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Prospective Evaluation of Reinforced Laryngeal Mask Airway Use in Ambulatory Facial Aesthetic Surgery: A Clinician-Led Innovation in Airway Management

Ehsan Ahmad, Ahmad Naseem, Abdullah Al-Qahtani

ABSTRACT:

Objective: To prospectively evaluate the safety, ergonomic advantages, and team-centred workflow impact of the reinforced laryngeal mask airway in ambulatory facial aesthetic surgery.

Study Design and Setting: A single-centre prospective observational study conducted at Care Medical Centre, Riyadh, Saudi Arabia, from 1st July–31st December 2025.

Methodology: One hundred and ten ASA I–II adult patients undergoing elective facial aesthetic procedures (submental liposuction, blepharoplasty, lip lift) were managed with reinforced laryngeal mask airway under general anaesthesia without neuromuscular blockade. Primary outcomes included RLMA placement success, need for intraoperative airway adjustment, and airway-related adverse events. Secondary outcomes included recovery time and structured surgical-team satisfaction using a 5-point Likert scale..

Results: Reinforced laryngeal mask airway placement succeeded on the first attempt in 100% of cases. Minor repositioning was required in 14 patients (12.7%). No hypoxia (SpO2 <94%), laryngospasm, regurgitation, or aspiration occurred. No conversion to endotracheal intubation was necessary. Mean discharge time from post anaesthesia care unit was 2.3 ± 0.4 hours. Staff satisfaction scores were high: surgical access (4.7/5), airway stability (4.6/5), and workflow facilitation (4.5/5).

Conclusion: The reinforced laryngeal mask airway is a safe, highly effective, and workflow-enhancing airway choice for ambulatory facial cosmetic surgery. Its flexible design ensures unobstructed surgical access without the need for neuromuscular blockade. This prospective cohort provides systematic evidence supporting the use of RLMA in selected facial aesthetic procedures and highlights the value of clinician-led innovation in perioperative care.

Keywords: Ambulatory Surgical Procedures; Airway Management; Anaesthesia, General; Laryngeal Masks; Patient Satisfaction; Post-anaesthesia Care Units.

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INTRODUCTION:

The demand for minimally invasive facial plastic surgery has grown worldwide, highlighting the importance of efficient, clinically safe and well-tolerated anaesthesia techniques.[1] Procedures such as blepharoplasty, lip shortening (lip lift), submental (chin) liposuction are routinely performed in daycare units, offering swift recovery, improved comfort and a smooth, well-tolerated peri-operative experience.[2]

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Although these surgeries are brief and considered minor procedures, they require unobstructed access to the submental area, including chin, neck, eyelids, lower face and peri-oral structures. Due to these precise prerequisites, airway management is considered a prime and critical element for successful surgeries, overall ergonomic practice and patient safety.[3]

For these specific facial procedures, traditional airway management techniques have inherent limitations. Simple face mask ventilation is easy and non-invasive, but it clearly interferes with access to the surgical field.[4] In order to maintain face mask ventilation, the anaesthesia provider needs to hold it manually for the entire procedure, encroaching on the operative field, hindering the drapes or causing contamination. These problems are more pronounced for lipo chin, which requires unobstructed access to the anterior neck and lip lift, which cannot be performed with mask ventilation.

Endotracheal intubation (ETT) is a safe and reliable airway management technique, but it is overly invasive for short-duration procedures. Intubation also requires direct

laryngoscopy, which unnecessarily causes sympathetic stimulation during these procedures. It can also cause trauma to the airway or post-anaesthetic sore throat. Another important clinical factor is that intubation requires neuromuscular blocking agents, which are not indicated for facial plastic procedures such as blepharoplasty or lip lift.[5] In addition, ETT use may prolong emergence time and postanaesthetic recovery.[6]

The reinforced laryngeal mask airway (RLMA) can be considered a reliable clinical alternative airway management strategy that balances the two extremes of mask ventilation and ETT use.[7] What distinguishes RLMA from other LMAs is its wire-reinforced, kink-resistant shaft, which allows 360 degrees of flexible securing of the device without compromising airway patency.[8,9] These structural characteristics of RLMA enable anaesthesia providers to secure and position the RLMA laterally, caudally or superiorly depending upon the type of facial procedure and surgical access. This flexibility gives both the anaesthetist and the surgeon the freedom and safety to maintain the sterile surgical field, minimise airway adjustments and facilitate uninterrupted access to facial regions, e.g., eyes, submental and anterior neck regions.[10]

