Review Article

A new device, LMA Gastro™, on the horizon for endoscopy procedures: A narrative review

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Abstract

Interventional endoscopy procedures are challenging for anaesthesiologists due to the various patient, procedural, logistic, and position-related issues. Complex endoscopic procedures like biliary interventions and endoscopic myotomy necessitate longer procedural duration. The mode of anaesthesia is usually deep sedation without any definitive airway device and is frequently associated with hypoxemia events which can be catastrophic. An endotracheal tube, though the gold standard for securing the airway, would prolong the anaesthesia time and delay the recovery. The laryngeal mask airway Gastro™ is a novel supraglottic airway device specifically meant for these procedures as it provides access to the gastrointestinal tract simultaneously with a patent airway. Though its purported advantages are undoubted, its clinical usage has various pitfalls that can hinder its wider acceptance and practical utility, especially when newly introduced. The literature is limited on the feasibility of this device in both the ease of endoscopy and the prevention of hypoxemia. In this review, we have discussed the device's properties, its varied use cases, the supporting evidence for the same, the caveats, and the future perspectives.

Keywords: Airway obstruction, anaesthesia, cholangiopancreatography, deep sedation, endoscopic retrograde, endoscopy, gastrointestinal, hypoxia, laryngeal masks

Introduction

Upper gastrointestinal endoscopy is a commonly done medical procedure worldwide. In 2009, an estimated 6.9 million upper, 11.5 million lower, and around 220,000 biliary endoscopies were performed in the United States.[1] Sedation or monitored anaesthesia care with propofol is considered a safe technique. But, one large prospective multi-center observational study of 2132 patients reported a high rate of significant unplanned events in 23% of patients undergoing gastrointestinal endoscopy with propofol sedation, including a significant cardiorespiratory event in 18%.[2] As the complexity of interventional upper gastroduodenal endoscopic procedures increases and as the patient population ages, there became a need for securing the airway during these interventions to avoid respiratory complications.

The laryngeal mask airway (LMA) Gastro™ Airway (Teleflex Medical, Athlone, Ireland) was specifically developed for upper gastrointestinal endoscopy by Dr. M. Skinner.[3] The unique feature of the LMA Gastro™ Airway is a dedicated endoscopy channel of 16 mm internal diameter, which runs parallel to the separate airway channel with the terminal cuff. This endoscopy channel ends at the cuff's distal tip to align with the upper esophageal entrance. The LMA Gastro™ Airway enabled esophageal intervention whilst providing a

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secure airway for positive pressure ventilation with clinically satisfactory seal pressures. In this review, we will discuss the device's properties, its varied use cases, the supporting evidence for the same, the pitfalls and caveats, and the future perspectives.

Search Strategy

This narrative review has been compiled from the evidence collected from various electronic databases like Google scholar©, Embase©, Medline©, Scopus©, and PubMed©. Various combinations of relevant search terms like 'LMA gastro', 'upper gastrointestinal endoscopy', 'ERCP', 'transesophageal echocardiography', and 'tracheobronchoscopy' were searched in the title and abstract. A total of 60 results were obtained in this search. Abstracts of shortlisted papers available in the English language were read, and relevant papers were identified for full manuscript reading. References of all identified papers were scrutinised to explore any of the articles which would have inadvertently got missed during the literature search. Details of relevant randomised controlled articles assessing the usage of LMA Gastro in at least one arm are summarised in tabular form.

Device Description

Design features

LMA Gastro™ Cuff Pilot is a specialised second-generation supraglottic airway device. It has a dual channel, one for the airway and the other for gastric access that allows simultaneous ventilation of the lungs and access to the upper gastrointestinal tract. LMA Gastro™ is supplied sterile (sterilised by ethylene oxide) for single use only. The anatomically shaped airway tube ends distally at the laryngeal mask. The inflatable cuff conforms to the contours of the hypopharynx, with the bowl and the mask facing the laryngeal inlet [Figure 1].

