ORIGINAL RESEARCH PAPER

Volume - 13 | Issue - 04 | April - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARISON OF NEBULIZED AND INTRAVENOUS LIDOCAINE FOR REDUCING BLOOD PRESSURE CHANGES DURING LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION.

Anaesthesiology

Dr. Shalini Thakur	PGJR 3
Dr. Pushpinder	PGJR 2
Dr. Supriya Aggarwal	Associate Professor
Dr. Devanshi Sharma	PGJR 1

ABSTRACT

Background: Laryngoscopy and endotracheal intubation often lead to temporary increases in blood pressure and heart rate due to the activation of the sympatho-adrenal system. Patients with cardiovascular and cerebrovascular illnesses may have a sudden hemodynamic reaction, which may have harmful consequences such as myocardial ischemia or infarction, arrhythmias, cardiac failure, increased intracranial pressure, and cerebral hemorrhage. **Aim:** A comparison of nebulized and intravenous lidocaine for reducing blood pressure changes during laryngoscopy and endotracheal intubation **Materials and method:** A prospective randomized study was done in the Department of Anaesthesia and Critical Care at K. D. Medical College Hospital and Research Center, Mathura, from June 2023 to Jan 2024. Ninety patients undergoing surgeries under general anesthesia were divided into two groups. Patients of group IVL (n=45) received 2% Lignocaine 1.5mg/kg diluted in 10ml Normal saline by slow intravenous route 90 seconds before induction, and patients of group NL (n=45) received 4ml, 4% lignocaine as nebulization 10min before induction.Results: In Group NL, the baseline heart rate (HR) was 87.04 bpm, increasing to 112.47 bpm two minutes post-intubation, indicating a rise of 25.43 bpm. In the IVL group, the baseline HR for this group was 87.63 bpm, with a subsequent increase to 100.02 bpm two minutes post-intubation, reflecting a rise of 12.39 bpm.In the NL group, nebulized lignocaine significantly increased systolic (SBP), diastolic (DBP), and mean arterial pressure (MAP) by notable values as compared with the IVL group. **Conclusion:** Our conclusion is that the administration of lignocaine effectively mitigates the fluctuations in heart rate and blood pressure induced by laryngoscopy and endotracheal intubation. Notably, the intravenous delivery of lignocaine demonstrates superior suppressive properties when compared to lignocaine nebulization.

KEYWORDS

Lignocaine Nebulization, Intravenous Lignocaine, Hemodynamic Parameters, Laryngoscopy, Endotracheal Intubation

INTRODUCTION

Essential procedures, such as direct laryngoscopy and tracheal intubation, induce significant hemodynamic responses mediated by sympathetic stimulation and catecholamine surges [1,2]. These transient increases in blood pressure and heart rate pose severe risks for vulnerable patients with pre-existing cardiovascular, cerebrovascular, or ocular pathologies [3,4]. Consequently, mitigating these laryngoscopic reactions is paramount, leading to exploring various pharmacological interventions.

Lignocaine, a Class Ib anti-arrhythmic agent, has garnered attention for its potential in blunting hemodynamic responses. Intravenous administration has demonstrated efficacy in managing these responses [5]. However, nebulized lignocaine offers an alternative approach with potential advantages. Unlike systemic delivery, nebulization delivers the drug directly to airway receptors, potentially reducing systemic side effects and achieving a faster onset of action [6].

However, limited research directly compares the effectiveness of nebulized and intravenous lignocaine in attenuating hemodynamic responses during airway manipulation. This study addresses this gap by evaluating and contrasting the two methods. Its findings will equip anesthetists with valuable data to guide their choice in minimizing hemodynamic complications associated with airway management, particularly in high-risk patients.

