Section: Anaesthesiology

Original Research Article

A RANDOMIZED CLINICAL COMPARISON OF THE KINGS LARYNGEAL TUBE SUCTION II (LTSII) AND PROSEAL LARYNGEAL MASK AIRWAY (PLMA) IN PATIENTS POSTED FOR SHORT DURATION SURGERIES UNDER GENERAL ANAESTHESIA WITH CONTROLLED VENTILATION

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Received : 15/07/2026
Received in revised form : 20/08/2026
Accepted : 31/08/2026

Keywords:
Laryngeal Masks, Airway Management, General Anesthesia, Positive-Pressure Respiration, Supraglottic Airway Devices.

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DOI: 10.47009/jamp.2026.8.5.45

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (5); 287-291

ABSTRACT

Background: Supraglottic airway devices provide effective ventilation with less airway stimulation than endotracheal intubation; second-generation devices like PLMA and LTS II improve sealing and gastric drainage. The aim is to compare the King's LTS II and PLMA in anaesthetised, paralysed patients undergoing short surgical procedures under general anaesthesia with controlled ventilation. **Materials and Methods:** This single-blinded randomised study included 70 patients (18–65 years, ASA I–II, Mallampati I–II) undergoing surgery under general anaesthesia at Government Stanley Medical College, Chennai. Patients were randomised to PLMA (n=35) or KLTS II (n=35). Insertion time was the primary outcome. Attempts, ease of insertion, airway sealing pressure, and postoperative complications were secondary outcomes. Analysis used an independent t-test and a Chi-square test ($p<0.05$). **Result:** Insertion time was shorter with PLMA (54.53 ± 5.50 s) than with KLTS II (61.34 ± 3.74 s; $p<0.001$). First-attempt success occurred in 100% of PLMA cases and 71.4% of KLTS II cases ($p=0.001$). Easy insertion occurred in 91.4% with PLMA and 71.4% with KLTS II ($p=0.03$). Airway sealing pressure was higher with PLMA at 5 min (25.46 ± 1.99 vs 20.11 ± 2.08 cmH_2O), 30 min (25.46 ± 1.99 vs 19.89 ± 2.04 cmH_2O), and end of surgery (24.57 ± 2.00 vs 19.20 ± 2.03 cmH_2O) ($p<0.001$). Blood staining (5.7% vs 31.4%), hoarseness (0% vs 20%), and dysphagia (2.9% vs 42.9%) were lower with PLMA. **Conclusion:** PLMA provided faster insertion, higher first-attempt success, better airway sealing pressure, and fewer postoperative airway complications compared with KLTS II during controlled ventilation.

INTRODUCTION

Airway control is the main part of safe general anaesthesia during surgical procedures that require controlled ventilation.[1] Supraglottic airway devices (SADs) provide an alternative to endotracheal intubation and are commonly used during short surgical procedures as they permit effective ventilation with less airway stimulation.[2] Second-generation SADs include additional design features such as gastric drainage channels and improved sealing cuffs, which help reduce the risk of aspiration and improve ventilation efficiency.[3]

The ProSeal laryngeal mask airway (PLMA) represents a second-generation SAD designed with a modified cuff and an integrated drain tube to allow gastric decompression.[4] This device also provides higher oropharyngeal sealing pressure than earlier laryngeal mask designs, which supports controlled ventilation during anaesthesia.[5] Clinical use of PLMA has been associated with effective airway sealing, reliable ventilation, and a relatively low incidence of postoperative throat discomfort.[6]

The King laryngeal tube suction II (LTS II) represents another supraglottic airway device that includes a dual-cuff design and a separate gastric drainage channel. The distal cuff seals the oesophagus while the proximal cuff stabilises the device within the oropharynx, creating a ventilatory pathway between the two cuffs.[7] This structure allows ventilation without direct visualisation of the vocal cords and permits gastric tube insertion through the drainage channel.[3]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Both PLMA and LTS II have been used during controlled ventilation in anaesthetised and paralyzed patients.[8] Comparative studies have examined parameters such as insertion time, number of attempts required for placement, airway sealing pressure, and postoperative airway complications in order to evaluate the clinical performance of these devices.[7,8] Device insertion characteristics remain important because rapid airway establishment and minimal manipulation reduce procedure-related airway trauma and facilitate stable ventilation.[9] Airway sealing pressure also represents a key functional parameter for SADs, particularly during positive pressure ventilation.5 Higher sealing pressure allows effective ventilation while reducing gas leakage and maintaining adequate tidal volume delivery.[3] Postoperative complications, such as sore throat, dysphagia, hoarseness of voice, and blood staining on the device, provide additional indicators of airway trauma associated with device placement.[6] Direct comparisons between PLMA and LTS II remain limited in clinical literature, particularly in adult patients undergoing short-duration surgical procedures under general anaesthesia with controlled ventilation.[8] A randomised comparison of these devices helps clarify differences in insertion characteristics, airway sealing properties, and postoperative airway morbidity in routine anaesthetic practice. Hence, this study aims to compare the King's LTS II and PLMA in anaesthetised, paralysed patients with respect to ease of insertion, time of insertion, and airway sealing properties during controlled ventilation, along with associated postoperative complications.

