Journal of Anaesthesia and Pain, 2024, Volume: 5, No.2: 29-34
https://jap.ub.ac.id
P-ISSN : 2722-3167
E-ISSN : 2722-3205

Original Article

Comparison of Hemodynamic Response to Endotracheal Intubation with Nebulized Lignocaine and Dexmedetomidine: a Prospective Randomized Controlled Trial

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ABSTRACT

Background: Though different studies have compared intravenous (IV) lignocaine with dexmedetomidine for blunting laryngoscopic and intubation response, there is hardly any study comparing nebulized Lignocaine and dexmedetomidine for the same. This study compared the effectiveness of nebulized dexmedetomidine and Lignocaine for blunting hemodynamic response to laryngoscopy and intubation.

Methods: This prospective randomized double-blinded study among 60 patients was divided into two equal groups of 30 (groups D and L). Group D patients were nebulized with 1 µg/kg of dexmedetomidine diluted in 0.9% saline to a total volume of 4 ml, and Group L patients were nebulized with 4ml of 4% Lignocaine hydrochloride in the preoperative room over 5 min. After induction of general anesthesia, laryngoscopy and intubation were performed, and hemodynamic changes were recorded for statistical analysis. A two-sample t-test was applied to compare means in two groups with a confidence interval of 95%.

Result The Dexmedetomidine group demonstrated a significant difference, with lower values of mean heart, systolic, diastolic, and mean arterial pressure rate immediately before laryngoscopy until 10 minutes postintubation (recorded at 2 minutes intervals until 10 minutes) compared to the lignocaine group.

Conclusion: Nebulised Dexmedetomidine before laryngoscopy is not just an alternative technique but a superior one for blunting the hemodynamic response to laryngoscopy and endotracheal intubation. It outperforms Nebulised Lignocaine without significant adverse effects, such as postoperative sore throat and sedation, making a compelling case for its adoption in clinical practice.

Keywords: Dexmedetomidine, lignocaine, nebulization, hemodynamic

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Received: July 2023, **Revised**: November 2023, **Accepted:** May 2024, **Published**: June 2024
How to cite this article: Dash, S, PSK Sree, S Panigrahy, A Sahu, AK Nath, PS Rani. Comparison of hemodynamic response to endotracheal intubation with nebulized lignocaine and dexmedetomidine: a prospective randomized controlled trial. *Journal of Anaesthesia and Pain*. 2024:5(2):29-34. doi:10.21776/ub.jap.2024.005.02.01

INTRODUCTION

Frequent complications like tachycardia, hypertension, and arrhythmias lead to unexpected complications after intubation, leading to increased morbidity and mortality.[1] These hemodynamic instabilities are mainly due to sympathoadrenal stimulation due to laryngoscopy and endotracheal intubation. So, this complication has challenged anesthesiologists to search for better techniques to blunt such responses. Harris et al. noted that the hemodynamic responses taking place because of laryngoscopy and tracheal intubation were caused by increased sympathetic reactions aggravated by the provocation of the epilarynx and laryngopharynx.[2] The blunting of cardiovascular reactions to laryngoscopy followed by tracheal intubation has to be done, particularly in patients with comorbidities like hypertension and ischemic heart disease, intracranial aneurysms and cerebrovascular diseases, as even a brief period of hemodynamic changes can result in possibly harmful effects like intra cranial hemorrhage, ventricular dysrhythmias and might lead to pulmonary edema. A study by Forbes AM and Dally FG showed that laryngoscopy and intubation increased MAP up to 25 mmHg in the study patients with a maximum rise at 1 minute after intubation, which returned to the pre-laryngoscopy levels within 5-10 minutes.[3] Sympathoadrenal reactions at different stages of anesthesia and surgery during the peri-operative period and plasma catecholamine levels show significant correlation between the mean arterial pressure and plasma nor-

