Ease of Endotracheal Intubation and Hemodynamic Changes Following Topical Airway Anaesthesia Spray in Critically Ill Patients: An Observational Study

Dr. Sowmiyan B[1], Dr. Shailendra Singh[2], Dr. Sumit Shukla[3]
[1]Junior Resident, Department of Emergency Medicine, M.G.M Medical College, Indore, Madhya Pradesh
Email: sowmiyan97@gmail.com
[2]MBBS, DA, MD Anaesthesia, Department of Emergency Medicine, M.G.M Medical College, Indore, Madhya Pradesh
Email: sengarshailendraraj@gmail.com
[3]MBBS, MS FIAGES, FAIS, Department of Emergency Medicine, M.G.M Medical College, Indore, Madhya Pradesh
Email: drsumitshukla@gmail.com

Received: 25th Aug, 2026 | Revised: 1st Sep, 2026 | Accepted: 5th Sep, 2026 | Available Online: 7th Sep, 2026

ABSTRACT:

Background and Aims:

Endotracheal intubation in critically ill patients was frequently associated with hemodynamic instability and procedure-related complications. Although rapid sequence intubation (RSI) remains the standard approach, it may be relatively contraindicated or high-risk in patients with severe hemodynamic compromise or anticipated peri-intubation instability. In such scenarios, adjunctive techniques that attenuate airway reflexes without significant systemic effects may improve intubation conditions. Topical airway anaesthesia with lignocaine spray offers a potential strategy to facilitate airway management while minimising physiological derangements. This study aimed to assess the use of 10% lignocaine spray in facilitating intubation and its impact on hemodynamic parameters in critically ill patients.

Materials and Methods:

This hospital-based cross-sectional study was conducted in the Emergency Department of a tertiary care centre. It included 100 adult patients with Glasgow Coma Scale (GCS) ≤8 with clinical indications for airway protection requiring endotracheal intubation. Topical airway anaesthesia was administered using 10% lignocaine spray as an adjunct to standard airway management protocols before laryngoscopy. Ease of intubation was assessed using Modified Cormack–Lehane grading and first-pass success rate. Hemodynamic parameters, including heart rate, mean arterial pressure (MAP), and oxygen saturation (SpO_2), were recorded at baseline and at 2, 5, 10, and 15 minutes post-intubation. Statistical analysis was performed using the chi-square test, Fisher's exact test, and repeated-measures ANOVA.

Results:

The first-pass success rate was 83% (95% confidence interval: 76%–90%). Favourable laryngoscopic views (Grade I–IIa) were observed in 67% of patients and were significantly associated with first-pass success ($p < 0.001$). Heart rate increased transiently immediately after intubation, while mean arterial pressure initially decreased and subsequently stabilised. Oxygen saturation improved progressively over time. All hemodynamic changes were statistically significant ($p < 0.001$). Complications occurred in a small proportion of patients.

Conclusion:

Topical airway anaesthesia using 10% lignocaine spray appears to be a clinically feasible adjunct, with favourable intubation conditions and acceptable hemodynamic parameters observed in critically ill patients. It may serve as a useful adjunct in emergency airway management, particularly in patients for whom standard RSI may be high risk or relatively contraindicated.

Keywords:

Topical anaesthesia, endotracheal intubation, emergency airway, lignocaine spray, and hemodynamic response.

How to cite this article: Sowmiyan B1 Dr. Shailendra Singh2 Dr. Sumit Shukla3. Ease of Endotracheal Intubation and Hemodynamic Changes Following Topical Airway Anaesthesia Spray in Critically Ill Patients: An Observational Study. Int J Drug Deliv Technol. 2026;16(80s):1444-1451. DOI: 10.25258/ijddt.16.80s.184.

INTRODUCTION

Airway management is a fundamental component of emergency care, with endotracheal intubation being the most reliable method for securing the airway and ensuring adequate oxygenation and ventilation in critically ill patients. However, intubation in the emergency department (ED) is associated with significantly higher complication rates compared to controlled operating room settings, primarily due to physiological instability, hypoxemia, acidosis, and hemodynamic compromise [5,7].

