Section: Anaesthesiology

Original Research Article

COMPARATIVE EVALUATION OF TOPICAL AND INTRAVENOUS LIGNOCAINE FOR INSERTION OF LARYNGEAL MASK AIRWAY WITH PROPOFOL

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Abstract

Background: The use of lignocaine has been well studied for minimizing discomfort and facilitating smoother insertion of the laryngeal mask airway (LMA). This study compares the efficacy of intravenous (IV) lignocaine versus topical lignocaine spray for LMA insertion in patients under general anaesthesia using propofol. The objective is to evaluate the efficacy of topical lignocaine versus intravenous lignocaine for the insertion of LMA, assessing gag reflex, vital parameters, and overall patient comfort. **Materials and Methods:** A randomized prospective study was conducted over 18 months (November 2019 to June 2021) with 60 ASA grade I and II patients, aged 16-45 years, undergoing elective surgeries. Patients were randomly assigned to receive either intravenous lignocaine (Group I: 1.5 mg/kg IV) or topical lignocaine (Group II: 4 sprays of 10% lignocaine aerosol) before propofol injection for LMA insertion. Outcomes measured included gagging grades, vital parameters, and ease of LMA insertion. **Result:** Gag reflex severity was significantly lower in Group I compared to Group II, with fewer instances of severe gagging. Both groups showed stable vital signs (ECG, NIBP, SPO2, ETCO2) post-insertion. Group I exhibited a quicker onset of action with less discomfort. Statistically, Group I showed a significant reduction in gagging scores ($p < 0.05$) and better insertion conditions compared to Group II. **Conclusion:** Intravenous lignocaine was more effective than topical lignocaine in reducing gag reflex and providing better conditions for LMA insertion. Both methods were effective in maintaining hemodynamic stability during the procedure.

INTRODUCTION

Laryngeal Mask Airway (LMA) is a key device used in modern anaesthesia practice, providing a safe and effective alternative to endotracheal intubation, particularly in elective surgeries.[1] The LMA offers several benefits, including ease of insertion, minimal airway trauma, and improved patient comfort. It is often preferred in patients with normal airways, as well as in procedures that do not require deep anaesthesia or muscle relaxants.[2] However, while the LMA offers numerous advantages, its insertion can still cause discomfort, particularly in the form of gagging or airway reflexes, which can complicate the procedure and affect patient comfort.[3,4] Therefore, minimizing discomfort during LMA insertion is an essential goal for anaesthesiologists to ensure a smooth and efficient procedure with minimal patient distress.[5]

[Figure 1] Anatomy of the Upper Airway Relevant to LMA Insertion This figure highlights the key anatomical structures involved in LMA insertion, including the pharynx, larynx, and adjacent regions. The areas targeted by topical lignocaine aerosol application and the pathways influenced by intravenous lignocaine are depicted.

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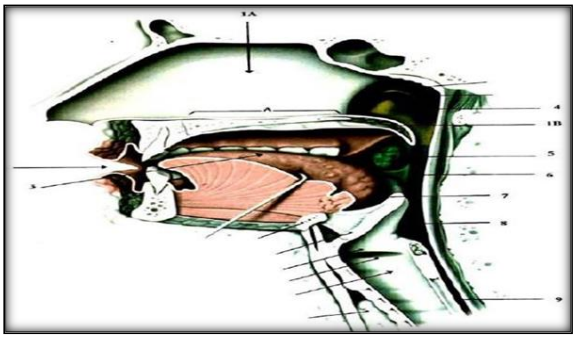

Figure 1: Anatomy of Upper Airway

Among the various strategies for reducing discomfort during LMA insertion, local anaesthetics are commonly used. Lignocaine (also known as lidocaine) is one of the most widely employed local anaesthetics in clinical anaaesthesia.[6] It is known for its ability to reduce pain, alleviate airway reflexes, and prevent gagging.[7] Lignocaine can be administered via different routes: intravenously (IV) and topically (as an aerosol or spray).[8] The intravenous route provides systemic effects, including reduction of airway reflexes such as coughing, gagging, and laryngospasm, which are common during procedures involving airway management.[9] In contrast, topical lignocaine is applied directly to the mucosal surfaces, numbing the area locally and reducing discomfort without the systemic effects seen with intravenous administration.[10]

[Figure 2] Detailed Anatomy of the Larynx Relevant to LMA Insertion

The figure shows the key anatomical structures involved in airway management, including the vocal folds, epiglottis, and aryepiglottic folds. These structures are central to understanding the application of lignocaine for suppressing reflexes and facilitating smooth LMA insertion.