LMA Gastro™ has a 16 mm ID endoscope channel which runs parallel to the airway tube. The endoscope channel ends at the cuff distal tip which communicates distally with the upper esophageal sphincter. It has a built-in bite block to prevent damage to the endoscope and to prevent obstruction of the airway tube. It has an adjustable holder and strap fixation system for securing it [Figure 1]. The various device specifications and size selections of LMA Gastro™ have been mentioned in Table 1.

The inflation system consists of an inflation line with Cuff Pilot technology. This enables continuous visualisation of pressure inside the mask cuff. It is used in the same way as a pilot balloon for cuff inflation and deflation. This is magnetic resonance (MR) safe, enabling use in magnetic resonance imaging (MRI) suites when required.

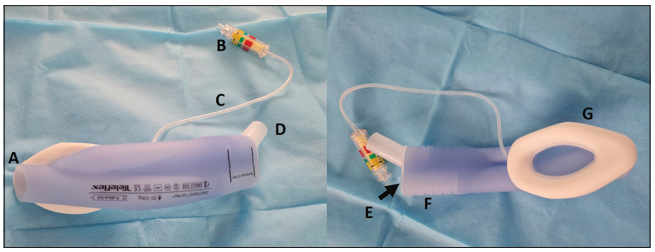

Figure 1: LMA Gastro front and back view. A: endoscope channel exit; B: cuff pressure valve; C: inflation line; D: connector; E: endoscope port; F: bite block and G: cuff

Table 1: Device Specifications and size determination

	Size 3	Size 4	Size 5
Airway connector		15 mm male	
Inflation valve		Luer cone	
The internal volume of the ventilatory pathway	15 ml	15 ml	20 ml
The nominal length of the internal ventilatory pathway	16 cm	17 cm	18 cm
The nominal length of the internal endoscope pathway	18 cm	20 cm	22 cm
Cuff pressure maximum	60 cm H2O	60 cm H2O	60 cm H2O
Min. interdental gap	24 mm	28 mm	28 mm
Max. endoscope size (OD)	14 mm	14 mm	14 mm
Patient Weight (Kg)	30– 50	50– 70	70– 100

Steps for device insertion

1. Lubricate the posterior surface of the LMA with water-based lubricant gel.
2. Insertion can be done in a supine or lateral position.
3. Pass the strap underneath the patient's head.
4. Position the holder over the bite block section such that the flat surface of the flange faces towards the patient.
5. Maintain the head in a neutral position.
6. Press the distal tip against the inner aspect of the upper teeth or gums.
7. Slide the device inwards by a slightly diagonal approach (direct the tip away from the midline).
8. Continue to slide inwards rotating the hand in a circular motion so that the device follows the curvature behind the tongue.
9. Resistance should be felt when the distal end of the device reaches the upper oesophageal sphincter.
10. The holder's position can be adjusted using two fingers while holding onto the device.
11. Secure the device with an adjustable holder and strap.

The cuff should be inflated with sufficient air to prevent a leak with positive pressure ventilation, but it must not exceed the

Table 2: Summary of evidence (Table to summarize evidence) Use for diagnostic endoscopy

Ref no	Author name	Study type	Procedure	Outcome	Result
(3)	N. C. S. Terblanche *et al.*	Prospective open-label observational study (n=292)	ASA physical status classification 1 and 2 patients at low risk of pulmonary aspiration undergoing upper gastrointestinal endoscopy received intravenous propofol anaesthesia and standardised insertion of the LMA Gastro Airway. Outcomes included insertion success, first attempt success, and ease of endoscope insertion. LMA Gastro Airway outcomes included insertion success, first attempt success, ease of insertion, lowest oxygen saturation, airway compromise, laryngospasm, blood-stained device, and sore throat	Per protocol analysis, the endoscopy success rate amongst the cohort with successful LMA Gastro Airway insertion was 99% [95% confidence interval (CI): 98, 100]. The LMA Gastro Airway insertion success rate (n=292) was 99% (95% CI: 98, 100). For endoscopy and LMA Gastro Airway insertion success, the lower limit of the 95% CIs was at least 98%, indicating LMA Gastro Airway efficacy. The median (inter-quartile range) lowest intraoperative oxygen saturation was 98% (98, 99). Only one serious adverse event occurred (re-admission for sore throat and inability to tolerate fluids)	The LMA Gastro Airway appears effective for clinical use in upper gastrointestinal endoscopy.

maximum cuff pressure. If no manometer is available, inflate with just enough air to achieve a seal sufficient to permit ventilation without leaks.