Rapid sequence intubation (RSI), which involves the administration of a sedative and a neuromuscular blocking agent, is widely considered the standard approach for airway management in emergencies [8]. Despite its effectiveness, RSI may precipitate adverse hemodynamic events, particularly hypotension

and cardiovascular instability, which are known predictors of poor outcomes in critically ill patients [3]. The integration of neuromuscular blocking agents into emergency airway management occurred later than in other settings, largely due to concerns about losing airway control in paralysed patients. It may be deferred when the clinician anticipates a high risk of a cannot intubate, cannot oxygenate scenario (CICO), profound hypoxemia, or limited tolerance to apnea. Additionally, airway instrumentation during laryngoscopy triggers sympathetic stimulation, leading to tachycardia and hypertension, which may be detrimental in patients with limited physiological reserve [12,13].

Topical airway anaesthesia has emerged as a useful adjunct to minimise these adverse responses. Lidocaine, commonly used for airway topicalization, acts by stabilising neuronal membranes and suppressing airway reflexes such as coughing and gagging. This results in improved patient tolerance, smoother intubation, and reduced sympathetic surge without significant systemic effects [11]. Topical anaesthesia may be particularly advantageous in patients where maintaining spontaneous respiration is desirable or where the use of neuromuscular blockers is contraindicated [2,8].

Despite these advantages, the use of topical airway anaesthesia in emergency settings remains limited, and evidence regarding its effectiveness in critically ill patients is relatively scarce. Most existing studies have focused on elective or operating room settings, with fewer studies evaluating its role in emergency airway management [6,9].

Therefore, this study was conducted to assess the topical anaesthetic spray's ability to improve the ease of endotracheal intubation, as measured by laryngoscope view and first-pass success rate, and to analyse its impact on hemodynamic parameters in critically ill patients presenting to the emergency department.

Materials and Methods

Study Design and Setting

This hospital-based cross-sectional study was conducted in the Department of Emergency Medicine at M.G.M Medical College and M.Y. Hospital, Indore, a tertiary care centre.

Study Duration

The study was conducted over 12 months, from April 2024 to March 2025, following approval from the Institutional Ethics and Scientific Review Committee.

Study Population and Sample Size

A total of 100 adult patients presenting to the emergency department with altered sensorium and requiring endotracheal intubation were included in the study.

Inclusion Criteria

- Adult patients aged ≥18 years
- Patients presenting with altered sensorium requiring endotracheal intubation with a Glasgow Coma Scale (GCS) score ≤8
- Patients whose legally authorised attendants provided informed consent

Exclusion Criteria

- Refusal of consent by the patient's legally authorised attendant
- Patients with known coagulation or bleeding disorders
- Patients with known hypersensitivity or allergy to lignocaine or study drugs

Procedure

All patients meeting the inclusion criteria underwent initial triage and resuscitation in the emergency department. Baseline vital parameters, including heart rate (HR), mean arterial pressure (MAP), and oxygen saturation (SpO_2), were recorded before intubation.

Patients were positioned appropriately, and airway preparation was performed. Gentle suctioning of the oral cavity and nares was performed, followed by preoxygenation with bag-mask ventilation using supplemental oxygen.

Premedication was administered with intravenous glycopyrrolate (0.3 mg), and low-dose sedation was achieved using midazolam (0.05–0.1 mg/kg).

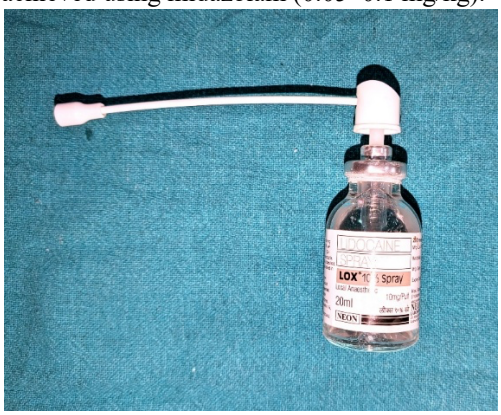


Figure 1 shows 10% LOX. Figure 2 shows the Atomiser.