Despite known clinical and safety advantages, the use of RLMA in facial plastic procedures is sparse. The use of RLMA is well-known in ENT, dental, ophthalmic and oral maxillofacial surgeries, yet existing evidence is limited to small case series and retrospective analysis. Prospective data specifically related to plastic and cosmetic facial surgeries is lacking, which indicates a significant clinical gap considering the growing number of daycare plastic surgical loads globally and the demand for minimally invasive airway management compatible with these procedures.[11]

The present study aims to address this clinical gap by evaluating the use of RLMA in a daycare plastic surgery centre. This study used a cohort of 110 patients. It was not conducted to promote any device, but it arose from the need for patient safety and clinician-led innovation.[12] The attributes leading to change in practice included difficulty maintaining facemask ventilation, restricted surgical access and unnecessary intubation. A pilot project of RLMA use in selected patients yielded early positive results, paving the way for wider adoption. Positive feedback from surgeons and nursing staff reinforced the perception of improved field visibility, fewer procedural interruptions and efficient workflow.[13]

The process of adopting RLMA use is in accordance with the established change management models. The Kotter's 8 steps model encourages problem identification, pilot testing and reinforcement through early success.[14] The Rogers' Diffusion of Innovation theory explains how RLMA use transitioned from an experimental clinical tool to routine practice. From clarity point of view, these change management models are not the primary focus of this study.

This study prospectively assesses the clinical performance of RLMA, its safety, impact on surgical access, intraoperative stability and team satisfaction. This study marks itself as first prospective cohort using RLMA in this specific surgical context by incorporating clinical outcomes and clinician-led adoption in selected patients.[15]

METHODOLOGY:

This prospective observational study was conducted at Care Medical Centre, a specialised plastic surgery centre in Riyadh, Saudi Arabia, from 1st July to 31st December, 2025. All surgeries were performed under consultant supervision and in accordance with the international perioperative safety protocols. This study was purposefully designed to evaluate the clinical performance, patient safety and impact on operating room workflow by using airway RLMA as the primary airway device for submental liposuction, upper and lower blepharoplasty, and lip lift surgeries.

The ethical review committee of CMC granted ethical approval (ERC Reference Number: ERC/CMC/2025/020). All patients provided written informed consent. The study followed the principles of the Declaration of Helsinki (2013 revision). The data was anonymised and non-identifiable and no additional interventions beyond routine clinical care were performed.

All eligible patients were adults aged =18 years with ASA physical status I–II who were scheduled for elective facial aesthetic surgery, including submental liposuction, blepharoplasty, or lip lift. All included patients had a planned use of a reinforced laryngeal mask airway (RLMA) for primary airway management and provided informed consent before enrolment.

Patients were excluded if they had ASA physical status III–IV, an anticipated difficult airway (e.g., Mallampati IV, restricted mouth opening, or limited neck mobility), active gastro-oesophageal reflux disease or increased aspiration risk, a recent upper respiratory infection, or a body mass index (BMI) > 35 kg/m². Emergency procedures were also excluded. These eligibility criteria reflect standard safety considerations for the use of supraglottic airways in elective ambulatory settings.

All patients were assessed preoperatively by a consultant anaesthesiologist. Standard monitoring, like ECG, non-invasive blood pressure, pulse oximetry, and capnography, was applied following induction and maintained throughout the procedure. Anaesthesia was induced intravenously using intravenous Propofol 1.5–2.5 mg/kg and Fentanyl 1–2 µg/kg for analgesia**.** No neuromuscular blockers were administered, as muscle relaxation is not required for these facial aesthetic procedures.

After the patients were adequately deep under anaesthesia, an RLMA was inserted. The wire-reinforced and kink-

resistant shaft of the RLMA was secured with tape on the forehead, lateral cheek or over the chin, depending on the type of surgical procedure. This ensured clear access to the surgical field, sterile draping and absence of traction or displacement during head movements. Correct placement of the RLMA was confirmed by a regular, equal chest rise, a capnography trace and normal ventilation pressures. Patients were maintained on spontaneous breathing or assisted mandatory ventilation. Anaesthesia was maintained with sevoflurane in a 50/50 O_2/air mixture. There was no case where RLMA was switched to endotracheal intubation.