Endoscope insertion

The endoscope channel facilitates the insertion of an endoscope without the need for adjustments using the controls of the endoscope. For gastroscopy procedures, the endoscopic device can be moved along the channel using normal forward vision. The oesophagus may collapse, causing occlusion on the distal end of the port, and with gentle advancement, the endoscope will pass into the oesophagus.

Correct position

Correct placement produces a leak-free seal against the glottis. Upon successful insertion, ventilation and seal pressure should be tested at 20 cm H_2O, with the Cuff Pilot Cuff Pressure Valve in the Green. The holder's underside should be flush against the patient's lips and not pressing against it, with the holder engaged to one pair of the grooves.

Use of the endoscope channel

The endoscope channel can be used to advance the endoscope into the oesophagus directly or to provide a separate conduit from and to the alimentary tract, enabling the egress of gases or liquids from the patient.

Upon insertion, some resistance may be felt as the endoscope is passed through the device. The use of excessive force is not recommended. If an appropriate-size endoscope cannot be passed, it indicates that the device is kinked or wrongly positioned. Flexing the endoscope that may be too large for the patient will trap the endoscope. If that happens, the LMA is gently withdrawn a little or repositioned.

The intra-cuff pressure may rise slightly once the endoscope has been inserted due to the direct pressure applied internally on the cuff. The cuff pressure should be monitored to ensure that it does not exceed the maximum recommended cuff pressure.

Indications

- Diagnostic upper gastrointestinal endoscopy
- Interventional upper gastrointestinal procedures (e.g., peroral endoscopic myotomies, percutaneous endoscopic gastrostomies, endoscopic submucosal dissection)
- Endoscopic retrograde cholangiopancreatography (ERCP)
- Trans-oesophageal echocardiography (TEE)
- Combined bronchoscopy and gastroscopy
- Patients with prior experience of poor tolerance to endoscopic procedures under sedation.

Contraindications

- Radiotherapy to the neck (owing to the mucositis or fibrosis) as there is a risk of trauma and/or a potential failure to seal effectively.
- Patients with restricted mouth opening to facilitate device insertion.
- Patients at risk of massive gastric regurgitation due to conditions such as acute intestinal obstruction or ileus.
- Patients who have not fasted or patients whose fasting status cannot be confirmed.
- Patients with poor lung compliance or peak insufflation pressure anticipated to exceed 20 cm H_2O because the device forms a low-pressure seal (approximately 20 cm H_2O) around the larynx.
- Adult patients who are unable to understand instructions or who cannot provide adequate disease history.

Discussion

Device usage and evidence [Tables 2–6]

1. Use in diagnostic upper GI endoscopy:

The primary stated indication for LMA Gastro is upper GI endoscopy. Terblanche *et al.*[4] in their prospective open-label