Topical airway anaesthesia was applied using 10% lignocaine spray (5-10 puffs) delivered via an atomiser to the posterior pharynx. After approximately 3 minutes, further anaesthesia was

administered using the "spray-as-you-go" (SAY Go) technique with 2% lignocaine (1-2ml) directed towards the vocal cords and surrounding laryngeal structures.

Direct laryngoscopy was performed using Macintosh blades (size 3 or 4). The laryngeal view was assessed using the Modified Cormack–Lehane grading system. Endotracheal intubation was then performed, and correct tube placement was confirmed using standard clinical methods, including bilateral chest rise and auscultation.

Figure 3: Grade 1 Cormack Lehane Grading

Figure 4: Grade 2a Cormack Lehane Grading

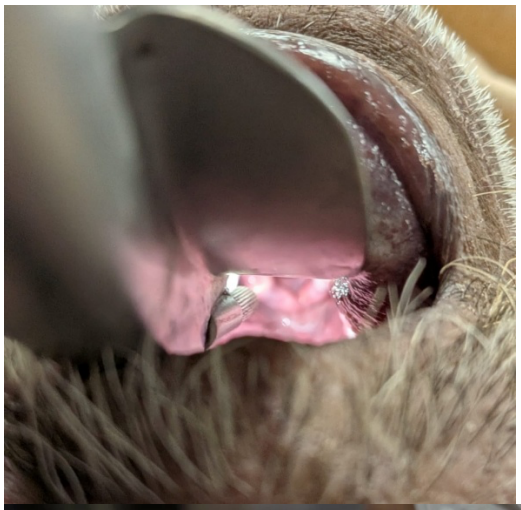


Figure 5: Grade 2b Cormack Lehane Grading

Figure 6: Grade 3 Cormack Lehane Grading

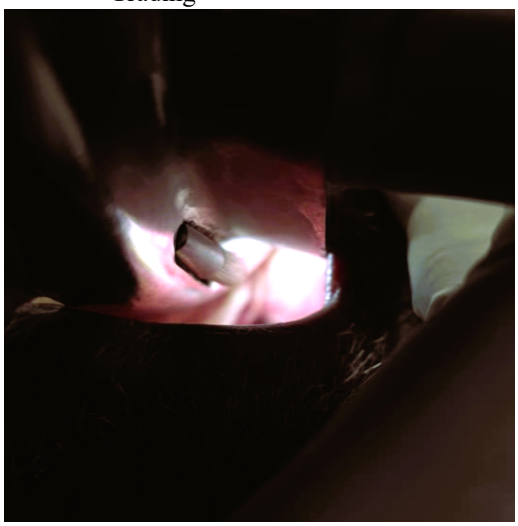


Figure 7: Grade 4 Cormack Lehane Grading

The number of intubation attempts and first-pass success were recorded. Hemodynamic parameters (HR, MAP, SpO_2) were documented at baseline and at 2, 5, 10, and 15 minutes following intubation.

All patients were subsequently managed as per standard clinical protocols. Any procedure-related complications, including dental trauma, laryngeal

injury, hypotension, bradycardia, or aspiration, were recorded and managed appropriately.

Outcome Measures

Primary Outcome:

1. Ease of endotracheal intubation, assessed by:
    - Modified Cormack–Lehane laryngoscope grading
    - First-pass intubation success rate

Secondary Outcomes:

1. Changes in hemodynamic parameters:
    - Heart rate (HR)
    - Mean arterial pressure (MAP)
    - Oxygen saturation (SpO_2) (Recorded at baseline and at 2, 5, 10, and 15 minutes post-intubation)
2. Incidence of procedure-related complications, including:
    - Dental trauma
    - Laryngeal injury
    - Hypotension
    - Bradycardia
    - Gastric aspiration

Statistical Analysis

Data were entered into Microsoft Excel and analysed using JAMOVI statistical software (version 2.3.28).

Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD).