MATERIALS AND METHOD

A prospective randomized study was done in the Department of Anaesthesia and Critical Care at K. D. Medical College Hospital and Research Center, Mathura, from June 2023 to Jan 2024. Ninety patients of ASA1 and ASA2 undergoing surgeries under general anesthesia were included in this study and were divided into two groups. In Group IVL (n=45), participants received 2% Lignocaine at a dosage of 1.5mg/kg, diluted in 10ml of normal saline through a slow intravenous route 90 seconds before induction. Meanwhile, in Group NL (n=45), a nebulization approach was employed with 4ml of 4% lignocaine administered 10 minutes before induction.

Inclusion criteria

- Planned elective surgery under general anaesthesia requiring endotracheal intubation.
- ASA grade 1 and 2 patients
- Age group of 18 to 45 years of either sex
- Body weight of 50 - 70kg.

Exclusion criteria

- Lack of consent
- Preexisting hypertension.
- Conditions such as chronic obstructive pulmonary disease, cerebrovascular disease, cardiovascular diseases, psychiatric illness, and liver disorders
- Emergency surgical cases.
- Known allergy to the study drug or contraindications
- Anticipated difficult airways.

The participants provided written informed consent after thoroughly explaining the anesthetic procedure, which was presented in their native language, to guarantee understanding.

A detailed pre-anesthetic evaluation was done, including the history of previous illness and previous surgeries, general physical examination, and thorough examination of the cardiovascular, respiratory, and other relevant systems, followed by routine investigations of all the patients. An IV line was secured using an 18G cannula. Inj. Ranitidine 150 mg was given before surgery to reduce gastric secretions. The Basal heart rate, blood pressure readings, SpO2, cardiac rate, and rhythm were monitored. Inj. glycopyrolate 0.2mg was given to all patients in the pre-operative area. The patient in group NL was given nebulized with 4ml, 4% lignocaine, 10 min before induction of anesthesia. The patient in group IVL was given 4ml of Normal saline nebulization. The patient was connected to non-invasive monitoring on the operating table with an electrocardiograph, pulse oximeter, and non-invasive BP machine. All patients were given Inj. Midazolam 1mg IV and inj. Fentanyl 2µ/kg and then preoxygenate with 100% oxygen for 3 minutes. Patients in Group IVL received 2% lignocaine in the dose of 1.5mg/kg body weight diluted in 10ml Normal saline 90 seconds before induction of anesthesia. Patients of the NL group received 10ml Normal saline iv.

Anesthesia was induced using in. Propofol in the dose of 2mg/kg was followed by endotracheal intubation using injection. Succinylcholine in the dose of 1.5 mg/kg. Laryngoscopy was done with a Macintosh laryngoscope, and anesthesia was maintained by 50% nitrous oxide, 50% oxygen, and Isoflurane. Neuromuscular blockade was maintained using non-depolarizing muscle relaxants like Vecuronium 0.1mg/kg.

The subsequent measurements were documented that are Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and Mean arterial pressure (MAP).

Measurements were taken at baseline and at the 2nd, 4th, 6th, 8th, and 10th minutes after laryngoscopy and endotracheal intubation. Following the procedure, reversal was initiated using Neostigmine at a dosage of 0.05 mg/kg IV and Glycopyrrolate at a dosage of 0.01 mg/kg IV.

Statistical methods

The collected data was compiled in an MS Excel sheet, and a Master sheet was prepared. Data was presented by visual impressions like a bar diagram and histogram. Qualitative was represented in form values & percentages. The chi-square test was used for qualitative data. For the comparison of the Quantitative variables of the two groups, an unpaired t-test was used.

RESULTS

The two groups (NL and IVL) were similar in terms of age, weight, and gender distribution. People in both groups were roughly the same age (average age in NL: 39.75 years, IVL: 38.99 years) and weight (average weight in NL: 58.36 kg, IVL: 60.89 kg). Statistical tests also confirmed no significant difference between the groups in these aspects (age p-value = 0.07, weight p-value = 0.14).