Objectives: The objectives were to assess the time taken for device insertion, evaluate the ease of insertion and number of attempts required for successful placement, measure airway sealing pressures at different time intervals, and assess postoperative complications such as hoarseness of voice, dysphagia, and the presence of blood on the device after removal.

MATERIALS AND METHODS

This single-blinded, randomised comparative study was conducted at Government Stanley Medical College and Hospital, Chennai. The study was conducted after obtaining approval from the Institutional Ethics Committee of Government Stanley Medical College, and written informed consent was obtained from all participants.

Inclusion Criteria

Patients aged 18–65 years, belonging to ASA physical status I or II, with Mallampati airway class I or II, and of either sex.

Exclusion Criteria

Patient refusal, obesity, pregnancy, history of gastric regurgitation, heartburn or full stomach, low pulmonary compliance, high pulmonary resistance, known history of difficult endotracheal intubation, and anatomical pharyngeal or laryngeal pathologies.

Methods: A total of 70 adult patients scheduled for surgery under general anaesthesia requiring a supraglottic airway device were enrolled in the study after obtaining written informed consent. Patients were randomly allocated into two groups of 35 patients each: Group KLTS-II (King's Laryngeal Tube Suction II) and Group PLMA (ProSeal Laryngeal Mask Airway). All patients were fasted for 8 hours for solids and 2 hours for clear liquids.

In the operating room, intravenous access was secured using an 18-G cannula and Ringer's lactate infusion was initiated. Standard monitoring, including pulse oximetry, non-invasive blood pressure, and electrocardiography, was instituted, and baseline parameters were recorded. Patients were premedicated with glycopyrrolate 0.2 mg IV and midazolam 1 mg IV. Following preoxygenation with 100% oxygen for 3 minutes, anaesthesia was induced using fentanyl 2 µg/kg and propofol 2 mg/kg, and muscle relaxation was achieved with atracurium 0.5 mg/kg. Adequate depth of anaesthesia for device insertion was confirmed by jaw muscle relaxation, absence of eyelash reflex, and no response to pressure applied over the angles of the mandible.

The assigned supraglottic airway device was inserted by the same anaesthesiologist using the manufacturer-recommended technique. In Group KLTS-II, device size selection was based on patient height, and insertion was performed in the midline with the head in sniffing or neutral position using a lubricated deflated cuff, followed by inflation with the recommended volume. In Group PLMA, size selection was based on patient weight, and insertion was carried out in the sniffing position with a pillow under the occiput using a lubricated deflated cuff, followed by cuff inflation as per recommended volume. Correct placement was confirmed by bilateral chest expansion, normal thoracoabdominal movements, presence of a square waveform on capnography, absence of audible air leak, and maintenance of adequate oxygen saturation. The device was then secured, and a gastric tube was inserted through the drain tube, with correct placement confirmed by epigastric auscultation or aspiration of gastric contents.

If malposition occurred, corrective manoeuvres such as jaw thrust, chin lift, head extension or flexion, and in-out adjustments were performed. A maximum of two attempts was permitted, after which endotracheal intubation was performed. Anaesthesia was maintained with sevoflurane (1–2%) in a mixture of 66% nitrous oxide and 33% oxygen under controlled ventilation. At the conclusion of surgery, anaesthetic agents were discontinued, and patients were ventilated with 100% oxygen. The SAD was removed after spontaneous eye opening and was inspected for blood staining. Patients were monitored in the post-anaesthesia care unit and followed up for 24 hours postoperatively.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Insertion time was defined as the time from removal of the face mask to the delivery of the first effective breath through the device, confirmed by the appearance of a square capnography waveform. The number of attempts required for successful placement was recorded. Ease of insertion was graded as easy (single attempt without manipulation), slightly difficult (single attempt with up to two manipulations), or difficult (> two manipulations or > one attempt). Airway sealing pressure was defined as the maximum pressure at which no audible leak was detected and was measured at 5 minutes, 30 minutes, and at the end of surgery. Postoperative complications assessed included blood staining of the device, hoarseness of voice, and dysphagia.