The association between categorical variables was assessed using the chi-square test or Fisher's exact test, as appropriate. Changes in hemodynamic parameters (heart rate, mean arterial pressure, and SpO_2) over time were analysed using repeated-measures analysis of variance (ANOVA).

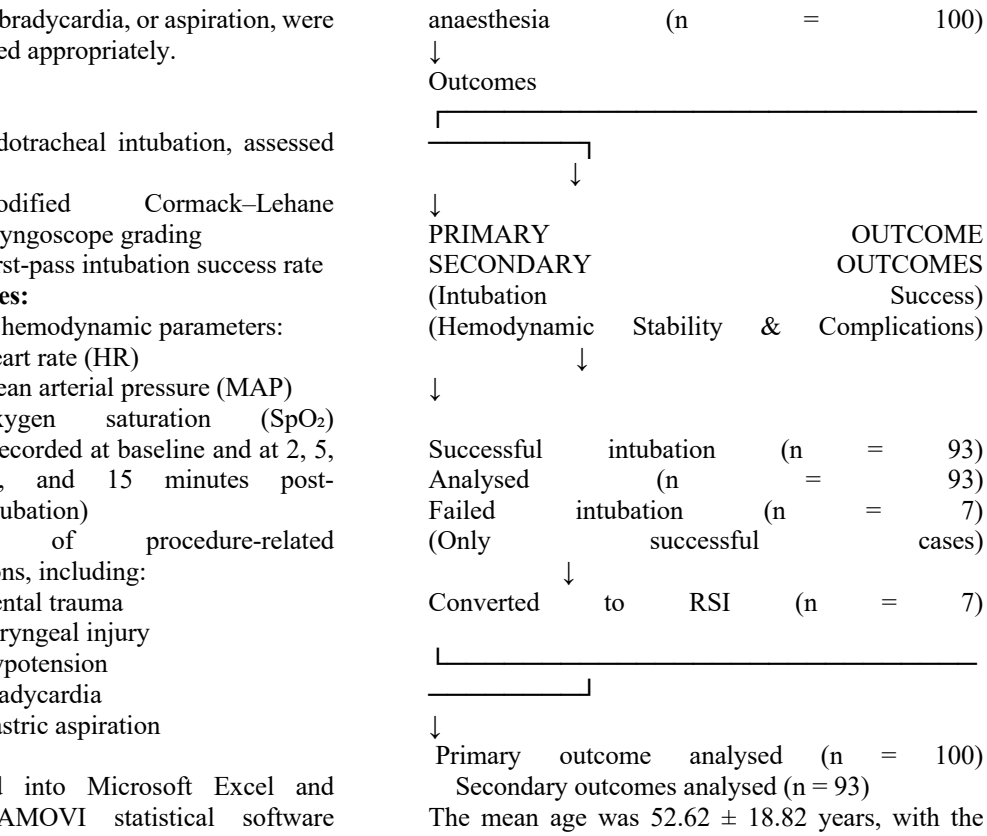
A p-value of <0.05 was considered statistically significant. All statistical tests were two-tailed.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of M.G.M Medical College and M.Y. Hospital, Indore. Informed written consent was obtained from the legally authorised representatives of all participants. The study was conducted in accordance with the Declaration of Helsinki. Patient confidentiality and anonymity were strictly maintained throughout the study. No identifying information was recorded or disclosed. All procedures were performed in accordance with standard clinical protocols.

Results

A total of 100 patients were included in the study.



The mean age was 52.62 ± 18.82 years, with the majority belonging to the 46–65-year age group. There was a male predominance (70%).

Intubation Characteristics:

First-pass intubation was successful in 83% of patients, while 10% required a second attempt and 7% had failed intubation. First-pass intubation was achieved in 83% (95% CI: 76%-90%). Favourable laryngoscope views (Modified Cormack–Lehane Grade I and IIa) were observed in 67% of patients. Difficult laryngoscopy (Grade III and IV) was noted in 9% of cases. A statistically significant association was found between laryngoscope grade and first-pass success rate ($p < 0.001$).