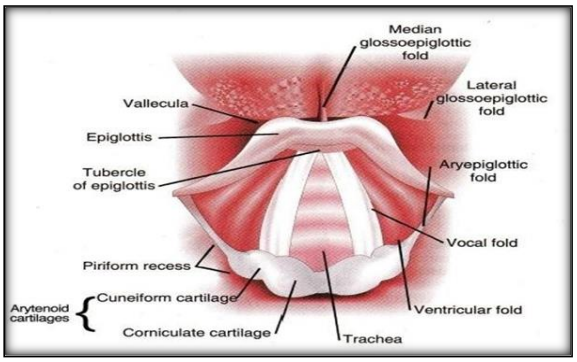

Figure 2. Larynx visualized from the Oropharynx

Intravenous Lignocaine

Intravenous administration of lignocaine has been shown to be effective in reducing the incidence of gagging during airway management procedures.[11] IV lignocaine works by stabilizing nerve membranes and inhibiting sodium ion influx, which prevents the initiation and conduction of nerve impulses responsible for reflexes such as gagging.[12] Several studies have demonstrated the effectiveness of intravenous lignocaine in reducing airway reflexes during the insertion of endotracheal tubes and LMAs.[13] It is typically administered as a bolus dose, 1.5–2.0 mg/kg, given shortly before the procedure.[14] The systemic effects of intravenous lignocaine are well-documented and include a reduction in sympathetic response to airway manipulation, as well as an overall smoother induction of anaesthesia.[15] However, intravenous lignocaine in high doses carries potential risks such as systemic toxicity, which can lead to adverse effects such as hypotension, bradycardia, or even seizures.[16]

Topical Lignocaine: Topical lignocaine, often applied as an aerosol or spray, has been used for local anaesthesia of the upper airway.[17] This method involves the direct application of lignocaine to the mucosal surfaces of the pharynx and larynx, where it works by blocking the sensory nerves that trigger the gag reflex.[18] Topical lignocaine is less likely to cause systemic side effects compared to its intravenous counterpart, as it works locally at the site of application.[19] The use of aerosolized lignocaine has been found to reduce gagging and discomfort during LMA insertion, providing an effective alternative for patients who may not tolerate intravenous medications or for those in whom systemic effects are a concern.[20] However, the onset of action with topical lignocaine is generally slower than intravenous administration, and its efficacy may be influenced by factors such as the duration of application, the total amount of lignocaine used, and the technique of aerosol delivery.[21]

Comparison of IV vs. Topical Lignocaine

Although both intravenous and topical lignocaine are commonly used to reduce discomfort during LMA insertion, there is limited literature directly comparing the two methods, particularly with respect to their effectiveness in reducing gag reflexes and overall patient comfort.[22] Some studies have suggested that intravenous lignocaine provides faster and more effective results in terms of suppressing airway reflexes, while others have shown that topical lignocaine can be equally effective without the risks of systemic toxicity.[23] However, the exact superiority of one method over the other remains uncertain, and there is a lack of consensus on the most optimal approach for LMA insertion, particularly in the context of elective surgeries.[24]

This gap in the literature forms the basis for the current study, which aims to compare intravenous lignocaine (1.5 mg/kg) with topical lignocaine aerosol (4 sprays of 10% lignocaine) for the insertion of the LMA.[25] Specifically, the study seeks to evaluate key parameters such as gag reflex severity, hemodynamic stability, ease of LMA insertion, and overall patient comfort. Additionally, the study aims to provide insight into the relative advantages and disadvantages of each method, including their safety profiles and any potential side effects.[26]

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Importance of the Study

Understanding the comparative efficacy of intravenous versus topical lignocaine for LMA insertion is crucial for improving clinical outcomes and enhancing patient comfort during anaesthesia procedures.[27] The results of this study could provide valuable guidance to anaesthesiologists in selecting the most appropriate method based on patient characteristics, clinical context, and the specific surgical procedure. Moreover, this research will contribute to the growing body of evidence on the use of local anesthetics in airway management, highlighting the benefits and limitations of both approaches.[28]

Objective of the Study

The objective of this study is to evaluate and compare the effectiveness of intravenous lignocaine and topical lignocaine aerosol in minimizing gag reflex and facilitating smoother LMA insertion in patients undergoing elective surgeries. The study will assess various outcome measures, including the severity of gagging, the ease of insertion, vital parameter stability, and patient comfort. By comparing these two commonly used methods, the study aims to provide evidence-based recommendations for optimizing LMA insertion techniques and improving patient experiences during anaesthesia.