Statistical analysis: Continuous variables were expressed as mean ± standard deviation and compared using the independent sample t-test, while categorical variables were expressed as frequency and percentage and analysed using the Chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

RESULTS

The mean age was 27.34 ± 6.10 years in the PLMA group and 29.26 ± 7.04 years in the KLTS II group (p = 0.228). Females constituted 71.4% in the PLMA group and 62.9% in the KLTS II group, while males were 28.6% and 37.1% (p = 0.445) [Table 1].

Table 1: Demographic Characteristics

Variable		PLMA	KLTS II	P value
Age (years)		27.34 ± 6.10	29.26 ± 7.04	0.228
Gender	Female	25 (71.4%)	22 (62.9%)	0.445
	Male	10 (28.6%)	13 (37.1%)	

Insertion time was significantly shorter with PLMA (p < 0.0001). First-attempt success occurred in 35 patients in the PLMA group and 25 patients in the KLTS II group, while 10 patients in the KLTS II group required a second attempt (p = 0.001). Easy insertion occurred in 91.4% of PLMA cases and 71.4% of KLTS II cases (p = 0.03). No manipulation was required in 88.6% with PLMA vs 65.7% with KLTS II (p = 0.072) [Table 2].

Table 2: Comparison of Insertion Characteristics Between Groups

Parameter		PLMA	KLTS II	P value
Time of insertion (sec)		54.53 ± 5.50	61.34 ± 3.74	<0.001
Number of attempts	1 attempt	35 (100%)	25 (71.4%)	0.001
	2 attempts	0	10 (28.6%)	
Ease of insertion	Easy	32 (91.4%)	25 (71.4%)	0.03
	Slightly difficult	3 (8.6%)	4 (11.4%)	
	Difficult	0	6 (17.1%)	
Total manipulations	0	31 (88.6%)	23 (65.7%)	0.072
	1	2 (5.7%)	5 (14.3%)	
	2	2 (5.7%)	7 (20%)	

Airway Sealing Pressure at 5 minutes, the values were 25.46 ± 1.99 cmH_2O for PLMA and 20.11 ± 2.08 cmH_2O for KLTS II (p < 0.001). At 30 minutes, values were 25.46 ± 1.99 cmH_2O vs 19.89 ± 2.04 cmH_2O (p < 0.001). At the end of surgery, values were 24.57 ± 2.00 cmH_2O vs 19.20 ± 2.03 cmH_2O (p < 0.001) [Table 3].

Table 3: Comparison of Airway Sealing Pressure Between Groups

Time Interval	PLMA	KLTS II	P value
5 minutes	25.46 ± 1.99	20.11 ± 2.08	<0.001
30 minutes	25.46 ± 1.99	19.89 ± 2.04	<0.001
End of surgery	24.57 ± 2.00	19.20 ± 2.03	<0.001

Blood staining occurred in 5.7% of PLMA cases and 31.4% of KLTS II cases (p = 0.006). Hoarseness was absent in 100% of PLMA patients, while 6 patients had minimal and 1 patient had moderate hoarseness in the KLTS II group (p = 0.02). Dysphagia occurred in 1 patient with PLMA and 15 patients with KLTS II (p < 0.0001) [Table 4].

Table 4: Comparison of Postoperative Complications Between Groups

Complication		PLMA	KLTS II	P value
Blood staining on the device	No	33 (94.3%)	24 (68.6%)	0.006
	Yes	2 (5.7%)	11 (31.4%)	
Hoarseness	None	35 (100%)	28 (80%)	0.02
	Minimal	0	6 (17.1%)	
	Moderate	0	1 (2.9%)	
Dysphagia	None	34 (97.1%)	20 (57.1%)	<0.001
	Minimal	1 (2.9%)	13 (37.1%)	
	Moderate	0	2 (5.7%)	

ISSN (O): 2687-5365; ISSN (P): 2753-6556

DISCUSSION

SADs are widely used for airway management during general anaesthesia due to their ease of insertion and effective ventilation. Among them, PLMA and LTS II are commonly used for controlled ventilation.3 However, differences in insertion characteristics, airway sealing pressure, and postoperative airway morbidity remain clinically relevant. The present study compared PLMA and LTS II and evaluated these findings with previously published studies.

In our study, the age and gender distribution were comparable between the two groups. Similarly, Shenoy et al. reported a study population with a mean age of 39.8 ± 11.9 years and a female predominance (5 males and 25 females).[7] These findings indicate that comparable baseline demographic characteristics ensures in providing minimal effect on the study outcomes. The predominance of females in the previous study could be due to the type of surgery and the inclusion criteria set by that study.