Table 3: Use for ERCP

Ref no	Author name	Study type	Procedure	Intervention	Control	Outcome	result
(4)	Luca Aiello *et al*.	Retrospective descriptive and anonymous study design. (n=14)	Data for this retrospective analysis were derived from the difficult airway database collected prospectively from June 2018 to September 2018 at a general community hospital. The study outcomes included insertion success, first attempt success, airway compromise, laryngospasm, blood-stained device, and sore throat.	-	-	The insertion success rate was 100% with a first-attempt success rate of 100%. No airway compromise or laryngospasm or bloodstains on the device were observed. Only one patient experienced a transient sore throat. The endoscopy was performed successfully in all patients.	LMA Gastro Airway Cuff Pilot appears safe and effective for clinical use in upper gastrointestinal endoscopy
(5)	M W Skinner *et al*.	Case reports (n=2)	Two patients posted for ERCP, one with BMI of 24 and the other with BMI of 35 kg/m^2, underwent the procedure with LMA Gastro which was inserted after induction with fentanyl and propofol.	-	-	Both procedures were uneventful with no complications	LMA Gastro may provide an additional safe alternate approach for endoscopic procedures.
(6)	Harun Uysal *et al*.	Prospective randomised observational trial (n=103)	Patients posted for ERCP without high risk of aspiration were included. Patients were randomly allocated to the LMA Gastro and GLT groups. The primary study outcomes were the comparison of the two SGADs in terms of oropharyngeal leak pressure (OLP). The secondary study outcome was SGAD-related adverse events.	The device was inserted as per manufacturer's recommendation. Then the cuff was inflated to a pressure of 60 cmH2O.	The device was inserted as per manufacturer's recommendation. Then the cuff was inflated to a pressure of 60 cmH2O. a	The rate of successful insertion at first attempt was 72% in GLT and 96% in LMA Gastro (P=0.004). The mean OLP of LMA Gastro Group (31.8 cmH2O) was significantly higher than that of the GLT Group (26.5 cmH2O) (P=0.0001). However, endoscopists' satisfaction was higher in GLT (P=0.0001). Mucosal damage and sore throat were lower in LMA Gastro Group.	LMA® Gastro™ is superior to GLT with its easier insertion and low rate of associated complications. It also provides better ventilation efficiency. It is evident that the LMA® Gastro™ is superior in terms of patient safety. On the other hand, GLT provides a better environment for duodenoscope insertion and manoeuvres.
(7)	Andre tran *et al*.	Retrospective observational analysis (n=177)	LMA GASTRO vs. sedation with low-flow nasal cannula vs general anaesthesia (GA) with an endotracheal tube (ETT) from March 2017 to June 2018. Outcomes analysed were hypoxia defined as any SpO_2 <92%, requirement of conversion to endotracheal tube, blood pressure control with vasopressors/inotropes/ vagolytics, incidence of adverse intraoperative and postoperative (PACU) events and ERCP failure. Airway was employed in a total of 64 procedures (36%); 85 (48%) procedures were done with sedation and 28 (15%) procedures required GA with an endotracheal tube	LMA Gastro	Low-flow nasal canula vs GA with ETT insertion	LMA Gastro Airway was used as the primary airway device in 63, and in one instance, it was used as a rescue airway intervention for a failed sedation technique. Of the 64 procedures, ERCP was successfully completed with LMA Gastro Airway in 63 (98%) instances, with only one requiring conversion to an endotracheal tube due to difficulty in negotiating the endoscope through LMA Gastro Airway. Adverse intra- operative events were recognised in 2 cases. One patient had minimal blood-stained secretions in the oral cavity that	In patients undergoing ERCP, the LMA Gastro Airway demonstrated a high success rate of ERCP completion. Ventilation was well maintained with minimal intraoperative and postoperative adverse events. While the technique may not be required for low-risk patients, it may have a role in high-risk groups such as high ASA status, high BMI, and those with known or suspected sleep apnoea.

Contd...

Table 3: Contd...