A structured data sheet was used to collect the data for each case. The variables recorded included patient demographics, ASA classification, RLMA insertion success, number of attempts, need for RLMA adjustment during the procedure or any airway-related adverse events. The incidence of hypoxia (SpO2 < 94%), laryngospasm, regurgitation, or aspiration was recorded. Total time for anaesthesia, surgery and post-anaesthesia care unit was also recorded. Perioperative teams completed a postoperative 5-point Likert satisfaction survey, evaluating: 1. Airway stability 2. Surgical field accessibility 3. Ergonomic workflow 4. Need for airway-related interruptions 5.Overall team satisfaction Surveys were completed within 30 minutes following each procedure to ensure accuracy.

Sample size was calculated based on an anticipated RLMA complication rate of 5%, as reported in the literature regarding the supraglottic airway. We used 95% confidence interval and a 4% margin of error. The calculated minimum sample size was 114. Due to technical and study-period limitations, 110 patients were included, providing adequate power to evaluate the primary outcomes.

The primary outcomes included the success rate of first-attempt RLMA insertion, the incidence of intraoperative repositioning, and airway-related adverse effects, such as, hypoxia, laryngospasm and aspiration. The secondary outcomes included the time to discharge from the PACU after the end of the procedure, surgical team and nursing staff satisfaction rate and the overall impact on surgical workflow and drape integrity.

RESULTS:

A total of 110 patients, scheduled for daycare facial plastic surgery at CMC were included. All the patients completed the study without any deviation in protocol or loss of follow up. No patients were lost after induction of study.

The demographic data is presented in Table 1. The majority of the study population comprised of healthy, low-risk individuals classified under ASA class I or II, which is expected in elective plastic surgery list in a daycare centre. The average age of the cohort was 38 ± 10.5 years (range: 19–62 years), with dominant female ratio of 85%, evident from worldwide demographic trends of facial plastic surgery. Various plastic surgery procedures were performed, but submental liposuction was the most common, accounting for 60% of all procedures, with blepharoplasty in second place (25%) and lip lift in third place (15%), as presented in Table 2. It shows commonly performed plastic surgery cases in our centre. Successful first attempt insertion of RLMA was noted in all 110 patients (100%). No other airway devices were required either. This demonstrates the consistency of RLMA performance in this specific cohort, as all patients had a normal airway assessment before surgery. Minor airway adjustments in RLMA position were made in 14 patients (12.7%), primarily due to adjustments in patients' head position during submental liposuction. No other complications were noted during the study. The capnography traces were normal in all these surgical patients. There were no interruptions in ventilation or surgical workflow. No patient needed replacement of RLMA with ETT. There were no episodes of hypoxia, regurgitation, laryngospasm or airway obstruction. These findings further support the safety and efficacy of RLMA as the sole airway management device for elective facial plastic surgeries that do not require neuromuscular blockade and are short in duration.

The perioperative results are summarised in Table 3. The mean duration of the surgeries was 42 minutes (range: 25-70 minutes). The emergence from anaesthesia was smooth in all patients.

Mean discharge time from PACU was 2.3 ± 0.4 hours, which clearly supports the findings that RLMA is suitable for minor procedures, including facial plastic and aesthetic surgeries.

None of the patients experienced airway-related complications or adverse effects like coughing, sore throat or delayed recovery in PACU. We achieved high satisfaction scores through postoperative staff surveys. Improved uninterrupted surgical access was particularly noted by the surgeon after RLMA use. While nursing staff highlighted smoother workflow and no drape disruptions.

A 5-point Likert scale was used to measure satisfaction. Surgical access had the highest mean score of 4.7, followed by airway stability at 4.6 and workflow satisfaction at 4.5 as shown in Table 4. Figure 1 shows the schematic positioning of RLMA in the midline over the chin, forehead and side of the cheek (on either side of the face) using adhesive taping. This allows unobstructed surgical access for all three plastic surgery procedures, ensuring optimal exposure and maintaining proper ventilation and sterilize drapping.