In the present study, insertion time was shorter with PLMA. First-attempt placement occurred more frequently with PLMA than with KLTS II. Ease of insertion was better with PLMA. The number of manipulations required during insertion did not differ between the groups. Similarly, Shenoy et al. reported a median insertion time of 15.5 seconds for PLMA and 17.5 seconds for LTS II ($p = 0.012$), with first-attempt success rates of 96.7% and 90%, and fewer repositioning attempts with PLMA (16.7% vs 50%, $p = 0.03$). This study aligns with our study, where PLMA has a shorter insertion time and higher first-attempt success compared to LTS II.7 Similarly, Chandrakar et al., comparing LTS II and PLMA in pediatric patients, reported comparable insertion characteristics, with insertion times of 13.84 ± 2.38 s for LTS II and 14.02 ± 1.70 s for PLMA.[10] Comparable insertion characteristics suggest both devices allow reliable airway placement, though PLMA may offer easier insertion in adult patients.

Similarly, Singh et al. compared PLMA and Blockbuster LMA, reported a mean insertion time of 23.50 ± 1.19, first-attempt success in 86.7%, and easy insertion in 93.3% of PLMA cases.[11] Agrawal et al. compared the Baska mask and PLMA, reporting a mean time for achieving effective ventilation of 17.92 ± 2.45 seconds with PLMA, with easy insertion in 90% of cases and minimal airway manipulation.[12] Even with different devices, similar insertion parameters indicate PLMA provides reliable, easy airway placement with high first-attempt success during controlled ventilation.

In our study, the airway sealing pressure was higher with PLMA at all measured time points during surgery. Shenoy et al. reported a mean airway leak pressure of 27.03 ± 5.02 cmH_2O with PLMA and 26.43 ± 4.46 cmH_2O with LTS II, with no significant difference between the devices ($p = 0.52$).[7] In contrast, the present study showed significantly higher airway sealing pressures with PLMA compared to KLTS II at all measured time points, indicating better airway sealing with PLMA during controlled ventilation. Similarly, Chandrakar et al. also reported higher oropharyngeal seal pressure with LTS II (25.18 ± 1.59 cmH_2O) compared to PLMA (22.10 ± 1.36 cmH_2O; $p < 0.001$).10 Differences in sealing pressure might be due to population variation, and the device performance can vary between pediatric and adult airway anatomy.

Abdalla et al. compared the Baska mask and PLMA and reported a seal pressure of 26.38 ± 2.00 cmH_2O with PLMA, which was significantly lower than that of the Baska mask (35.92 ± 2.10 cmH_2O; $p < 0.001$).[13] Using different supraglottic devices, these findings suggest PLMA provides reliable airway sealing, which may improve ventilation stability during controlled anaesthesia.

In our study, postoperative throat symptoms, blood staining, hoarseness, and dysphagia were more frequent with KLTS II compared to PLMA. Similarly, Genzwürker et al. reported traces of blood on the device were observed in a few cases (LTS II 2 patients, PLMA 3 patients), and postoperative pharyngeal complaints remained mild and infrequent in both LTS II and PLMA groups during elective surgeries under controlled ventilation.[14] These findings suggest that both PLMA and LTS II are generally associated with low postoperative airway morbidity, although PLMA may result in fewer throat-related complications. Singh et al. reported sore throat in 8 patients, dysphagia in 1 patient, and hoarseness in 1 patient at 1 hour postoperatively, with no significant difference between groups.[15] In contrast, the present study showed lower postoperative complications with PLMA compared to LTS II. Despite different comparator devices (Baska Mask vs LTS II), PLMA showed lower postoperative airway morbidity and reduced airway trauma during controlled ventilation.

The findings of the present study suggest that PLMA provides easier insertion, better airway sealing, and fewer postoperative airway complications compared to LTS II during controlled ventilation. Limitations include the single-centre design, small sample size, and short follow-up period. Only limited studies are directly comparing these two devices, making broader comparisons difficult. Future research should include larger multicenter trials to further evaluate insertion characteristics, airway sealing pressures, and postoperative airway morbidity.

CONCLUSION

ProSeal LMA showed faster insertion, higher first-attempt success, and easier placement than KLTS II in anaesthetised, paralysed patients undergoing short surgical procedures under controlled ventilation. Airway sealing pressure remained higher with PLMA throughout surgery. Postoperative airway complications, including blood staining on the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

device, hoarseness, and dysphagia, occurred less frequently with PLMA. PLMA provides better insertion characteristics, improved airway sealing, and lower airway morbidity during controlled ventilation.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556