate, SBP, and DBP intraoperatively ($p < 0.001$), while SpO_2 remained stable (>99%). The mean procedure duration was 32.25 ± 17.66 min, and recovery time averaged 9.78 ± 2.41 min. Complications were minimal (12.9%), with sore throat being most common. Endoscopist satisfaction was high (median 4, IQR 4–5). **Conclusion:** LMA Gastro™ provides a secure airway with stable hemodynamics, rapid recovery, and minimal complications, making it a safe and efficient option for upper GI endoscopy.

Keywords: LMA Gastro, Endoscopy, Airway Management, Hemodynamic Stability, Supraglottic Device

*Corresponding Author: Jeevithan Shanmugam
Email: dr.jeevithan@gmail.com

Graphical Abstract



Introduction

Upper gastrointestinal (GI) endoscopic procedures are commonly performed for both diagnostic and therapeutic purposes. Sedation and airway management are critical components of these procedures, as they influence patient safety, procedural efficiency, and operator satisfaction. Conventional airway control during upper GI endoscopy often relies on conscious sedation with supplemental oxygen. However, sedation-induced respiratory depression, hypoxia, and loss of airway tone can lead to serious complications, especially in participants with comorbidities or prolonged procedures [1,2].

The advent of supraglottic airway devices (SADs) has revolutionized anesthesia practice by providing a safe and effective alternative to endotracheal intubation. Among these, the Laryngeal Mask Airway (LMA) has become a cornerstone device for elective procedures, owing to its ease of insertion, reduced hemodynamic response, and minimal postoperative discomfort compared to endotracheal tubes [3,4]. The LMA Gastro™, is a second-generation device with a dual channel for simultaneous ventilation and gastric access. It features an integrated endoscope channel, allowing continuous airway maintenance and unimpeded endoscopic access simultaneously [5].

Several studies have demonstrated that LMA Gastro enables secure ventilation while permitting endoscopist maneuverability during upper GI procedures [5,6]. It minimizes hypoxemic events, improves operator visibility, and provides better control of airway patency than traditional nasal cannula or oropharyngeal airways [7]. In addition, the use of LMA Gastro reduces sympathetic stimulation during insertion compared with laryngoscopy and intubation, leading to greater hemodynamic stability — a key consideration in high-risk populations [8].

Despite these advantages, real-world evidence regarding its clinical performance in terms of ease of insertion, hemodynamic changes, complications, and procedural satisfaction remains limited, particularly in routine diagnostic and therapeutic endoscopy. Most available literature has focused on small sample sizes or simulation-based trials, highlighting the need for larger observational datasets [9,10].

In this context, the present prospective observational study was conducted to evaluate the clinical performance of LMA Gastro during upper GI endoscopy in adult participants. The study aimed to analyze insertion characteristics, hemodynamic trends, recovery parameters, and complication rates. It also explored operator satisfaction and associations between ASA classification, number of airway attempts, and complication incidence.

Materials and Methods

This prospective observational study was conducted in the Department of Anaesthesiology in collaboration with the Department of Gastroenterology at a tertiary care hospital. The study was carried out over a period of six months after obtaining approval from the Institutional Human Ethics Committee (Ref. No: GEMREC01012022). The study adhered to the ethical principles outlined in the Declaration of Helsinki and the Indian Council of Medical Research (ICMR) National Ethical Guidelines (2017).

Before enrolment, each participant received a clear explanation of the purpose and procedure of the study in their own language, and written informed consent was obtained. Confidentiality of patient details was ensured throughout data collection and analysis. Participation was voluntary, and no additional intervention or risk was introduced beyond routine anesthetic management.

Participants aged between 18 and 80 years belonging to ASA physical status I–III and undergoing diagnostic or therapeutic upper gastrointestinal endoscopy under general anesthesia with LMA Gastro™ were included. Those with anticipated difficult airway, restricted mouth opening (<2.5 cm), upper airway pathology, increased risk of aspiration, emergency cases, ASA IV and V categories, or pregnant and lactating women were excluded from the study.

All participants underwent avthorough pre-anesthetic assessment including detailed history, airway examination, and routine investigations. Standard fasting guidelines were followed. After securing intravenous access, baseline parameters such as pulse rate, systolic and diastolic blood pressure, and oxygen saturation (SpO_2) were recorded. Continuous monitoring with electrocardiography, non-invasive blood pressure, and pulse oximetry was used throughout the procedure.

Anesthesia was induced with propofol (2–2.5 mg/kg) and fentanyl (1–2 µg/kg) intravenously. Once adequate depth of anesthesia and jaw relaxation were achieved, an appropriately sized LMA Gastro™ (size 3 or 4) was inserted and its position confirmed by chest rise and capnographic waveform. The cuff was inflated and secured, allowing the endoscope to be passed through the integrated channel without airway compromise. Maintenance of anesthesia was achieved with a mixture of oxygen and air along with sevoflurane (1–2%). Muscle relaxants were not used. Hemodynamic

parameters including PR, SBP, DBP, and SpO_2 were recorded at baseline, 5 minutes after insertion, 15 minutes intraoperatively, and 5 minutes post-procedure.