Table 1: Patient Demographics

Variable	Value
Total patients	110
Age (mean ± SD)	38 ± 10.5 years
Gender	85% female, 15% male
ASA I	n = 90
ASA II	n = 20

Table 2: Types of Surgical Procedures

Procedure	Number (%)
Submental liposuction	66 (60%)
Blepharoplasty	28 (25%)
Lip lift	16 (15%)

Table 3. Perioperative Outcomes

Parameter	Value
Mean surgery duration	42 min
Smooth emergence	100%
Mean discharge time	2.3 ± 0.4 hours
Postoperative airway complications	0

Table 4. Team Satisfaction (5-Point Likert Scale)

Domain	Mean Score
Airway stability	4.6
Surgical access	4.7
Workflow facilitation	4.5

Figure 1: 360° RLMA Positioning Strategy

DISCUSSION:

The results from this prospective study show that RLMA is a reliable, very safe and structurally advantageous airway option for daycare facial plastic surgery. The study also demonstrates its first attempt success rate of 100% without any episodes of clinically significant airway complications such as hypoxia, laryngospasm or aspiration. Absence of these airway related complications in 110 consecutive patients is a very strong clinical evidence to support the use of RLMA in facial plastic procedures which do not require neuromuscular blockade and are short in duration. These findings are also aligned with existing LMA evidence in ENT and eye surgeries, where RLMA use is consistently associated with low airway-related complication rates and stable ventilation even during change of head position.[16]

The consistency with which RLMA was tolerated during these procedures, even during head tilt and change of position from side to side, was one of the notable and key success factors for this study. Only 12.7% cases needed minor adjustments during the surgery and did not result in any disruption to ventilation or surgical workflow. As per literature, these minor adjustments are consistent with known LMA use in surgeries involving face or head positioning.[17] No patient needed endotracheal intubation post RLMA use, reinforcing RLMA dependability as a primary airway tool for short duration facial plastic surgeries.

Uninterrupted improved surgical access was among the major advantages witnessed from this study. Blepharoplasty, submental liposuction and lip lift surgeries require clear access to face region while keeping the surgical area sterile. Classic LMAs and traditional facemask ventilation not only obstruct the surgical field during these procedures but also complicate draping, reduce workspace and increase the risk of contamination. One of the main disadvantages of classic LMAs is their less-flexible shaft and less-forgiving tube angles. RLMA with a wire-reinforced shaft allows multidirectional securing, e.g., superior, caudal and lateral, enabling surgeons to utilize full surgical field exposure without compromising airway stability.[18] It was reflected in the high surgeon satisfaction score (4.7/5), which highlights improved surgical access, reduced interference, and smoother workflow.

Another significant advantage of RLMA is the minimal workflow disruptions. In many centres, where anaesthesiologists are not using RLMA, they frequently need to reposition the facemask or adjust the airway tools, resulting in the need to reapply the drapes and repeat cleaning of the surgical field. These incidents result in prolonged operating time, higher cost and reduced overall perioperative efficiency. These disadvantages can be eliminated by using RLMA, which provides stable ventilation and a hands-free, safe airway that remains clear of the operative field.[8] It also resulted in improved nursing feedback regarding reduced drape disruption and fewer requests for airway-related assistance, which reflected in a higher workflow rating (4.5/5).

Postoperative recovery was also improved in this study, contributed by the use of RLMA.[19] Airway-related trauma, sore throat, hoarseness and coughing were not witnessed by simply avoiding endotracheal intubation. For plastic surgery patients, expecting minimal discomfort and rapid recovery, these differences are quite meaningful in improving perioperative experience. In this study, the mean PACU discharge time was 2.3 hours, signifying the RLMA's compatibility with short-duration daycare procedures.

This study also demonstrates clinician-lead service improvement, an important aspect of leadership and innovation.[20] This RLMA use originated from practical challenges faced during routine plastic surgeries. The use of RLMA in this study has no connection with commercial promotion. Clinical problems faced with mask-only ventilation, unnecessary intubation and repeated interruption during these procedures created a compelling need for an alternative airway management technique. Successful implementation of pilot project for RLMA encouraged a wider adoption. For this implementation, the present study followed the established change management frameworks such as Kotter's 8-steps model, where problem recognition, urgency, early wins and coalition building led to a sustainable change.[21]

The process of RLMA's wider adoption was also consistent with Roger's Diffusion of Innovation Theory.[22] Being first ever documented use in facial plastic surgery, the introduction of RLMA represented the innovator stage. Consistent successful implementation and operative team satisfaction resulted in RLMA diffusion to early adopted group and finally becoming standard and routine practice for these procedures. This prospective clinical evaluation of RLMA contributes not only to the clinical evidence, but also to a framework for successful, bottom-up innovation in perioperative practice.[23]

Comparing with international medical literature, studies done in ENT and eye surgeries have consistently reported that RLMA provides safe and stable airway control, decreased intraoperative airway adjustments, reduced incidence of laryngospasm and improved, uninterrupted surgical access.[24] However, previous studies did not address facial plastic surgeries, particularly and associated airway implications related to these procedures. The novelty of this cohort lies in its specific application to facial aesthetic surgeries, where ergonomics and surgical field exposure are as critical as safe airway control. This study establishes the RLMA as a suitable airway device in aesthetic units and also expands the supraglottic airway evidence for its use in an underrepresented and rapidly growing subspeciality.