Ref no	Author name	Study type	Procedure	Intervention	Control	Outcome	result
						resolved with suctioning, and the other patient had mild laryngospasm which resolved on its own within a few minutes. Two patients were noted to have adverse events in PACU. Laryngospasm resolving within a few minutes was noted in one, whilst another patient developed significant abdominal pain treated with a proton-pump inhibitor and an anti-emetic. No major airway interventions were noted in PACU. Similar to LMA Gastro, one case required airway conversion to ETT in the context of apnoeic episodes on nasal specs. There was a high incidence of intraoperative events in the sedation group in the setting of bronchospasm, epistaxis, desaturation and bradycardia HR 30–35. Like the LMA Gastro group, the 2 ERCP failures in the low-flow cannula group also related to procedural difficulty. The majority of ETT cases were emergency procedures needing rapid sequence intubation. A large number of the 28 ETT cases were flagged as extremely high-risk procedures pre-operatively relating to aspiration risk and airway difficulty, poor oxygen saturation below 95% at baseline, likely extended duration of anaesthesia and prolonged ventilation or airway protection postoperatively, and one case of severe autism requiring general anaesthesia. Of note in PACU, 1 ETT case had a minor desaturation to 94%, another case required ongoing intubation and extended inotropic support, and another demonstrated multiple apnoeic episodes in recovery.	

Contd...

Table 3: Contd...

Ref no	Author name	Study type	Procedure	Intervention	Control	Outcome	result
(8)	Katherine B Hagan *et al.*	Prospective observational study (n=30)	Adult patients (≥18 years old) scheduled for elective ERCP with total intravenous anaesthesia (TIVA) were enrolled. The number of attempts and time to successful supraglottic airway (SGA) placement, vital signs, peripheral oxygen saturation (Spo2), median end-tidal CO2, practitioner satisfaction, and any complications were the outcomes assessed.			The overall rate of successful SGA placement within 3 attempts was 96.7% (95% CI, 82.8–99.9) or 29/30. The rate of successful ERCP with SGA placement within 3 attempts was 93.3% (95% CI, 77.9–99.2) or 28/30. Both the gastroenterologist and anaesthesiologist reported satisfaction with the device in 90% of the cases (in 66.7% of the cases, both the anaesthesiologist and gastroenterologist scored the device a 7/7 for satisfaction). Patients maintained an Spo2 of 95–100% from induction to discharge, with the exception of 1 patient who had an Spo2 of 93%. The median end-tidal CO2 during the procedure for all patients was 35 mm Hg. Observed aspiration did not occur in any patient. Symptoms of hoarseness (13.3%), mouth soreness (6.7%), sore throat (6.6%), and minor bleeding/cuts/redness/change in taste to the tongue (3.3%) were determined through patient questioning before post-anaesthesia care unit (PACU) discharge.	LMA Gastro might be a safe alternative for ERCP procedures with a high level of practitioner satisfaction.

observational study found a 99% success rate with LMA Gastro insertion and a 99% success rate with the endoscopic procedure with only three patients (1%) showing endoscopic failure. Ninety six percent of endoscopists reported easy endoscope insertion in this study with only one patient having intraprocedural hypoxia compared to 2–70% incidence of hypoxia seen with sedation techniques. These results demonstrate a robust safety profile, excellent ease of insertion, high endoscopy success rates, and superior endoscopists' satisfaction levels with LMA Gastro compared to just propofol sedation [Table 2].

2. Use in ERCP

Aiello *et al.*[5] in their pioneering study on the use of LMA Gastro in ERCP patients demonstrated an excellent safety profile with an insertion success rate of 100% with a first attempt success rate of 100%. The endoscopy was successfully performed in all patients. Uysal *et al.*[6] compared LMA gastro with the gastro-laryngeal tube (GLT) in patients posted for ERCP and found that LMA Gastro is superior in terms of patient safety. On the other hand, GLT provides a better environment for duodenoscope insertion and manoeuvring. Tran *et al.*,[7] in their retrospective observational study of 177 patients comparing LMA Gastro with sedation using a nasal cannula and GA using endotracheal intubation, found that in patients undergoing ERCP, the LMA Gastro demonstrated a high success rate of ERCP completion. They concluded that while the technique may not be required for low-risk patients, it may have a role in high-risk groups such

