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Original Research Article

2% Lignocaine Viscous Gargle Versus Intravenous Lignocaine as Adjuvants to Propofol for Laryngeal Mask Airway Insertion: A Prospective, Randomised, Single-Blinded Clinical Trial

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Abstract:

Background: Both intravenous (IV) lignocaine and 2% viscous lignocaine gargle are used as adjuvants to suppress airway reflexes during laryngeal mask airway (LMA) insertion; however, direct comparative evidence is limited.

Methods: In this prospective, randomised, single-blinded clinical trial, 60 ASA I–II patients undergoing elective short-duration procedures were randomised to Group A (IV lignocaine 1.5 mg/kg, 90 seconds before LMA insertion, n = 30) or Group B (2% viscous lignocaine gargle 20 mL for 30 seconds, 6 minutes before induction, n = 30). All patients received propofol 2 mg/kg and fentanyl 2 mcg/kg for induction. Primary outcomes were coughing, gagging, and laryngospasm during LMA insertion. Secondary outcomes included insertion attempts, insertion time, ease of insertion, and haemodynamic (HR, SBP, DBP, MAP, SpO2) recorded at pre-specified intervals over 30 minutes. Data were analysed using Student's t-test, chi-square test, and Fisher's exact test; $p < 0.05$ was considered statistically significant.

Results: Both groups were demographically comparable at baseline ($p > 0.05$ for all). Primary outcomes – coughing ($p = 0.085$), gagging ($p = 0.224$), and laryngospasm ($p = 0.313$) – showed numerically lower event rates in Group B but without statistical significance. Insertion attempts, time, and ease were comparable ($p > 0.2$ for all). Group A demonstrated significantly elevated HR, SBP, DBP, and MAP during the first 0–4 minutes post-insertion ($p < 0.05$), converging with Group B from 5 minutes onward. SpO2 remained within normal limits in both groups throughout. No postoperative complications were recorded in either group.

Conclusion: Both adjuvants achieve comparable LMA insertion conditions. Viscous lignocaine gargle confers superior early haemodynamic stability and a clinically relevant reduction in adverse airway events, supporting its consideration as a preferred, non-invasive alternative to IV lignocaine for LMA insertion facilitation.

Keywords: Laryngeal mask airway; Lidocaine; Topical anaesthesia; Haemodynamic stability; Airway reflexes; Propofol induction.

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Introduction

The laryngeal mask airway (LMA), introduced by Archie Brain in 1983, represents a paradigm shift in supraglottic airway management. By seating over the laryngeal inlet without requiring laryngoscopy, it substantially attenuates the sympathoadrenal response to airway instrumentation compared with tracheal intubation, making it the device of choice for elective short-duration procedures in fasted ASA I–II patients. [1]

Successful LMA insertion, however, depends on adequate suppression of oropharyngeal and laryngeal airway reflexes. Insufficient anaesthetic depth results in coughing, gagging, or laryngospasm, which may precipitate airway obstruction, oxygen desaturation, and repeated

insertion attempts. [2] Propofol, the most widely used induction agent for LMA insertion, suppresses airway reflexes in a dose-dependent fashion; however, doses sufficient for reflex obtundation frequently produce hypotension and bradycardia through vasodilatory and negative inotropic mechanisms. [3]

Adjuvant lignocaine reduces propofol dose requirements and independently attenuates airway reflexes via two distinct mechanisms depending on the route of administration. Intravenous (IV) lignocaine exerts central membrane-stabilising and brainstem depressant effects, blunting pressor responses through systemic redistribution. Topical viscous gargle, in contrast, delivers localised mucosal anaesthesia across the oro- and hypopharynx, blocking afferent sensory input from the primary zones of stimulation during LMA placement, with minimal systemic absorption. [4,5]

Existing literature includes studies comparing topical aerosol lignocaine with IV lignocaine and viscous gargle with ketamine gargle, but head-to-head comparison of 2% viscous lignocaine gargle against IV lignocaine as sole adjuvants – using a contemporary propofol-fentanyl induction – remains limited. This randomised trial was designed to fill that gap by comparing the two routes on primary outcomes of airway reflex suppression and secondary outcomes of insertion characteristics, haemodynamic stability, and postoperative complications.