Hemodynamic Parameters:

There was a significant variation in all hemodynamic parameters over time ($p < 0.001$). The mean heart rate increased from 94.32 ± 18.58 bpm at baseline to 124.84 ± 14.97 bpm at 2 minutes post-intubation, followed by a gradual decline towards baseline values. Mean arterial pressure decreased from 103.79 ± 27.96 mmHg at baseline to 89.18 ± 23.23 mmHg at 2 minutes and partially recovered thereafter. Oxygen saturation improved progressively from 90.89 ± 5.58% at baseline to 99.29 ± 1.56% at 15 minutes.

Complications:

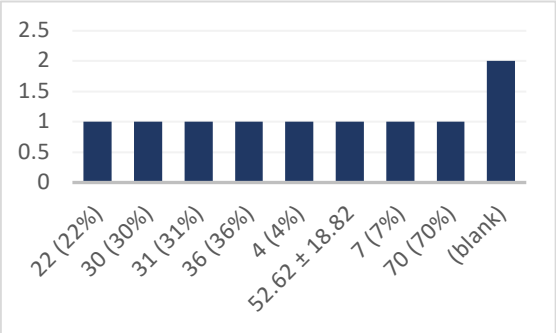
Procedure-related complications were minimal. Dental trauma occurred in 10.8% of patients, laryngeal trauma in 8.6%, and gastric aspiration in 6.4%. Hypotension was observed in 1.1% of cases, while no episodes of bradycardia were reported.

Table 1. Baseline Characteristics of Study Participants (n = 100)

Variable	Value
Age (years), mean ± SD	52.62 ± 18.82
Age group (years), n (%)	
18–25	7 (7%)
26–45	31 (31%)
46–65	36 (36%)
66–85	22 (22%)
>85	4 (4%)
Gender, n (%)	
Male	70 (70%)
Female	30 (30%)

Table Notes: Values are presented as mean ± standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables. Age distribution is categorised into predefined groups for descriptive analysis. The study population showed a predominance of middle-aged individuals and males. SD: Standard deviation.

Graph 1. Age Distribution of Study Participants



Graph 1 Notes: The bar diagram represents the distribution of study participants across different age groups. The highest proportion of patients was observed in the 46–65-year age group, followed by the 26–45-year group. Fewer participants were seen in the younger (<25 years) and older (>85 years) age categories. Values are expressed as frequency.

Table 2. Laryngoscope View (Modified Cormack–Lehane Grading)

Grade	Frequency (%)
Grade I	26 (26%)
Grade IIa	41 (41%)
Grade IIb	24 (24%)
Grade III	2 (2%)
Grade IV	7 (7%)

Table Notes: Values are expressed as frequency (percentage). The Modified Cormack–Lehane grading system was used to assess laryngeal view during direct laryngoscopy. Grades I and IIa represent favourable intubation conditions, while Grades IIb–IV indicate increasing difficulty. CL: Cormack–Lehane.

Table 3. Intubation Attempts and Success Rate

Intubation Attempts	Success rate
First pass attempt	83%
Second pass attempts	10%
Failed intubation	7%

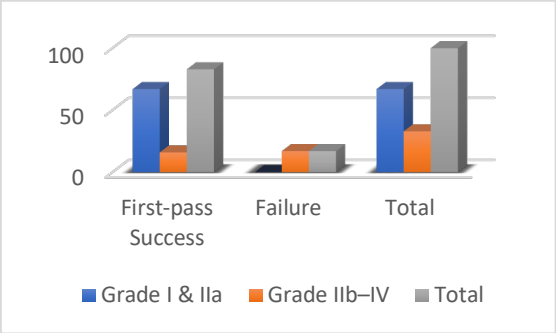
Table Notes: Values are expressed as frequency (percentage). First-pass success is defined as successful endotracheal intubation on the first attempt without the need for additional manoeuvres. Failed intubation includes cases requiring alternative airway management.