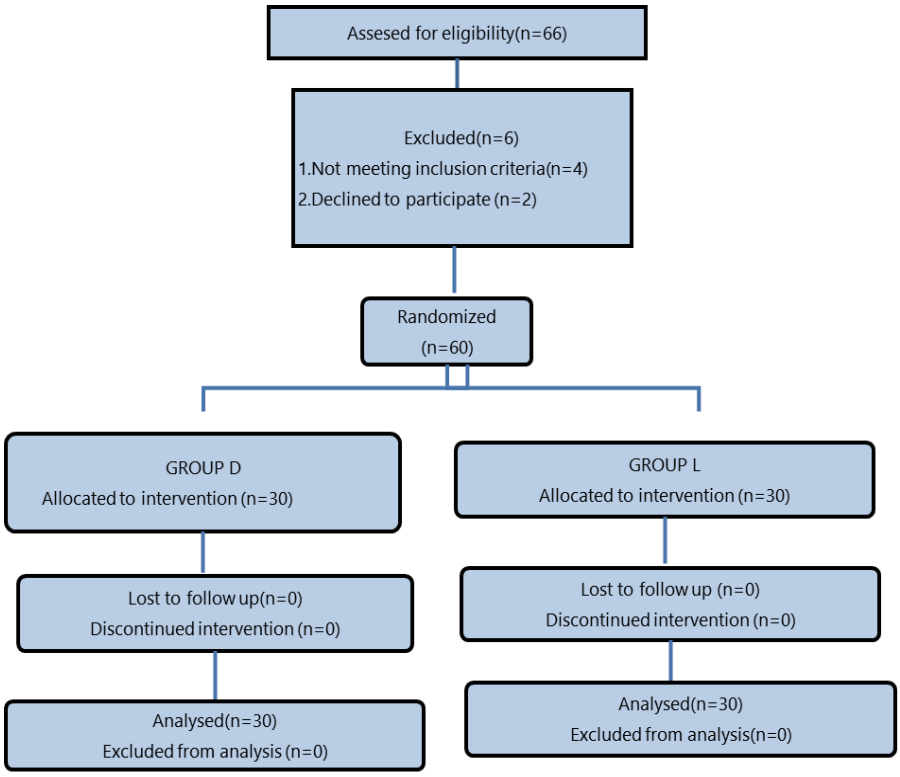

Figure 1. CONSORT diagram

adrenaline and adrenaline levels at laryngoscopy and intubation.[4]

So various agents were used for blunting laryngoscopic and intubation response like intra venous opioids, beta-blocking agents, calcium channel blockers, lignocaine, intranasal NTG spray, Clonidine, Dexmedetomidine, etc. Lignocaine has been used in different routes for blunting laryngoscopy and intubation response like intravenous injection of 2% and 4% solution as nebulization.[5] Dexmedetomidine, a highly selective alpha 2 adrenoreceptor agonist, has properties of conscious sedation, analgesia, hypnosis, anxiolysis, and sympatholysis with better hemodynamic stability & minimal respiratory depression. It is also used as an IV and nebulization for blunting laryngoscopy and intubation response.[6]

Many studies have compared IV Lignocaine with IV Dexmedetomidine for blunting intubation response. But until now, no study has compared nebulized Lignocaine and nebulized Dexmedetomidine for blunting laryngoscope response. So, in our study, we are comparing the nebulization of 4% lignocaine and Dexmedetomidine for attenuating hemodynamic response to laryngoscopy and intubation.

METHODS

It is a prospective comparative randomized, double-blind study conducted at our institution over a period of 2 years, 2020 to 2022, in the Department of Anesthesiology. After obtaining consent from the Institutional Ethics Committee, the trial was registered in the clinical trial registry of (CTRI NO REF/2022/10/059447). The study diagram is seen in **Figure 1.** A thorough pre-anesthetic evaluation was done for all patients and informed written consent was obtained. The sample size was calculated based on a previous similar study by Sale et al[7] between Dexmedetomidine (1 µg/kg), and Lidocaine (1.5 mg/kg) used IV for attenuating cardiovascular response to laryngoscopy and tracheal intubation undergoing elective surgical procedures using the formula mentioned below.[7]

$$n = \frac{2(Z\alpha + Z\beta)2 \times S_2}{d_2}$$

Where Zα =1.96 at 95% confidence level and Zβ =1.28 at 90% power, S= combined standard deviation and d = Mean difference S=14 d=11.7. The sample size was calculated to be 30 in each group (n=30 x 2 =60). This study was conducted on 60 adult patients aged between 18-60 years, belonging to American Society of Anesthesiologists (ASA) grades I and II, and both sexes were posted for elective surgery under general anesthesia.