Table 4: Use in complicated GIE in patients with complex comorbidity

Ref no	Author name	Study type	Procedure	Intervention	Control	Outcome	result
(9)	Axel Schmutz *et al.*	Retrospective cohort study (n=214)	Patients who received anaesthesia for gastroenterological interventions. There were 7 endoscopic retrograde cholangiopancreatographies, 7 peroral endoscopic myotomies, 5 percutaneous endoscopic gastrostomies and 12 other complex procedures (e.g., endoscopic submucosal dissection, esophageal stent placement etc.). Inclusion criteria were upper gastrointestinal endoscopic interventions, airway management with LMA Gastro™ and ASA status ≥3. The primary outcome measure was the successful use of LMA Gastro for airway management and endoscopic intervention.			Thirty-one patients with ASA physical status ≥3, undergoing complex and prolonged upper gastrointestinal endoscopic procedures, were included. Of these, 27 patients were managed successfully using the LMA Gastro. Placement of the LMA Gastro was reported as easy. Positive pressure ventilation was performed without difficulty. The feasibility of the LMA Gastro for endoscopic intervention was rated excellent by the endoscopists. In four patients, placement or ventilation with LMA Gastro™ was not possible.	This study demonstrated the feasibility of the LMA Gastro during general anaesthesia for advanced endoscopic procedures in high-risk patients.

Table 5: Use in children

Ref no	Author name	Study type	Procedure	Outcome	result
(10)	Charlotte Taylor *et al.*	Prospective observational study (n=55)	Following the initial education session, the LMA Gastro devices were made freely available for the anaesthetists to use, should they elect to do so. The primary anaesthetist was asked to complete a standardised paper audit form prospectively. Success rate, first attempt success, ease of use, and endoscopy rates were the outcomes analysed.	55 patients, the LMA Gastro provided an adequate airway in 52 (94.5%). Forty-six (88.5%) were sited on the first attempt, and 50 (96.2%) insertions were rated 'easy' by the anaesthetist. Aside from three insertion failures, there were no airway events. The endoscopy success rate was 100% in the 52 patients who had an LMA Gastro airway successfully inserted. First-pass oesophageal access was achieved in 51 (98%) cases, and 100% of insertions were rated 'easy' by the gastroenterologist.	High success rate with LMA gastro.
(11)	Mohammed Hakkim *et al.*	Randomized study (n=200)	Patients less than 21 years of age and weighing more than 30 kg were randomised to receive airway management with one of the two SGD [LMA gastro (LG) vs Ambu Aura (AA) Once] during EGD. After anaesthetic induction and successful LMA placement, the intracuff pressure of the LMAs was continuously monitored during the procedure. The primary outcome was the change of intracuff pressure of the LMAs	There was no difference in the intracuff pressure over the first 5 minutes after anaesthetic induction and before endoscope insertion (43±14 cmH2O with the LG cohort versus 38±14 with the AA). The maximum change in intracuff pressure was less with the LG (7±7 cmH2O versus 9±8 cmH2O, P=0.045) than with the AA. There was no difference in the number of cases with an intracuff pressure ≥60 cmH2O at any time during the case between the two groups	The LMA Gastro Airway blunted but did not prevent an increase in intracuff pressure during EGD when compared to the Ambu AuraOnce LMA. Throat soreness was generally low, and complications were infrequent in both groups. The ease of the procedure was slightly improved with the LMA Gastro Airway compared to the Ambu AuraOnce LMA.

as higher American Society of Anesthesiologists (ASA) status, high body mass index (BMI), and those with known or suspected sleep apnoea. Katherine B Hagan,[8] in their prospective observational study, concluded that LMA Gastro might be a safe alternative for ERCP procedures with a high level of practitioner satisfaction [Table 3 and Figure 2].

3. Use in complicated GIE in patients with complex co-morbidity

With advancements in endoscopic techniques and miniaturising of equipment, diseases that warrant open surgical repair are increasingly being done by the endoscopic route on a daycare basis. These include peroral endoscopic myotomies, percutaneous endoscopic gastrostomies, endoscopic submucosal dissection, oesophageal stent placement, and so on. Schumtz *et al.*[9] performed a retrospective cohort study demonstrating the feasibility of the LMA Gastro during general anaesthesia for the above-mentioned advanced endoscopic procedures in high-risk patients [Table 4].