Table 4. Association Between Laryngoscope Grade and First-pass Success

Laryngoscope Grade	First-pass Success	Failure	Total
Grade I & IIa	67	0	67
Grade IIb–IV	16	17	33
Total	83	17	100

Table Notes: Values are expressed as frequency. Grades I and IIa were grouped as favourable laryngoscope views, while Grades IIb–IV were considered difficult views. The association between laryngoscope grade and first-pass success was analysed using Fisher's exact test. A p-value <0.05 was considered statistically significant.

Graph 2. Association Between Laryngoscope Grade and First-pass Success



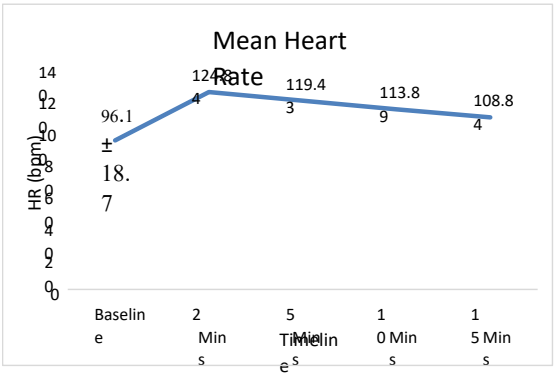
Graph Notes: The clustered bar diagram illustrates the relationship between laryngoscope grade and first-pass intubation success. Grades I and IIa demonstrated higher success rates, while Grades IIb–IV were associated with higher failure rates. A statistically significant association was observed between laryngoscope grade and first-pass success ($p < 0.001$). Values are expressed as frequency.

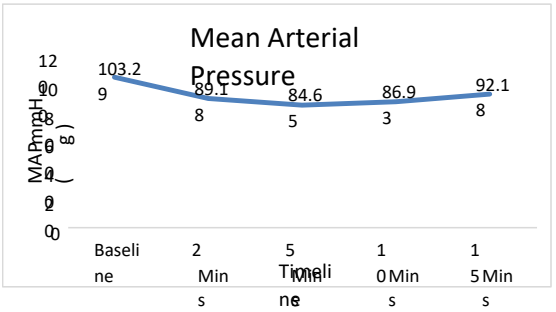
Table 5. Hemodynamic Parameters at Different Time Intervals

Parameter	Baseline	2 min	5 min	10 min	15 min	p-value
HR (bpm), mean ± SD	96.1 ± 18.7	124.84 ± 14.97	119.43 ± 15.25	113.89 ± 15.25	108.84 ± 14.20	<0.001
MAP (mmHg), mean ± SD	103.2 ± 28.4	89.18 ± 23.23	84.65 ± 21.92	86.93 ± 21.29	92.18 ± 21.61	<0.001
SpO_2 (%), mean ± SD	91.2 ± 5.6	93.03 4.36	97.10 ± 2.37	98.81 ± 1.73	99.29 ± 1.56	<0.001

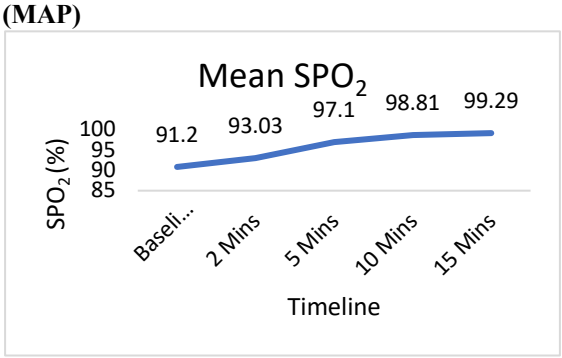
Table Notes: Values are presented as mean ± standard deviation (SD). Hemodynamic parameters were recorded at baseline and at predefined intervals following intubation. Repeated-measures analysis of variance (ANOVA) was used to assess changes over time. A p-value <0.05 was considered statistically significant. HR: Heart rate; MAP: Mean arterial pressure; SpO_2: Oxygen saturation.