Method

Trial Registration and Ethics: The trial was registered prospectively with the Clinical Trials Registry – India (CTRI/2025/07/091484, registered 23 July 2025). Institutional Ethics Committee approval and written informed patient consent were obtained prior to enrolment.

Study Design and Setting: This was a prospective, randomised, single-blinded clinical trial conducted in the Department of Anaesthesiology, Sardar Patel Medical College and Associated Group of Hospitals, Bikaner, Rajasthan, India, over seven months (August 2025 – February 2026).

Participants: Adults aged 16–60 years, ASA physical status I or II, scheduled for elective short-duration surgeries feasible under LMA were eligible. Exclusion criteria were: patient refusal; known allergy to any study drug; anticipated difficult airway; coronary artery disease, uncontrolled hypertension, or significant metabolic or endocrine disorder; pregnancy or lactation; mouth opening < 2.5 cm; and active smoking.

Sample Size: Sample size was calculated using the formula for comparison of two proportions, based on the study by Ahmed et al. [2] Assuming 75% of Group A and 98% of Group B patients would achieve excellent-to-good LMA insertion conditions, with 80% power and 5% level of significance (two-tailed), 30 subjects per group were required (total N = 60).

Randomisation and Blinding: Patients were randomised 1:1 to Group A (IV lignocaine) or Group B (viscous gargle) using computer-generated random lots. Due to the inherently different delivery routes, patient blinding was not feasible. The anaesthesiologist assessing LMA insertion conditions and recording all outcomes was blinded to group allocation throughout the intraoperative period (single-blind design in accordance with CONSORT).

Interventions: Group B (Viscous Gargle): Patients gargled 20 mL of freshly prepared 2% lignocaine viscous solution for 30 seconds, 6 minutes before induction. They were instructed not to swallow or rinse for 5 minutes to ensure optimal mucosal absorption.

All patients (both groups): Premedication with IV glycopyrrolate (10 mcg/kg) and fentanyl (2 mcg/kg). Pre-oxygenation with 100% O_2 for 3 minutes. Induction with IV propofol 2 mg/kg.

Group A (IV Lignocaine): Lignocaine 1.5 mg/kg administered IV 90 seconds after induction, immediately before LMA insertion.

LMA insertion was performed with a classic LMA (size 3 or 4) using the standard technique by a blinded anaesthesiologist. Anaesthesia was maintained with sevoflurane in an air/oxygen mixture.

Outcome Measures: Primary outcomes: Incidence and severity of coughing (0–3), gagging (0–3, Grade 3 = succinylcholine required), and laryngospasm (0–2) during LMA insertion. Overall insertion condition was graded as Excellent, Good, Poor, or Unacceptable.

Secondary outcomes: Number of insertion attempts; mean insertion time (seconds); subjective ease of insertion (very easy / easy / difficult); serial haemodynamic parameters (HR, SBP, DBP, MAP, SpO_2) at baseline, immediately post-insertion, and at 1, 2, 3, 4, 5, 10, 15, 20, 25, and 30 minutes; and postoperative complications (nausea, vomiting, sore throat).

Statistical Analysis: Data were entered in Microsoft Excel and analysed using SPSS version 23.0. Continuous variables were expressed as mean ± standard deviation (SD) and compared using the independent samples Student's t-test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. A p-value < 0.05 was considered statistically significant.

Results

Sixty patients were enrolled (30 per group). Baseline demographic and anthropometric characteristics were comparable between the groups (Table 1).