4. Use in paediatric cases

LMA Gastro had been used in paediatric cases with size 3 being used in children weighing between 30 and 50 kg. Taylor *et al.*[10] in their prospective observational study were able to secure LMA

Table 6: Accessory uses: Oesophageal echocardiography

Ref no	Author name	Study type	Procedure	Outcome	Result
(12)	Sarah Saxena *et al.*	A prospective observational study (n=9)	9 patients posted for percutaneous foramen ovale closures were prepared for our anaesthetic technique by lubricating the inside of a transparent TEE probe cover utilising a gel-filled syringe. The TEE probe was then inserted into the cover. We used the same gel-filled syringe to slightly lubricate the channel for oesophageal intubation of the LMA Gastro. Before inserting the SAD into the patient's airway, we slid the TEE probe into the lubricated channel to ensure its smooth passage.	All patients had successful insertion of a TEE probe in the channel for oesophageal intubation of the LMA Gastro	Novel study to report the successful use of LMA Gastro for TEE

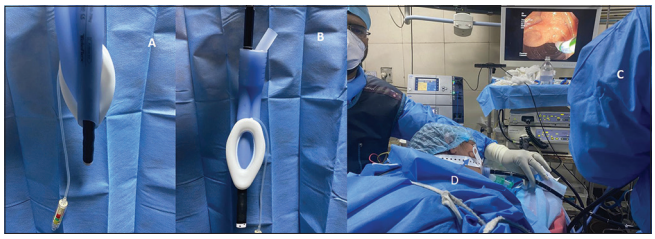

Figure 2: LMA Gastro with an endoscope *in situ* back view (A) and front view (B); ERCP being done in lateral position with LMA Gastro inserted and endoscopist (C) doing the procedure in the patient (D)

Gastro in 52 out of 55 patients with no significant airway-related adverse events with 100% endoscopic success rate. Hakim *et al.*[11] in their randomised trial compared LMA Gastro with Ambu Aura Once for oesophagogastroduodenoscopy and found that the LMA Gastro Airway blunted but did not prevent an increase in intracuff pressure during oesophagogastroduodenoscopy when compared to the Ambu Aura Once LMA. Throat soreness was generally low, and complications were infrequent in both groups. The ease of the procedure was slightly improved with the LMA Gastro Airway compared to the Ambu Aura Once supraglottic device [Table 5].

5. Accessory uses: Oesophageal echocardiography

Trans-oesophageal echocardiography (TEE) is yet another diagnostic modality which came into practice quite recently. Saxena *et al.*[12] performed a prospective observational study wherein they successfully used LMA Gastro in nine patients posted for percutaneous patent foramen ovale closure. All patients had successful insertion of a TEE probe in the channel for the oesophageal channel of the LMA Gastro [Table 6].

Use of LMA Gastro in special circumstances

COVID-19 pandemic

Thiruvenkatarajan *et al.*[13] in their letter to the editor listed the plausible benefits of LMA Gastro in the coronavirus disease (COVID-19) pandemic situation.

LMA Gastro with a viral filter with a leak-free seal under general anaesthesia will provide an excellent conduit for complex gastrointestinal interventions such as an ERCP for biliary obstruction/sepsis in patients without aspiration/difficult airway risk. The device has a high insertion success rate (99%) and a low (1%) endoscopy failure rate with a low incidence of serious adverse events. No data suggest that the LMA Gastro technique is safer than routine sedation techniques with an open airway in asymptomatic COVID-19 patients. However, the near-perfect seal would enable LMA Gastro to be a much more favourable option. Also, since it is a second-generation supraglottic airway device (SAD), it provides higher seal pressures during assisted ventilation and subsequently reduces viral aerosolisation. Additionally, it avoids the need for airway manipulation (e.g. chin lift, jaw thrust). It also negates patient movement and cough during the intervention and facilitates smooth emergence (compared with endotracheal tube).