Patients who refused to participate had anticipated difficult airways, had baseline heart rate (HR)<60 bpm and Blood pressure <90/50 (65) mmHg, weighed less than 40, and had a history of allergies to local anesthetic agents or to the study drugs were excluded from the study. The Primary outcome of the study was a comparison of mean values of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (SDP), and mean arterial pressure (MAP) between two groups before laryngoscopy and after laryngoscopy at 2,4,6,8 and 10 minutes. The secondary outcome was a comparison of postoperative sore throat during 24 hours and Ramsay sedation score at 6 hours postoperatively between the two groups.

Per the recommended fasting guidelines, the patients were kept nil by mouth 6 hours before surgery. The IV line was secured in the preoperative room, and Ringer lactate infusion was started. All the patients were premedicated with IV glycopyrrolate and pantoprazole. Group D received nebulization with 1 µg/kg of Dexmedetomidine diluted in 0.9% saline to a total volume of 4 ml, while Group L received nebulization with 4 ml of 4% Lignocaine. Lignocaine hydrochloride solution via face mask with cirrus nebulizer with oxygen at the rate of 8 L/min in the preoperative room over a period of 5 mins 10 minutes before induction of GA. The person who prepared the study drug, the investigator who recorded the study parameters, and the patient were not aware of group allocation to ensure blinding. The technician opened the sealed envelopes in the preoperative room and handed the preloaded syringes with study drugs to

the researcher. Baseline HR, SBP, DBP, and MAP were recorded before nebulization for both groups. After nebulization, the patients were transferred to the operating theater (OT), where they received IV Midazolam at 0.02 mg/kg and IV Fentanyl at 2 µg/kg. Anesthesia was induced with an injection of Propofol at 2 mg/kg, and neuromuscular blockade was achieved with an injection of Vecuronium at 0.1 mg/kg. Just before the laryngoscopy, pre-intubation vitals were recorded. Laryngoscopy was performed by a senior anesthesiologist or a 2-year resident in anesthesiology using Macintosh laryngoscope and endotracheal intubation was done with a cuffed endotracheal tube. No surgical stimulus was allowed till 10 minutes of intubation. Then Hemodynamic parameters were recorded every 2 min till 10 min after intubation. Data was recorded for further analysis. Anesthesia was maintained with air and oxygen (50%:50%) with Isoflurane (1 MAC) using a closed circuit with a circle absorber using low flows and muscle relaxation with intermittent doses of vecuronium (0.04 mg/kg). Ventilation was adjusted to maintain end-tidal carbon dioxide between 35 to 40 mmHg.

All patients were monitored for hypotension and bradycardia during the study, and the patient was advised to record the data and treat it appropriately. At the end of surgery, residual muscle paralysis was reversed with IV Neostigmine (0.05 mg/kg) and Glycopyrrolate (0.01 mg/kg). After adequate reversal, patients were extubated. All patients were monitored in the recovery room for 30 minutes till they met the discharge criteria. Post-extubation supplemental oxygen via a face mask was given to all, and any postoperative adverse events, if they occurred, were managed appropriately. Patients were monitored in the postoperative anesthesia care unit for 24 hours. Any incidence of postoperative sore throat in the next 24 hours was recorded. Patients were monitored for postoperative sedation by Ramsay sedation scale (RSS) at 6 hours postoperatively, and data was recorded.

Data was analyzed using SPSS for Windows Version 23, Statistical Package for Social Science, SPSS Inc., Chicago, Illinois, and USA. Mean and standard errors were used to express normally distributed continuous data, and median and interquartile ranges were used for nonparametric data. A two-sample t-test was applied to compare means in two groups. A normality check was done using the Kolmogorov-Smirnov test or the Shapiro-Wilk test. Post-hoc analysis was done to analyze the significant differences among the groups.