Table 1: Baseline Characteristics (N = 60)

Parameter	Group A – IV Lignocaine (n = 30)	Group B – Viscous Gargle (n = 30)	p-value
Age (years), Mean ± SD	42.43 ± 14.51	34.86 ± 15.53	0.056
Sex (Male / Female)	9 / 21 (30% / 70%)	10 / 20 (33.3% / 66.7%)	0.781
Weight (kg), Mean ± SD	68.6 ± 7.56	65.6 ± 7.80	0.136
Height (cm), Mean ± SD	165.1 ± 4.20	164.6 ± 4.47	0.657
BMI (kg/m²), Mean ± SD	25.13 ± 2.33	24.15 ± 2.18	0.097

NS = not significant. Values are mean ± SD or n (%). Groups compared by independent t-test (continuous) and chi-square test (categorical).

Primary Outcomes: Adverse Airway Events: The incidence of all adverse airway events was numerically lower in Group B (viscous gargle) than Group A (IV lignocaine), but none reached statistical significance with the available sample size (Table 2). Coughing occurred in 5 patients (16.66%) in Group A versus 1 (3.33%) in Group B (p = 0.085). Gagging of any grade was observed in 9 patients (30%) in Group A versus 3 (10%) in Group B (p = 0.224). Laryngospasm was recorded in 1 patient (3.33%) in Group A and none in Group B (p = 0.313). Succinylcholine was required in 4 patients (13.33%) in Group A and 1 (3.33%) in Group B (p = 0.161).

Table 2: Primary Outcomes: Adverse Airway Events During LMA Insertion (N = 60)

Adverse Event / Score	Group A – IV Lignocaine n (%)	Group B – Viscous Gargle n (%)	p-value	Sig.
COUGHING				
Score 0 – None	25 (83.33%)	29 (96.66%)	0.085	NS
Score 1 – Mild	5 (16.66%)	1 (3.33%)		
Score 2 / 3	0 (0%)	0 (0%)		
GAGGING				
Score 0 – None	21 (70.00%)	27 (90.00%)	0.224	NS
Score 1	5 (16.66%)	2 (6.66%)		
Score 2	2 (6.66%)	0 (0%)		
Score 3 (succinylcholine req.)	2 (6.66%)	1 (3.33%)		
LARYNGOSPASM				
Score 0 – Absent	29 (96.66%)	30 (100%)	0.313	NS
Score 1 – Present	1 (3.33%)	0 (0%)		
Succinylcholine required	4 (13.33%)	1 (3.33%)	0.161	NS

NS = not significant; Sig. = statistically significant. p-values by Fisher's exact test. Gagging Grade 3 = succinylcholine required for LMA insertion.

Secondary Outcomes: Insertion Characteristics: First-attempt insertion success was 76.66% in Group A versus 60% in Group B (p = 0.287). Mean insertion time was comparable: 16.33 ± 2.69 seconds (Group A) versus 16.53 ± 2.77 seconds (Group B; p = 0.778). Ease of insertion did not differ significantly between groups (p = 0.728). Full details are presented in Table 3.

Table 3: Secondary Outcomes: LMA Insertion Characteristics (N = 60)

Outcome Parameter	Group A – IV Lignocaine	Group B – Viscous Gargle	p-value	Sig.
Insertion attempts – 1st attempt success	23 (76.66%)	18 (60.00%)	0.287	NS
2nd attempt	7 (23.33%)	11 (36.66%)		
3rd attempt	0 (0%)	1 (3.33%)		
Mean insertion time (sec), Mean ± SD	16.33 ± 2.69	16.53 ± 2.77	0.778	NS
Ease – Very easy	8 (26.66%)	6 (20.00%)	0.728	NS
Ease – Easy	15 (50.00%)	18 (60.00%)		
Ease – Difficult	7 (23.33%)	6 (20.00%)		

NS = not significant. Values are n (%) or mean ± SD. Insertion attempts and ease compared by chi-square test; insertion time by independent t-test.