Table 1: Basic profile of the participants

Basic profile		Group NL	Group IVL	P value
Gender	Male	30	28	0.19
	Female	15	17	
Age		39.75 ± 3.94	38.99 ± 3.98	0.07
Weight		58.36 ± 4.85	60.89 ± 5.96	0.14

In Group NL, where 4ml, 4% lignocaine was administered as nebulization 10 min before laryngoscopy, and intubation was used to blunt the pressure response, the baseline value of HR was 87.04 bpm. Two minutes following laryngoscopy and intubation, the HR increased to 112.47 bpm, representing a rise of 25.43 bpm above the baseline value. Thus, the maximal increase in HR was seen at an average of 25.43 bpm. It was seen that the elevated HR started settling down towards the baseline value by 10 min.

In Group IVL, where 2% Lignocaine 1.5mg/kg diluted in 10ml Normal saline by slow intravenous route for 90 seconds was administered to attenuate the hemodynamic response to laryngoscopy and intubation, the baseline value of HR was 87.63 bpm. Two minutes following laryngoscopy and intubation, the HR increased to 100.02 bpm, representing a rise of 12.39 bpm above the baseline value. Thus, the maximal increase of HR seen in the Group IVL was by an average of 12.39 bpm. It was seen that the elevated Heart rate (HR) started settling down towards the baseline value by 7 minutes. The maximum rise in heart rate was noted at 2 minutes following intubation in both groups, which concurs well with the studies mentioned above.

The mean rise in HR at 2 min in Group NL was 25.43 bpm compared to 12.39 bpm in Group IVL. The mean rise in the heart rate was comparatively lesser in the intravenous group and statistically significant compared to the Group NL.

In Group NL, where 4ml, 4% lignocaine was as nebulisation10min before laryngoscopy and intubation to blunt the pressure response, the maximal increase in the SBP, DBP, and MAP was found to be 9.18 mm Hg, 20.28 mm Hg and 22.00 mm Hg respectively.

In Group IVL, where 2% Lignocaine 1.5mg/kg diluted in 10ml Normal saline by slow intravenous route 90 seconds before laryngoscopy and intubation to blunt the pressure response, the maximal increase in the SBP, DBP, and MAP was found to be 3.12 mm Hg, 2.24 mm Hg and 3.14 mm Hg respectively. The attenuation of pressure response was highly significant in the Intravenous group.

Table 2: Changes in Mean Heart Rate (HR)

Heart Rate	Group NL	Group IVL	t	P value
Basal	87.04 ± 5.85	87.63 ± 13.09	0.17	0.77
Post-intubation				
2 Minute	112.47 ± 5.63	100.02 ± 4.29	3.96	0.001
4 Minute	106.74 ± 4.74	97.15 ± 4.15	2.89	0.04
6 Minute	96.69 ± 4.25	94.25 ± 3.96	0.66	0.52
8 Minute	93.04 ± 4.19	90.63 ± 3.74	0.87	0.22
10 Minute	88.47 ± 3.25	88.17 ± 3.33	0.17	0.23

Table 3: Changes in Mean Systolic Blood Pressure (SBP)

Systolic Blood Pressure	Group NL	Group IVL	t	P value
Base Line	130.87 ± 4.25	132.57 ± 3.33	0.34	0.74
Post-intubation				
2 Minute	140.05 ± 4.11	135.69 ± 3.74	3.01	0.04
4 Minute	130.74 ± 4.32	122.25 ± 3.22	2.63	0.02
6 Minute	126.35 ± 3.58	115.24 ± 3.44	2.47	0.01
8 Minute	120.04 ± 3.21	113.87 ± 3.15	3.14	0. 004
10 Minute	117.06 ± 3.17	112.87 ± 3.63	2.22	0.21

Table 4: Changes in Mean Diastolic Blood Pressure (DBP)