At the end of the procedure, sevoflurane was discontinued, and participants were allowed to breathe spontaneously. The device was removed after the return of protective airway reflexes and adequate spontaneous ventilation. The recovery time was noted from the removal of the airway device to the time the patient obeyed verbal commands. Post-procedural monitoring was continued in the recovery room, and participants were observed for complications such as sore throat, laryngospasm, bleeding, and airway events. The endoscopist's satisfaction regarding ease of procedure and visualization was rated using a 5-point Likert scale (1–5).

All study-related parameters including demographic data, ASA grade, airway characteristics, hemodynamic readings, duration of procedure, recovery time, and postoperative outcomes were entered in a structured proforma designed for the study. Data accuracy was verified by the principal investigator. Statistical analysis was performed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Quantitative data were expressed as mean ± standard deviation (SD), and categorical data as frequency and percentage. Changes in hemodynamic parameters at different time intervals were compared using the Friedman test. The association between ASA grade or number of LMA attempts and postoperative complications was analyzed using the Chi-square test. Spearman's correlation was applied to examine the relationship between procedure duration and recovery time. Comparison of satisfaction scores between participants with and without complications was made using the Mann–Whitney U test. A p-value < 0.05 was considered statistically significant

Results

The study population had a mean age of approximately 56 years, indicating inclusion of both middle-aged and elderly participants. Males constituted nearly two-thirds of the participants, reflecting a slight male predominance. The majority of participants were classified under ASA II, suggesting that most belonged to the moderate-risk category, while only a small proportion were ASA III, denoting higher anesthetic risk. The average body mass index fell within the normal to overweight range, signifying a representative clinical distribution without extremes of obesity or undernutrition (Table 1).

Table 1. Demographics & Baseline Characteristics

Variable	**Value**
Mean Age (years)	56.15 ± 16.16
Sex	
Male	64 (63.4%)
Female	36 (35.6%)
ASA Classification	
ASA I	31 (30.7%)
ASA II	52 (51.5%)
ASA III	17 (16.8%)
Mean BMI (kg/m^2)	24.75 ± 4.55

Insertion of the LMA was successful on the first attempt in 90% of cases, with only a minimal proportion requiring multiple attempts or conversion, demonstrating excellent ease of placement and airway control. Endoscopy completion rates were high, with the majority accomplished in a single attempt, and only a few procedures requiring repetition or being cancelled. The commonly used LMA size was 3, followed by size 4, aligning with expected adult airway dimensions. The mean procedure duration was around 32 minutes, while recovery averaged under 10 minutes, reflecting short anesthetic exposure and quick emergence. The endoscopist's median satisfaction score of 4 (IQR 4–5) indicated overall favorable procedural conditions and airway stability (Table 2).

Table 2. Airway Management & Procedural Outcomes

Variable	**Value**
LMA Attempts	
1	90 (90%)
2	7 (7%)
3	1 (1.0%)
Failed	2(2.0%)
Endoscopy attempts:	
1	86 (86%)
2	7 (7%)
3	3(3%)
Cancelled	3(3%)
LMA size	
3	59 (59.0%)
4	41 (41.0%)
Procedure duration (min)	32.25 ± 17.66
Recovery time (min)	9.78 ± 2.41
Endoscopist satisfaction (Likert, median [IQR])	4.0 [IQR 4.0–5.0]

Haemodynamic trends revealed a significant yet clinically acceptable decline in pulse rate, systolic, and diastolic blood pressures following induction and during the intraoperative phase, with gradual return toward baseline in the postoperative period. These reductions were statistically significant but remained within physiologic limits, indicating stable cardiovascular dynamics under anesthesia. Oxygen saturation was consistently maintained above 99% throughout all stages, demonstrating effective oxygenation and ventilation without hypoxic episodes. Overall, the monitored parameters confirmed adequate anesthetic depth and safety during the procedure (Figure 1).

Figure 1. Haemodynamic Parameters (Pre-, Intra-, Post-operative)

The postoperative complication rate was low, with sore throat being the most common minor event (61.6%), followed by rare instances of laryngospasm and bleeding, and no airway-related emergencies. The overall complication incidence was limited to 13%, emphasizing the safety of LMA use in endoscopic procedures. Participants were mobilized within approximately two hours and resumed oral intake by four hours on average, confirming early recovery. Most participants were discharged on postoperative day 1, with very few requiring prolonged observation, indicating excellent recovery kinetics (Table 3).