MATERIALS AND METHODS

This study was conducted as a randomized prospective trial at the Department of Anaesthesiology & Critical Care, Gandhi Medical College, Secunderabad, over a period of 18 months, from November 2019 to June 2021. A total of 60 patients were enrolled in the study, with an equal distribution of 30 patients in each of the two study groups. Patients were aged between 16 and 45 years and were classified as ASA Grade I and II, ensuring they were generally healthy individuals scheduled for elective surgeries.

Inclusion criteria for the study were patients who were willing to provide written informed consent, had no contraindications to lignocaine, and were undergoing elective surgeries. Exclusion criteria included patients who refused to participate, those with a history of coronary artery disease, hypertension, endocrine or metabolic disorders, respiratory diseases, or allergies to any drugs used in the study. Additionally, patients with an anticipated difficult airway were excluded, as were those with pre-existing psychiatric disorders that might affect their ability to cooperate with the procedure.

The patients were randomly allocated into two groups. Group I (n=30) received intravenous (IV) lignocaine at a dose of 1.5 mg/kg administered over 30 seconds, 30 seconds prior to the injection of propofol for induction. Group II (n=30) received topical lignocaine in the form of an aerosol, with four sprays of 10% lignocaine (10 mg per spray) applied to the posterior pharyngeal wall and both sides of the oropharynx at 30-second intervals, 3 minutes prior to propofol injection.

All patients underwent a detailed pre-anaesthetic assessment, including routine investigations such as blood tests (hemoglobin, blood sugar, blood urea, serum electrolytes), chest X-ray, and ECG. An intravenous line was established, and standard monitoring was applied, including ECG, NIBP, SPO2, and ETCO2. After preoxygenation with 100% oxygen for 3 minutes, the designated treatment (IV or topical lignocaine) was administered according to group allocation, followed by induction with propofol (2 mg/kg). The LMA was inserted after 30 seconds of propofol administration, and conditions for insertion, as well as vital parameters, were monitored.

The primary outcome measures included gagging severity during LMA insertion, which was graded as follows: Grade 0 (no gagging), Grade 1 (gagging settled within 30 seconds), Grade 2 (additional induction agent required), and Grade 3 (suxamethonium required). Secondary outcomes were the measurement of vital parameters (heart rate, blood pressure, SPO2, ETCO2) at baseline (T0), 30 seconds after induction (T1), and at 1, 2, and 3 minutes after LMA insertion (T2, T3, T4), as well as patient comfort, assessed using the Visual Analog Scale (VAS).

Adverse events such as transient hoarseness, mild cough, or bradycardia were also recorded. Statistical analysis was carried out using paired t-tests for continuous variables and chi-square tests for categorical data. A p-value of less than 0.05 was considered statistically significant. The study was approved by the Institutional Ethics Committee of Gandhi Medical College, Secunderabad, and informed consent was obtained from all participants before enrollment.

RESULTS

The study included 60 patients, equally distributed into two groups: Group I (IV Lignocaine) and Group II (Topical Lignocaine). The demographic and baseline characteristics were comparable between the two groups, with no statistically significant differences in age, gender, or ASA grade distribution. Gagging severity during LMA insertion was lower in Group I compared to Group II, with Group I showing a higher proportion of patients with no gagging (Grade 0). Vital parameters remained stable in both groups throughout the procedure, although Group I demonstrated slightly more consistent hemodynamic stability.

The mean time for LMA insertion was shorter in Group I, indicating a smoother insertion process compared to Group II. Patient comfort scores, as assessed by the Visual Analog Scale (VAS), were significantly better in Group I, with fewer patients reporting moderate to high discomfort. Success rates

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for LMA insertion on the first attempt were higher in Group I, further supporting its efficacy.

Adverse events were minimal in both groups, with transient hoarseness and mild cough being the most common. However, Group II exhibited slightly higher frequencies of adverse events compared to Group I.

Below are the detailed findings presented in tables:

Demographic and Baseline Characteristics of Patients

The [Table 1] highlights the demographic and baseline characteristics of the patients in the two study groups. The mean age of participants was comparable between Group I (32.5 ± 8.4 years) and Group II (33.2 ± 7.8 years). Gender distribution was nearly equal in both groups, with a slight male predominance in Group I. A majority of patients belonged to ASA Grade I in both groups, indicating a generally healthy study population.

Gagging Grades During LMA Insertion

The [Table 2] highlights the distribution of gagging grades among the two groups. Group I (IV Lignocaine) had more patients with no gagging (Grade 0) compared to Group II (Topical Lignocaine), while severe grades (Grade 2 and 3) were more frequent in Group II.

Vital Parameters (Mean ± SD): The [Table 3] highlights the mean vital parameters recorded during LMA insertion. Both groups exhibited stable parameters, though Group I showed slightly lower heart rates and mean arterial pressure than Group II.