Graph 3: Mean (SD) of Heart Rate (HR)





Graph 4: Mean (SD) of Mean Arterial Pressure (MAP)



Graph 5: Mean (SD) of SpO_2

Table 6. Procedure-related Complications (n = 93)

Complication	Present n (%)	Absent n (%)
Dental trauma	10 (10.8%)	83 (89.2%)
Laryngeal trauma	8 (8.6%)	85 (91.4%)
Gastric aspiration	6 (6.4%)	87 (93.6%)
Hypotension	1 (1.1%)	92 (98.9%)
Bradycardia	0 (0%)	93 (100%)

Table Notes: Values are expressed as frequency (percentage). Only patients with complete complication data (n = 93) were included in this analysis. Complications were recorded during and

immediately after the intubation procedure. The overall incidence of complications was low, indicating the relative safety of the technique.

DISCUSSION

The present study assessed the effectiveness of a topical airway anaesthesia spray in improving the ease of endotracheal intubation and its impact on hemodynamic parameters in critically ill patients. The findings demonstrate that topical anaesthesia is associated with a high first-pass success rate and acceptable hemodynamic stability.

The participants in the study had an 83% success rate on the first attempt at intubation (95% CI: 76%-90%). Our first-pass success rate was 83% in our study, similar to 85% (95% CI: 76% to 94%) reported by Kaisler et al. [16]. These results were relatively in line with the existing literature. Approximately 1 in 10 required a second attempt (95% CI: 4% to 15%), indicating that initial difficulties can be overcome with reinforcement of topical anaesthesia and minor procedural airway adjustments. Nevertheless, the first-pass success rate is most desirable in emergency airway management to reduce complications and adverse events associated with this technique, particularly aspiration. However, 7% of patients in the current study failed intubation with the topical anaesthesia spray method (95% CI: 2%-12%), despite an overall success rate of 93% with this method. Unsuccessful intubation in such situations can be explained by insufficient airway anaesthesia, excessive airway secretions, and insufficient time to optimally prepare the airways in patients with critical, unstable conditions [3-4]. Alternative airway plans were immediately implemented after all failed intubations, in line with standard difficult-airway algorithms, to ensure patient safety. The high success rate observed in this study suggests that topical anaesthesia may facilitate optimal conditions for laryngoscopy.

The majority of patients demonstrated favourable laryngoscope views (Grade I and IIa), indicating improved glottic visualisation. A statistically significant association was found between laryngoscope grade and first-pass success ($p < 0.001$), with higher grades correlating with increased failure rates. These findings are consistent with existing literature, which identifies laryngoscope view as a key predictor of intubation success [9,10,15].

Hemodynamic parameters showed significant but transient changes following intubation. A rise in heart rate and a decrease in mean arterial pressure were observed immediately after intubation, followed by gradual stabilisation. These findings align with previous studies in which topical lidocaine attenuated the pressor response but did not eliminate physiological fluctuations [11–14]. Compared to conventional rapid sequence intubation, topical anaesthesia may offer better hemodynamic tolerance, particularly in patients with limited physiological reserve [7,8].

Oxygen saturation improved progressively following intubation, reflecting effective airway control and adequate ventilation. The low incidence of complications, including hypotension and bradycardia, further supports the safety profile of the topical anaesthesia technique. Procedure-related complications such as dental and laryngeal trauma were observed in a small proportion of patients, which is consistent with rates reported in emergency airway management studies [5–7]. Any major adverse events following intubation were promptly identified and managed in accordance with institutional protocols.

Topical airway anaesthesia is particularly useful in situations where maintaining spontaneous respiration is desirable or where neuromuscular blockers may pose a risk. It provides adequate airway conditions without significant systemic effects, making it a valuable adjunct in emergency airway management [2,8].

CONCLUSION

Topical airway anaesthesia using lignocaine spray is an effective and clinically feasible technique for facilitating endotracheal intubation in critically ill patients. It is associated with a high first-pass success rate and favourable laryngoscope views, indicating improved ease of intubation.

Although transient hemodynamic changes were observed, overall parameters remained stable, suggesting acceptable physiological tolerance. The low incidence of complications further supports the safety of this approach.

Topical anaesthesia may serve as a valuable adjunct in emergency airway management, particularly in patients with limited physiological reserve. Further randomised controlled studies are recommended to validate these findings and compare their efficacy with conventional techniques.