For clinical practice, this study has substantial implications. In daycare plastic surgery units, especially for facial procedures, with a focus on improved efficacy and safety, RLMA offers a streamlined, predictable airway management solution that is time-efficient for induction and emergence, maintains an effective workflow and aligns with patient expectations for comfort and a pleasant surgical and anaesthesia experience.[25] From an institutional point of view, consistent workflow and improved turnover support higher theatre productivity and operational efficiency.

Future work should include randomised control trials and multicentre studies to strengthen the validity of findings. Further research into the use of RLMA in longer-duration plastic surgery procedures may also broaden its clinical use. A formal economic evaluation of RLMA use would be useful for quantifying its financial advantages.

In summary, this prospective evaluation study confirms that RLMA is a safe, effective, and reliable airway device, that enhances workflow and efficiency in a daycare plastic surgery centre. It provides stable ventilation without the need of muscle relaxant and superior surgical access with improved teamwork dynamics, making it an excellent choice for airway management for these procedures. This study also highlights the impact of clinician-led innovation by recognizing a clinical problem and tackling that problem through known change management models and keeping patient safety a priority.

Limitations of Study: Despite these strengths, several limitations warrant consideration. The single-centre design may limit generalisability to other settings with different patient demographics or workflow structures. The study did not include a comparator arm, such as classic LMA or endotracheal intubation, which would provide stronger evidence for relative advantages. The predominance of female patients reflects the typical aesthetic population but may limit the external applicability of the findings. Additionally, the absence of patient-reported outcome measures (PROMs) for postoperative discomfort or satisfaction is an area for future investigation. Including PROMs would enhance understanding of patient experience, particularly in cosmetic surgery. Finally, no formal cost-effectiveness analysis was conducted, although observational data suggest potential economic benefits from reduced theatre interruptions and faster turnover.

CONCLUSION:

From this prospective clinical study done in a daycare facial plastic unit, we can safely conclude that RLMA is an effective, stable, safe and ergonomically superior airway device for face procedures such as submental liposuction, lip lift and blepharoplasty. Use of RLMA in 110 patients in this cohort demonstrated stable ventilation without the need of muscle relaxant, 100% first attempt insertion success and no clinically significant airway-related complications. These findings highlight the RLMA's ability to maintain a stable and secure airway during these facial surgeries which involves frequent head movements to operate specifically submental liposuction.

Another clinical highlight of RLMA was uninterrupted and clear access to surgical field. Its wire-resistance and kink-free shaft allowed multidirectional yet flexible taping on the face which enabled surgeons to operate without any interference from airway equipment. As a result, we had fewer airway-related interruptions, smoother operating theatre workflow and higher satisfaction scores among surgeons and nursing staff. Significantly improved emergence profiles and rapid PACU discharge times were also the

hallmark of this study. In terms of clinical evidence, it is important that current study represents first documented clinical cohort evaluating RLMA in facial plastic surgery, highlighting a successful example of clinician-led innovation and its clinical implementation. The shift towards RLMA use emerged from recognizing limitations associated with facemask, traditional supraglottic airways and unwanted endotracheal intubation in these short-duration surgeries. The RLMA use became a standard practice through incremental adoption, demonstrating clinical safety, reliability and positive feedback from surgical and nursing teams. Although comparative and multicentre studies will be needed to validate this study's findings, which strongly support RLMA as an invaluable airway device for selective facial plastic surgeries. When applied to a selective patient cohort and within competent anaesthesia practice, RLMA enhances safety, boosts workflow efficiency and improves overall perioperative experience.

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Authors Contribution:
Ehsan Ahmad: Manuscript writing, study concept, and data collection.
Ahmad Naseem: Review of manuscript, final approval, and data analysis.
Abdullah Al-Qahtani: Literature search, conduct of discussion

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