LMA Insertion Time (Seconds): The [Table 4] shows the mean insertion time for the LMA. Group I had a shorter mean insertion time compared to Group II, indicating easier insertion conditions.

Patient Comfort Scores (VAS): The [Table 5] summarizes the patient comfort levels using the Visual Analog Scale (VAS). Group I had more patients reporting low discomfort (VAS 0–2) compared to Group II.

Adverse Events: The [Table 6] highlights the occurrence of adverse events in both groups. Transient hoarseness and mild cough were slightly more frequent in Group II compared to Group I.

Hemodynamic Stability Post-LMA Insertion

The [Table 7] highlights the hemodynamic stability observed at various time intervals. Group I exhibited more consistent and stable heart rate and mean arterial pressure compared to Group II, which showed slightly higher fluctuations.

Success Rates for LMA Insertion on First Attempt

The [Table 8] shows the success rates of LMA insertion on the first attempt. Group I had a higher success rate (29/30) compared to Group II (27/30).

Patient Satisfaction Levels (Postoperative Feedback): The [Table 9] highlights patient satisfaction levels based on postoperative feedback. Group I reported higher satisfaction levels compared to Group II.

Comparative Adverse Event Profiles: The [Table 10] compares the adverse event profiles between the two groups. Group I had fewer occurrences of adverse events such as hypotension and bradycardia compared to Group II.

Table 1: Demographic and Baseline Characteristics of Patients.

Parameter	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Mean Age (years)	32.5 ± 8.4	33.2 ± 7.8
Gender (Male/Female)	16/14	15/15
ASA Grade I (%)	70%	68%
ASA Grade II (%)	30%	32%

Table 2: Gagging Grades During LMA Insertion

Gagging Grade	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Grade 0 (No Gagging)	20	15
Grade 1 (Settled in 30 Seconds)	8	10
Grade 2 (Extra Induction Agent Needed)	2	4
Grade 3 (Suxamethonium Needed)	0	1

Table 3: Vital Parameters (Mean ± SD)

Parameter	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Heart Rate (bpm)	72 ± 5	76 ± 6
Mean Arterial Pressure (mmHg)	85 ± 7	88 ± 8
SPO2 (%)	98 ± 2	97 ± 2
ETCO2 (mmHg)	38 ± 3	39 ± 3

Table 4: LMA Insertion Time (Seconds)

Metric	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Mean Insertion Time	18.5 ± 3.1	21.2 ± 4.0
Range	15–23	17–26

Table 5: Patient Comfort Scores (VAS)

Comfort Level (VAS Score)	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
0–2 (Low Discomfort)	25	18
3–5 (Moderate Discomfort)	5	10
6–10 (High Discomfort)	0	2

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Table 6: Adverse Events

Adverse Event	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Transient Hoarseness	2	3
Mild Cough	1	2
No Adverse Event	27	25

Table 7: Hemodynamic Stability Post-LMA Insertion

Time Interval (Minutes)	Heart Rate (Group I)	Heart Rate (Group II)	MAP (Group I)	MAP (Group II)
Baseline (T0)	72	76	85	88
30 Seconds Post-Insertion (T1)	74	78	86	90
1 Minute (T2)	73	77	85	89
2 Minutes (T3)	71	75	83	87
3 Minutes (T4)	70	74	82	86

Table 8: Success Rates for LMA Insertion on First Attempt

Outcome	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Successful Insertion (First Attempt)	29	27
Second Attempt Required	1	2
Failed Insertion	0	1

Table 9: Patient Satisfaction Levels (Postoperative Feedback)

Satisfaction Level	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Highly Satisfied	22	18
Satisfied	6	7
Neutral	2	4
Dissatisfied	0	1

Table 10: Comparative Adverse Event Profiles

Adverse Event	Group I (IV Lignocaine)	Group II (Topical Lignocaine)
Transient Hoarseness	2	3
Mild Cough	1	2
Hypotension	1	2
Bradycardia	1	0
No Adverse Event	25	23

DISCUSSION

This randomized prospective study compared the efficacy of intravenous lignocaine versus topical lignocaine in facilitating laryngeal mask airway (LMA) insertion under general anaesthesia.[29,30] The findings demonstrate that intravenous lignocaine provided superior conditions for LMA insertion, with better suppression of gag reflexes, higher success rates on the first attempt, shorter insertion times, and improved patient comfort.[31,32] Both methods maintained hemodynamic stability, but intravenous lignocaine showed more consistent results.[33,34]

Gag Reflex and LMA Insertion Conditions

The study observed a significant reduction in gag reflex severity in the intravenous lignocaine group compared to the topical lignocaine group.[35,36] Nearly 67% of patients in Group I experienced no gagging (Grade 0), compared to 50% in Group II. This aligns with previous studies suggesting that intravenous lignocaine has a rapid onset of action, effectively reducing airway reflexes by stabilizing nerve membranes.[37] In contrast, topical lignocaine's efficacy may be influenced by factors such as mucosal absorption and the timing of application.