LIMITATIONS

This study has several limitations. It was a single-centre study with a relatively small sample size, which may limit the generalizability of the findings. The absence of a control group prevents direct comparison with conventional intubation techniques and limits causal inference. Additionally, variability in operator experience and patient clinical conditions may have influenced intubation outcomes. Further multicentric randomised controlled trials are required to validate these findings.

CLINICAL SIGNIFICANCE

Topical airway anaesthesia using lignocaine spray can be a valuable adjunct in emergency airway management, particularly in critically ill patients with hemodynamic instability. It facilitates easier intubation, improves first-pass success rates, and minimises adverse physiological responses. This technique may be especially beneficial in situations

where maintaining spontaneous respiration is desirable or when the use of neuromuscular blockers is limited.

REFERENCES

1. Sakles JC, Mosier JM, Patanwala AE, Dicken JM. First-pass success without adverse events is reduced equally in anatomically and physiologically difficult airways. West J Emerg Med. 2017;18(4):622–630.
2. Mosier JM, Sakles JC, Stolz U, Hypes CD, Chopra H, Malo J, et al. Neuromuscular blockade improves first-attempt success for intubation in the intensive care unit. Ann Am Thorac Soc. 2015;12(5):734–741.
3. Heffner AC, Swords DS, Kline JA, Jones AE. The frequency and significance of post-intubation hypotension during emergency airway management. J Crit Care. 2012;27(4):417.e9–417.e13.
4. Mort TC. Emergency tracheal intubation: Complications associated with repeated laryngoscopic attempts. Anesth Analg. 2004;99(2):607–613.
5. Walls RM, Brown CA, Bair AE, Pallin DJ; NEAR Investigators. Emergency airway management: A multi-center report of 8937 emergency department intubations. J Emerg Med. 2011;41(4):347–354.
6. Brown CA, Bair AE, Pallin DJ, Walls RM; NEAR III Investigators. Techniques, success, and adverse events of emergency department adult intubations. Ann Emerg Med. 2015;65(4):363–370.e1.
7. Jaber S, Amraoui J, Lefrant JY, Arich C, Cohendy R, Landreau L, et al. Clinical practice and risk factors for immediate complications of endotracheal intubation in ICU: A prospective multicenter study. Crit Care Med. 2006;34(9):2355–2361.
8. Higgs A, McGrath BA, Goddard C, Rangasami J, Suntharalingam G, Gale R, et al. Guidelines for the management of tracheal intubation in critically ill adults. Br J Anaesth. 2018;120(2):323–352.
9. Levitan RM, Kinkle WC. Initial anatomic investigations of the GlideScope video laryngoscope. Ann Emerg Med. 2005;46(3):S9–S10.
10. Adnet F, Borron SW, Racine SX, Clemessy JL, Fournier JL, Plaisance P, et al. The intubation difficulty scale (IDS): Proposal and evaluation of a new score. Anesthesiology. 1997;87(6):1290–1297.
11. Xue FS, Liu KP, Zhang GH, Li P, Sun HT, Li CW, et al. Circulatory responses to laryngoscopy and intubation: Comparison of lidocaine and opioids. J Clin Anesth. 2006;18(2):119–123.
12. Hamaya Y, Dohi S. Differences in cardiovascular response to airway stimulation at different sites. Anesthesiology. 2000;93(1):95–103.
13. Stoelting RK. Circulatory changes during direct laryngoscopy and tracheal intubation: Influence of duration of laryngoscopy. Anesthesiology. 1977;47(4):381–384.
14. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth. 1995;7(1):5–7.
15. Greenland KB, Edwards MJ, Hutton NJ. External laryngeal manipulation and laryngoscopy: Improving laryngeal view. Anaesth Intensive Care. 2000;28(5):490–495.
16. Kaisler MC, Hyde RJ, Sandefur BJ, Kaji AH, Campbell RL, Driver BE, Brown III CA. Awake intubations in the emergency department: a report from the National Emergency Airway Registry. The American Journal of Emergency Medicine. 2021 Nov 1;49:48-51.