Table 3. Recovery & Complications

Outcome	**Value**
Complications	
Sore throat	8 (61.6%)
Laryngospasm	2 (15.3%)
Bleed	3 (23.1%)
Any complication	13 (13%)
Discharge	
Discharge POD 1	80
POD 2	5
POD 3	6
POD 4	1
Mean time for Mobilization (hr)	2.36 ± 0.51
Mean duration for Oral intake (hr)	4.39 ± 0.70

Analysis of repeated measures demonstrated statistically significant reductions in pulse rate, systolic, and diastolic pressures during the intraoperative phase compared with preoperative values ($p < 0.001$), reflecting expected anesthetic effects. However, these changes remained clinically stable and returned toward baseline by the postoperative period. Oxygen saturation did not vary significantly across time points ($p > 0.05$), confirming maintenance of adequate oxygenation. Overall, these findings highlight hemodynamic stability under LMA anesthesia.

No statistically significant associations were observed between ASA grade and complication rate, although a trend toward higher events in ASA III participants was noted. Similarly, complications tended to be more frequent when LMA insertion required multiple attempts (≥2), yet the difference did not reach statistical significance.

Discussion

The present study evaluated the clinical performance, hemodynamic profile, recovery parameters, and complication rates associated with the use of LMA Gastro™ during upper gastrointestinal endoscopy. The findings indicate that this device provided a secure airway with minimal complications, stable hemodynamics, and high endoscopist satisfaction, demonstrating its suitability as a safe alternative to conventional methods of airway management for diagnostic and therapeutic endoscopic procedures.

In the present study, the mean age of the study population was 56.15 years, with a slight male predominance. This demographic trend is comparable to earlier endoscopy-based studies, where middle-aged adults formed the predominant group [1,2]. Most participants were classified as ASA II, reflecting moderate anesthetic risk, similar to previous observational trials using LMA devices.[4]

The LMA Gastro™ was inserted successfully on the first attempt in 90% of cases, which is consistent with the results other studies [5,6]. The device's design, including an integrated endoscope channel and separate airway lumen, facilitates easy insertion and simultaneous endoscope access. The few cases requiring more than one attempt or resulting in conversion highlight the importance of operator experience and proper size selection. In the present study, the most used sizes were 3 and 4, aligning with manufacturer guidelines for adult airway management.

Hemodynamic parameters showed a statistically significant but clinically acceptable reduction in pulse rate, systolic, and diastolic blood pressure during the intraoperative phase compared to baseline. This reduction reflects the attenuation of sympathetic stimulation due to smooth insertion without laryngoscopy or tracheal intubation. Previous studies have similarly demonstrated that LMA insertion causes minimal cardiovascular perturbation compared to endotracheal intubation [3,8]. The stability observed in this study supports the notion that supraglottic airway devices provide better hemodynamic tolerance, especially in ASA II–III participants. Notably, oxygen saturation remained consistently above 99%, confirming adequate ventilation and oxygenation throughout the procedure, like the findings of Terblanche et al. [5].

The mean procedure duration of approximately 32 minutes and recovery time under 10 minutes indicate short anesthetic exposure and rapid emergence.

Comparable studies have reported quick recovery profiles with LMA-based anesthesia due to the absence of neuromuscular blockade and lower anesthetic requirements [7]. In our cohort, the majority of participants were mobilized within 2.5 hours and resumed oral intake within 4 hours, suggesting excellent early recovery and minimal postoperative discomfort.

Complications were infrequent and minor, with sore throat (8.2%) being the most common. This rate is comparable to that reported with other second- and third-generation LMAs, such as the ProSeal and Supreme variants, where mild sore throat occurred in 5–10% of participants.[4] No airway-related adverse events or desaturation episodes were observed, underscoring the safety of LMA Gastro™ in maintaining airway patency even during shared airway procedures. The overall incidence of complication rate (12.9%) was lower than that reported with endotracheal intubation in similar settings, which is known to produce higher incidences of cough and laryngeal discomfort [10].

In the current study, ASA grade and number of LMA attempts did not show a statistically significant association with complication rates, although a trend toward higher events was noted in ASA III and multiple-attempt cases. This observation aligns with the work of Terblance et al. (2020), who found that operator experience and patient comorbidity may influence minor complication frequency without affecting major outcomes [5].

The endoscopist satisfaction scores were high, with a median rating of 4 (IQR 4–5), indicating excellent procedural conditions. Similar satisfaction levels were reported in prior studies evaluating LMA Gastro™ for upper GI procedures, where operators noted improved scope handling and visibility compared to conventional airway adjuncts [11]. The integrated design of the LMA Gastro™ minimizes airway obstruction and allows unimpeded endoscopic manipulation, thereby enhancing procedural efficiency.

Conclusion

The present prospective observational study demonstrated that the **LMA Gastro™** is a safe and effective airway device for upper gastrointestinal endoscopic procedures, offering stable hemodynamics, high first-attempt success, and excellent endoscopist satisfaction. It provided adequate oxygenation and ventilation throughout the procedure with minimal complications, most of which were minor and self-limiting. The short recovery time and early postoperative mobilization further highlight its suitability for ambulatory and day-care endoscopy. These findings support the use of LMA Gastro™ as a reliable alternative to endotracheal intubation or conventional airway adjuncts, particularly in **ASA I–III** participants undergoing short-duration procedures, ensuring both patient comfort and procedural efficiency.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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