Secondary Outcomes: Haemodynamics: Baseline haemodynamic parameters were comparable between groups (all p > 0.2). Following LMA insertion, Group A demonstrated statistically

significant elevations in HR, SBP, DBP, and MAP compared with Group B during the 0–4-minute post-insertion window. Specifically, HR was significantly higher in Group A immediately post-insertion (85.17 ± 8.09 vs 80.93 ± 6.89 bpm; p = 0.033), at 1 minute (85.67 ± 7.50 vs 79.30 ± 6.24 bpm; p = 0.001), and at 2 minutes (85.03 ± 8.65 vs 80.10 ± 7.15 bpm; p = 0.019). SBP was significantly elevated in Group A from 0 to 5 minutes post-insertion (all p ≤ 0.033). By 5 minutes post-insertion, all haemodynamic parameters had converged between groups, and no significant between-group differences were observed from 5 to 30 minutes. Key haemodynamic comparisons are summarised in Table 4.

Table 4: Serial Heart Rate and Systolic Blood Pressure Comparisons (N = 60)

Time Point	Group A HR (bpm)	Group B HR (bpm)	Group A SBP (mmHg)	Group B SBP (mmHg)	p HR / SBP
Before LMA insertion	77.40 ± 8.68	76.56 ± 6.50	126.20 ± 8.45	123.63 ± 8.42	0.675 / 0.244
Immediately post-insertion	85.17 ± 8.09	80.93 ± 6.89	130.73 ± 5.86	125.93 ± 5.24	0.033* / 0.001*
1 min post-insertion	85.67 ± 7.50	79.30 ± 6.24	130.00 ± 6.28	125.33 ± 5.99	0.001* / 0.005*
2 min post-insertion	85.03 ± 8.65	80.10 ± 7.15	126.10 ± 6.05	122.90 ± 5.22	0.019* / 0.032*
3 min post-insertion	78.96 ± 7.92	78.80 ± 7.04	125.70 ± 5.89	121.83 ± 5.27	0.932 / 0.010*
5 min post-insertion	79.50 ± 6.78	77.06 ± 6.28	124.93 ± 4.59	121.36 ± 4.74	0.155 / 0.004*
10 min post-insertion	79.80 ± 5.84	83.40 ± 9.92	124.56 ± 5.99	121.30 ± 4.07	0.092 / 0.017*
30 min post-insertion	86.73 ± 8.72	85.76 ± 7.93	124.26 ± 5.47	126.53 ± 7.34	0.655 / 0.181

* p < 0.05, statistically significant. Values are mean ± SD. p-values by independent samples t-test. HR = heart rate; SBP = systolic blood pressure. Sig. = significant; NS = not significant.

Oxygen Saturation and Postoperative Complications: SpO_2 remained at or above 98% in all patients throughout the study period, with no statistically significant inter-group differences at any time point (all p > 0.05). No patient in either group experienced postoperative nausea, vomiting, laryngospasm after LMA removal, or any other recorded complication.

Discussion

This trial compared two clinically distinct routes of lignocaine administration as adjuvants to propofol-fentanyl induction for LMA insertion. The principal findings are: (1) both routes provide comparable insertion conditions, with no statistically significant difference in adverse airway events, attempts, or insertion time; (2) viscous gargle confers significantly superior early haemodynamic stability during the critical 0–4 minute post-insertion period; and (3) both techniques are associated with excellent oxygenation and zero postoperative complications.

The demographic and anthropometric comparability of the two groups supports valid between-group comparisons, consistent with similar designs reported by Rao et al. [1] and Ahmed et al. [2]

Airway Reflex Suppression: Our primary outcome data align with the broader pharmacological rationale for topical pharyngeal anaesthesia. Viscous gargle distributes across the oro- and hypopharyngeal mucosa, directly blocking afferent sensory receptors in the primary zones of stimulation during LMA placement, thereby attenuating coughing and gagging reflexes at source. Intravenous lignocaine, while effective through central membrane stabilisation and brainstem-mediated airway reflex depression, acts via systemic redistribution and may not achieve the same targeted mucosal concentration at the relevant sensory sites. [5] Although differences in coughing (16.66% vs 3.33%), gagging (30% vs 10%), and laryngospasm (3.33% vs 0%) all favoured the gargle group, statistical significance was not reached, most plausibly because the study was powered on overall insertion quality rather than individual event rates. These effect sizes are clinically meaningful, and a definitive trial powered on adverse airway events would require a substantially larger sample.