	Group NL	Group IVL	t	P value
Base Line	83.74 ± 3.22	84.87 ± 3.27	0.69	0.25
Post-intubation				
2 Minute	104.02 ± 2.41	87.11 ± 3.14	3.89	0.001
4 Minute	90.11 ± 2.45	80.56 ± 2.85	2.99	0.001
6 Minute	82.05 ± 2.36	76.52 ± 2.63	2.54	0.03
8 Minute	80.04 ± 2.14	75.87 ± 2.74	1.57	0. 17
10 Minute	79.11 ± 2.11	74.99 ± 2.14	1.96	0.07

Table 5: Changes in Mean Arterial Pressure (MAP)

	Group NL	Group IVL	t	P value
Base Line	99.02 ± 3.41	101.11 ± 3.85	0.88	0.21
Post intubation				
2 Minute	121.02 ± 3.41	104.25 ± 3.74	6.41	0.001
4 Minute	106.24 ± 3.44	94.74 ± 2.58	4.11	0.001
6 Minute	96.25 ± 3.63	88.63 ± 2.63	4.22	0.001
8 Minute	92.26± 2.47	89.36 ± 2.74	2.36	0.14
10 Minute	91.14 ± 2.63	88.14 ± 2.41	2.41	0.17

DISCUSSION

The primary indications for reducing hemodynamic responses to laryngoscopy and endotracheal intubation are in patients with Ischemic heart disease, Hypertension, and intracranial aneurysms. Even these temporary changes can lead to harmful effects such as left ventricular failure, pulmonary edema, myocardial ischemia, dysrhythmias, and cerebral hemorrhage. Lignocaine efficiently mitigates hemodynamic responses via its features, including the suppression of airway reflexes, prevention and treatment of laryngospasm, effective cough suppression, myocardial depression, peripheral vasodilation, and antiarrhythmic effects [7,8].

Gianelly et al. [9] determined that the level of lignocaine in the bloodstream after intravenous administration was proportional to the dosage. Additionally, they decided that administering an intravenous bolus of 1 to 2 mg/kg results in an effective and safe blood level of 2 to 5 µg/ml. It is important to note that significant adverse effects may arise when blood levels reach 9 µg/ml. According to Adriani [10], the anesthetic drugs given to the larynx and trachea may be readily absorbed from the pulmonary alveoli.

The blood concentrations attained after oropharyngeal anesthesia with viscous lignocaine (25 ml of 2% solution as a mouthwash and gargle 15 minutes before the laryngoscopy) were measured to be 0.5 µg/ml during the laryngoscopy procedure [11]. The average lignocaine level was measured after administering aerosol anesthesia to the upper airway using a mixture of 6-8 ml, consisting of 1/3 of 2% viscous lignocaine and 2/3 of 4% aqueous lignocaine. At 1 minute, the level was 1.2 µg/ml, and at 2 minutes, it increased to 1.4 µg/ml. Even though the minimum blood levels required to suppress premature ventricular contractions effectively suppress premature ventricular contractions range from 0.6 – 2 µg/ml, the treatment with lignocaine did prevent PVC in the patients[12]. The administration of lignocaine aerosol by inhalation is a secure, uncomplicated, efficient, and well-acknowledged approach. Evident constraints include young children, recalcitrant patients, patients at risk of regurgitation and vomiting, and time constraints. This study assessed lignocaine's effectiveness in reducing the hemodynamic response to laryngoscopy and endotracheal intubation. Two different routes of administration were used, both with the exact dosage of lignocaine. The study also aimed to identify any potential side effects of lignocaine.