Problems associated with LMA Gastro

A. The LMA Gastro size starts from 3, which is recommended for patients weighing more than 30 kg, restricting their use in children less than 30 kg, who might benefit the most from the device owing to their poor tolerance for gastrointestinal procedures under sedation.
B. Inability to pass endoscopes larger than 14 mm as the endoscope channel comes in 16 mm internal diameter.
C. In many cases, the endoscopists find it difficult to introduce the side-viewing interventional endoscope through the conduit of the device and face trouble during the rotational movements at the time of intervention.
D. Collapse of the oesophagus, causing an obstruction for passage of the endoscope at the distal tip.

Future perspectives

1. A few design modifications may reduce the procedural difficulty encountered by endoscopists.[14] One suggestion is to broaden the endoscopy channel, but this may not be feasible due to the limitations of pharyngeal volume. Since most resistance is felt at the distal opening of the endoscope channel at its tip, the opening can be made oblong to increase its cross-sectional area. The provision of a flap at the distal dorsal wall of the LMA Gastro airway may also allow easy passage of the endoscope. Alternatively, ribs can be used to strengthen the distal end to prevent its compression against the pharynx, which further compromises the lumen available.

2. Paul Zilberman *et al*.[15] performed a bench test, comprising two phases, with a modification of the standard LMA Gastro to facilitate easy passage of the duodenoscope via the channel. During phase 1, LMA was used as per the manufacturer's recommendation and the endoscopists inserted the scope during the endoscopic channel, whilst the anaesthetists held the airway device in place. By slowly threading the duodenoscope down through the gastro channel, they located the "knee" of the LMA to be the point of maximum friction. During phase 2, they made a longitudinal cut from above the "knee" along the length of the gastro channel, resulting in a "U"-shaped configuration. With this, the endoscopist reported a smooth and effortless passage of the scope. They concluded that the modification facilitates the insertion of any duodenoscope through the LMA.
3. Another desirable modification of the LMA Gastro airway would be to make the airway tube bigger so as to allow an endotracheal tube to pass through it, in case of a need of securing the airway emergently during the procedure, especially in non-supine positions. There is also a need to reconsider the design and material of the adjustable holder for securing it in place as in most cases, it presses on the lips and its projections may injure them if proper padding is not applied.
4. Smaller-size LMA Gastro (size < 3) for use in children less than 30 kg would be desirable as it can provide a safe conduit for oesophagogastroduodenoscopy in children who would not tolerate those procedures under sedation and would require advanced airway frequently due to poor functional reserve.
5. Simulation-based training of the endoscopists in a life-like mannequin will help the operators to get acquainted with the device and help them develop endoscope navigation skills through the LMA Gastro and the rotational manoeuvres needed to do interventional procedures prior to its clinical use.

Conclusion

Interventional endoscopic procedures are becoming increasingly complex. The depth of sedation required for completing these lengthy procedures, non-supine positions, restrictions imposed by the fluoroscopy machine and table, non-operation room settings, sharing of the airway, and high-risk profiles of patients undergoing these procedures make the conditions particularly challenging for the anaesthesiologist as sedation-related respiratory events are rather frequent. LGA is a specialised supraglottic airway meant for endoscopy procedures which provides the benefit of a secure airway while minimally delaying patient recovery. LMA Gastro provides a safe, reliable, and economical alternative for performing upper gastrointestinal endoscopic procedures by securing the airway whilst ensuring a separate endoscopic channel for scope insertion and manoeuvring to reduce the risk of airway displacement. This has been successfully tested in varied clinical scenarios with some caveats. Though it can be routinely used for gastroduodenoscopies, the literature supporting its use for ERCP is scanty. Further randomised studies with robust designs and some device modifications might be awaited for definitive recommendations. However, the potential patient safety benefits justify further investigations into the device in future. Its usage in tracheobronchoscopy and TEE procedure needs further clinical studies to provide meaningful commentaries.

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Conflicts of interest
There are no conflicts of interest.

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