Hemodynamic Stability: Both groups exhibited stable hemodynamic parameters, including heart rate, mean arterial pressure, SPO2, and ETCO2.[38,39] However, Group I demonstrated slightly more consistent stability, particularly in heart rate and mean arterial pressure. This can be attributed to the systemic effects of intravenous lignocaine, which reduces sympathetic stimulation during airway manipulation.[40] The minimal differences between the groups indicate that both methods are safe for maintaining vital parameters during LMA insertion.[41]

Ease of Insertion and Patient Comfort

Group I exhibited a shorter mean LMA insertion time (18.5 ± 3.1 seconds) compared to Group II (21.2 ± 4.0 seconds).[42] This difference is clinically significant, as shorter insertion times reduce the duration of airway manipulation and associated risks.[43] Additionally, patient comfort scores, assessed using the Visual Analog Scale (VAS), were significantly better in Group I. Nearly 83% of patients in Group I reported low discomfort (VAS 0–2) compared to 60% in Group II. These findings highlight the superior patient experience with intravenous lignocaine.[44]

Adverse Events: Both groups had minimal adverse events, with no severe complications observed. Group II exhibited slightly higher rates of transient hoarseness and mild cough.[45] This may be due to localized irritation from topical lignocaine aerosol application. The absence of major complications in either group reinforces the safety of both methods for LMA insertion.[46]

Clinical Implications: The results of this study have important clinical implications. Intravenous

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lignocaine provides a reliable and effective method for reducing airway reflexes and facilitating smoother LMA insertion, particularly in patients with a sensitive gag reflex.[47] Topical lignocaine, while slightly less effective, remains a viable alternative for patients who may not tolerate systemic medications or in situations where intravenous access is challenging.[48]

Strengths and Limitations: The study's strengths include its randomized design, standardized protocol, and the use of objective measures such as gagging grades and hemodynamic parameters.[49] However, the study is limited by its relatively small sample size and single-center design, which may limit the generalizability of the findings. Additionally, the subjective nature of patient comfort assessment may introduce bias.[50,51]

Future Directions: Future research should focus on larger, multicenter trials to validate these findings across diverse patient populations. Exploring the combined use of intravenous and topical lignocaine could also provide insights into optimizing conditions for LMA insertion. Furthermore, studies evaluating the long-term outcomes of these methods in terms of patient satisfaction and recovery would be valuable.

CONCLUSION

This randomized prospective study highlights the comparative efficacy of intravenous lignocaine and topical lignocaine in facilitating laryngeal mask airway (LMA) insertion under general anaesthesia. The results demonstrate that intravenous lignocaine offers distinct advantages over topical lignocaine, including reduced gag reflex severity, shorter insertion times, higher first-attempt success rates, and improved patient comfort. These findings underscore the ability of intravenous lignocaine to provide superior airway conditions, ensuring a smoother and more efficient LMA insertion process.

Both methods maintained stable hemodynamic parameters during and after the procedure, indicating their safety and tolerability. However, intravenous lignocaine exhibited slightly more consistent results in terms of vital parameters, particularly heart rate and mean arterial pressure. Adverse events were minimal and comparable in both groups, with transient hoarseness and mild cough being the most commonly observed. Importantly, no severe complications were reported, reinforcing the safety profiles of both approaches.

From a clinical perspective, intravenous lignocaine appears to be the more effective option for patients requiring LMA insertion, particularly in settings where rapid and efficient airway management is critical. Topical lignocaine, while slightly less effective, remains a viable alternative, especially in patients where systemic administration may be contraindicated or intravenous access is challenging.

The study's findings contribute valuable evidence to the existing body of literature, supporting the preferential use of intravenous lignocaine in elective surgeries requiring LMA insertion. However, the relatively small sample size and single-center design limit the generalizability of the results. Future research should focus on multicenter trials with larger sample sizes to confirm these findings and explore additional factors such as patient-specific predictors of success and the long-term outcomes of these interventions.

In conclusion, both intravenous and topical lignocaine are effective and safe for facilitating LMA insertion, but intravenous lignocaine provides superior clinical benefits. Its routine use in clinical practice can enhance patient comfort, reduce procedural complexity, and improve overall outcomes during general anaesthesia.

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