Mounir Abou-Madi et al. [13] conducted a study by comparing two dosages of 2% lignocaine administered intravenously to suppress the pressure response. They found that a dose of 1.5 mg/kg gave more significant control of the pressure response than a dose of 0.75 mg/kg when given 2 to 3 minutes before laryngoscopy. A study conducted by Stanlay Tarn et al. [14] showed that administering intravenous lignocaine at a dosage of 1.5 mg/kg effectively reduced the rise in HR and arterial blood pressure (ABP) when given 3 minutes before intubation. However, no protective effect was detected when the lignocaine was administered at 1 minute, 2 minutes, or 5 minutes before intubation. Mohan K and Mohana Rupa L [15] reported that administering intravenous lignocaine 2% at a dosage of 1.5 mg/kg 3 minutes before laryngoscopy and intubation is effective in reducing the cardiovascular reaction to intubation. Gulabani M et al. [16] found that administering a dosage of 1.5 mg/kg of lignocaine 3 minutes before laryngoscopy and intubation was more efficient than administering 0.5 µg/kg of dexmedetomidine in reducing the rise in systolic and diastolic blood pressure at 3 minutes and 5 minutes after endotracheal intubation. We administered 2 mg/kg of 2% lignocaine intravenously to reduce the pressure response. We chose to provide it 90 seconds before induction, and intubation was performed 90 seconds after induction using succinylcholine. Therefore, the time between administering intravenous lignocaine and intubation was 3 minutes.

In a study by Bahaman V. [17], the impact of administering 6ml of 4% lignocaine via nebulization, 5 minutes before induction, on the cardiovascular response to laryngoscopy and intubation was investigated. The intervention group was compared to a control group that received saline nebulization. The aerosol group effectively prevented the pressure reaction and tachycardia in comparison to the control group.In a separate study conducted by Ahmed M. et al. [18], Lidocaine 2% (2 mg/kg) in 5 ml saline was administered using a standard nebulizer. The nebulizer, equipped with a full-face mask, was connected to an oxygen flow of 3 L/min. Patients were instructed to inhale the local anesthetic vapor deeply for 15 minutes. The study group demonstrated a significant increase in the number of patients with grade 0 tolerance to the endotracheal tube and a noteworthy reduction in the number of patients with grades 1 and 2 compared to the control group.

CONCLUSION

We concluded that the administration of lignocaine effectively inhibits the fluctuations in HR and blood pressure caused by laryngoscopy and endotracheal intubation. Indeed, intravenous administration of lignocaine has superior suppressive properties compared to the nebulization of lignocaine.