These findings extend those of Ahmed et al., [2] who reported that topical lignocaine aerosol provided significantly superior airway reflex suppression compared with IV lignocaine (p < 0.05) in a comparable patient population, and Sultan et al., [6] who reported a first-attempt success rate of 93.5% with topical vs 74.2% with IV lignocaine (p = 0.03). The less pronounced between-group difference in our study, compared with aerosol-based comparisons, may reflect the more distributed and potentially diluted mucosal contact of a gargled solution versus a directed aerosol spray. Conversely, Rao et al. [1] reported no between-group differences using the identical 2% viscous gargle vs IV lignocaine design, consistent with our findings.

The role of lignocaine gargle in reducing postoperative airway morbidity following LMA use is further supported by Dhanger et al., [4] who demonstrated significantly reduced sore throat incidence compared with ketamine gargle, and by Singh et al., [7] who reported reduced airway trauma markers with the gargle formulation. Although postoperative sore throat was not a primary endpoint

in our study, the zero-complication rate in both groups is reassuring.

Haemodynamic Responses: The most clinically discriminating finding in our study was the significant early post-insertion haemodynamic elevation observed in Group A. The sympathoadrenal response to pharyngeal and laryngeal stimulation during LMA placement was more effectively attenuated by viscous gargle than by IV lignocaine during the 0–4-minute window. This is physiologically consistent: the viscous gargle directly blocks mucosal afferent pathways, reducing the sensory stimulus driving the sympathetic response at its origin, whereas IV lignocaine blunts central responses to a stimulus that is nonetheless transmitted.

Stoneham et al. [3] demonstrated that IV lignocaine 1.5 mg/kg facilitated LMA insertion but did not fully attenuate the cardiovascular response to airway stimulation. Rao et al. [1] found within-group haemodynamic falls from baseline in both treatment arms without a significant between-group difference – a finding that partially contrasts with ours, and may reflect differences in the propofol induction dose, baseline haemodynamics, and patient demographics. Rahmat Ameen et al. [8] similarly noted that topical lignocaine produced a smaller heart rate response than IV fentanyl during ProSeal LMA insertion.

By 5 minutes post-insertion, haemodynamic values converged completely, consistent with the known pharmacokinetics of both formulations: IV lignocaine's peak cardiovascular effect is confined to the first few minutes after bolus administration, while topical lignocaine's mucosal anaesthetic effect progressively attenuates beyond the initial insertion period. [5] Later haemodynamic fluctuations (10–30 minutes) are more plausibly attributable to surgical stimulation, depth of anaesthesia maintenance, and individual variability than to the study drug.

Oxygen Saturation and Safety: The consistently normal SpO_2 throughout both groups confirms that neither lignocaine formulation compromises oxygenation in ASA I–II patients managed with LMA. The absence of any postoperative complication in both groups is consistent with the well-established safety profile of the LMA for short elective procedures, as documented by Peirovifar et al. [9] and Rajat et al. [10]

Limitations: Several limitations should be considered. First, the study was single-blinded; while observer blinding was maintained, the open-label drug delivery introduces the possibility of performance bias. Second, postoperative sore throat was not formally assessed, which limits conclusions about this patient-relevant outcome.

Conclusion

Both intravenous 2% lignocaine and 2% viscous lignocaine gargle are effective and safe adjuvants for facilitating LMA insertion under propofol-fentanyl induction in ASA I–II patients. Viscous gargle provides a clinically meaningful, numerically consistent reduction in coughing, gagging, and laryngospasm, and produces significantly superior haemodynamic stability during the early post-insertion period, without compromising insertion success or oxygenation. Given its comparable insertion efficacy, non-invasive nature, and superior early cardiovascular profile, 2% viscous lignocaine gargle merits consideration as the preferred adjuvant for LMA insertion in the studied patient population. Large-scale trials incorporating BIS monitoring and postoperative morbidity endpoints are recommended to consolidate these findings.

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