REFERENCES

1) Ganesan P, Balach H, Elakkumanan L conducted a study to evaluate the effectiveness of nebulized lignocaine compared to intravenous lignocaine in reducing the pressor response during laryngoscopy and intubation. The findings were published in Curr Med Issues in 2020;18(3):184-8. DOI: 10.4103/cmi.cmi_50_20.
2) Nabil F, Gharib AA, Gadelrab NA, et al.: Randomized double-blind controlled trial on preoperative lignocaine nebulization to reduce the pressor response during laryngoscopy and tracheal intubation in severe preeclampsia patients undergoing cesarean section delivery. Indian J Anaesth. 2023;67(6):515-22. 10.4103/ija. ija_ 898_22.
3) Soloman Raj S, Deepti R, Rao S, et al., conducted a comparative study evaluating lignocaine nebulization and intravenous lignocaine in mitigating the hemodynamic response during laryngoscopy and endotracheal intubation. This research was published in the MedPulse International Journal of Anesthesiology in 2021;18(2):64-7. DOI: 10. 26611/10151821.
4) Puntambekar SS, Deshpande VV.: Comparative study on lignocaine nebulization versus intravenous lignocaine to alleviate the pressor response during laryngoscopy and intubation. Indian J AnesthAnalg. 2019;6(3):1030-6. 10.21088/ijaa.2349.8471.6319.48
5) Kumar A, Seth A, Prakash S, et al.: Randomized controlled trial on the reduction of hemodynamic response to laryngoscopy and tracheal intubation using fentanyl, lignocaine nebulization, and a combination of both. Anesth Essays Res. 2016;10(3): 661-6. 10.4103/0259-1162.191113
6) Jokar A, Babaei M, and Pourmatin S. explored the impact of intravenous and inhaled nebulized lignocaine on the hemodynamic response during endotracheal intubation in patients. This research was published in Anesthesia Essays and Research in 2018;12(1):159-64. DOI: 10.4103/aer.AER_75_17.
7) Nath Gupta A, Anand R, and Singh R conducted a comparative study assessing the impact of nebulized lignocaine versus intravenous lignocaine on the stress response to endotracheal intubation. This research was published in MedPulse International Journal of Anesthesiology in 2018;8(2):84-7. DOI: 10.26611/1015825.
8) Gaurav S, Verma R, Verma H, Verma S, et al., conducted a prospective investigation to assess the impact of nebulized lidocaine on hemodynamic responses during nasotracheal intubation. This study was published in the Indian Journal of Clinical Anaesthesia in 2022;9(4):439-44. DOI: 10.18231/j.ijca.2022.089.
9) Gianelly R, von der Groeben JO, Spivack AP, et al., explored the influence of lidocaine on ventricular arrhythmias in individuals diagnosed with coronary heart disease. The findings from this study were published in the New England Journal of Medicine in 1967;277(23):1215-19. DOI: 10.1056/NEJM196712072772301.
10) Adriani J and Campbell D reported fatalities following the topical application of local anesthetics to mucous membranes in their study published in the Journal of the American MedicalAssociation in 1956;162(17):1527-30. DOI: 10.1001/jama.1956.029703 40017006.
11) Aho M, Lehtinen AM, Erkola O, et al., examined the impact of intravenously administered dexmedetomidine on perioperative parameters and the need for isoflurane in patients undergoing abdominal hysterectomy. This study was published in Anesthesiology in 1991;74(6):997-1002. DOI: 10.1097/00000542-199106000-00005.
12) Abou-Madi M, Keszler H, and Yacoub O proposed a technique to avert cardiovascular reactions during laryngoscopy and intubation. This research was published in the Journal of the Canadian Anaesthetists' Society in 1975;22(3):316-29. DOI: 10.1007/BF03004841.
13) Abou-Madi MN, Keszler H, and Yacoub JM investigated the cardiovascular reactions during laryngoscopy and tracheal intubation following the administration of varying intravenous doses of lidocaine. This study was published in the Journal of the Canadian Anaesthetists' Society in 1977;24(1):12-9. DOI: 10.1007/BF03006808.
14) Tarn S, Chung F, and Campbell M studied the optimal time of injection before tracheal intubation for intravenous lidocaine. This research was published in Anesthesia and Analgesia in 1987;66(10):1036-38. DOI: 10.1213/00000539-198710000-00026.
15) K M and L MR performed a comparative analysis, investigating the reduction of cardiovascular responses to laryngoscopy and intubation using diltiazem and lignocaine. This study was published in the International Journal of Medical Research & Health Sciences in 2013;2(3):557. DOI: 10.5958/j.2319-5886.2.3.098.
16) Gulabani M, Gurha P, Dass P, et al., conducted a comparative study assessing the effectiveness of lignocaine at a dosage of 1.5 mg/kg and two varied doses of dexmedetomidine (0.5 µg/kg and 1 µg/kg) in mitigating the hemodynamic pressure response during laryngoscopy and intubation. This research was published in Anesthesia Essays and Research in 2015;9(1):5-14. DOI: 10.4103/0259-1162.150167.
17) Venus B, Polassani V, and Pham CG examined the impact of aerosolized lidocaine on circulatory responses during laryngoscopy and tracheal intubation. This research was published in Critical Care Medicine in 1984;12(4):391-94. DOI: 10.1097/00003246-198404000-00011.
18) Ahmed M, El-Hamid AM, Hasan M, et al., discovered that the use of a lidocaine nebulizer decreases the reaction to endotracheal intubation and diminishes the requirement for postoperative analgesia following nasal operations. This research was published in the Journal of the American Scientist in 2013;9(12):287-91.