RESULT

The data of all 60 patients were recorded and tabulated for statistical analysis. From our study results, we found that the mean baseline heart rate was comparable (p-value > 0.001, **Table 1)** between the two study groups, but the mean heart rate immediately before laryngoscopy was significantly lower in Group D compared to Group L (P value < 0.001) (**Figure 2**).

Table 1. Demographic parameters of study participants

Patient characteristics	Group D	Group L	P-value
Age in years (mean±SD)	33.96/9.49	38.50/9.02	0.608
Weight in Kg (mean±SD)	59.1/9.17	59.16/8.73	0.979
Male: female	17:13	15:15	0.604
BMI (mean ± SD)	20.57/2.87	21.12/2.59	0.439
ASA grading	20/10	21/9	0.781

BMI: body mass index; ASA: American Society of Anesthesiologists

The mean values of SBP, DBP, and MAP at baseline and before laryngoscopy in the two groups were comparable **(Table 2**, **Figure 3,4,5**). But immediately after intubation and at 2, 4-, 6-, 8- and 10 minutes post-intubation, we found that the mean values of SBP, DBP, and MAP were significantly lower in Group D compared to Group L(P<0.001) as **Figure 3,4 and 5**.

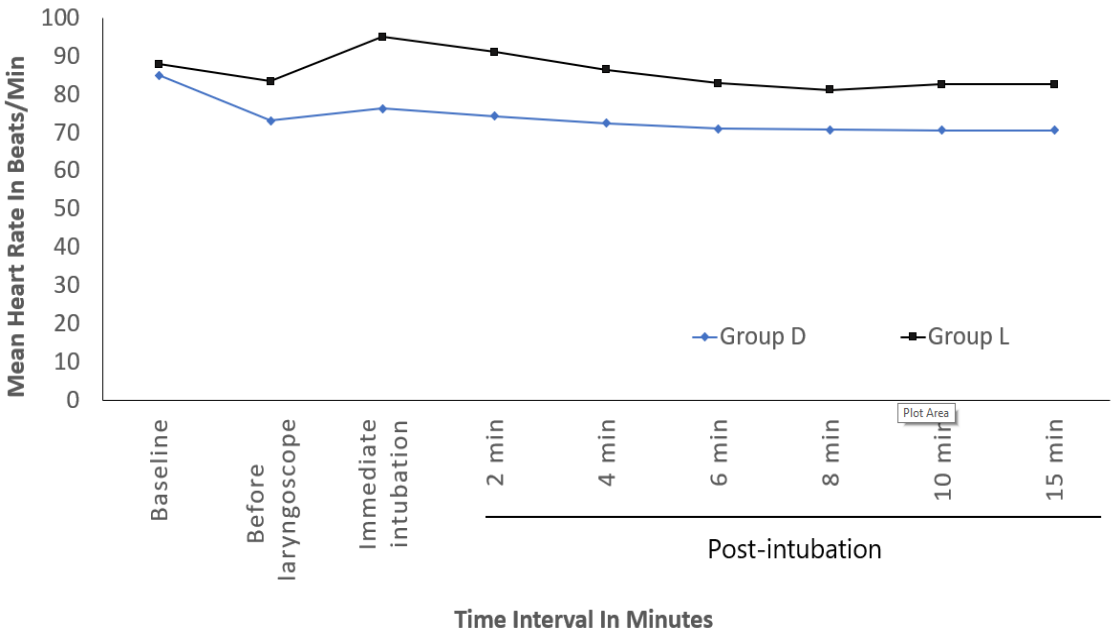

Figure 2. Depicting the mean values of HR variation from baseline.

Our study also shows that there was no statistically significant difference in incidences of postoperative sore throat during 24 hours of the postoperative period (P value is 0.754) and sedation score at 6 hours postoperatively (P value is 0.943) between the two study groups **(Table 3** and **4).**

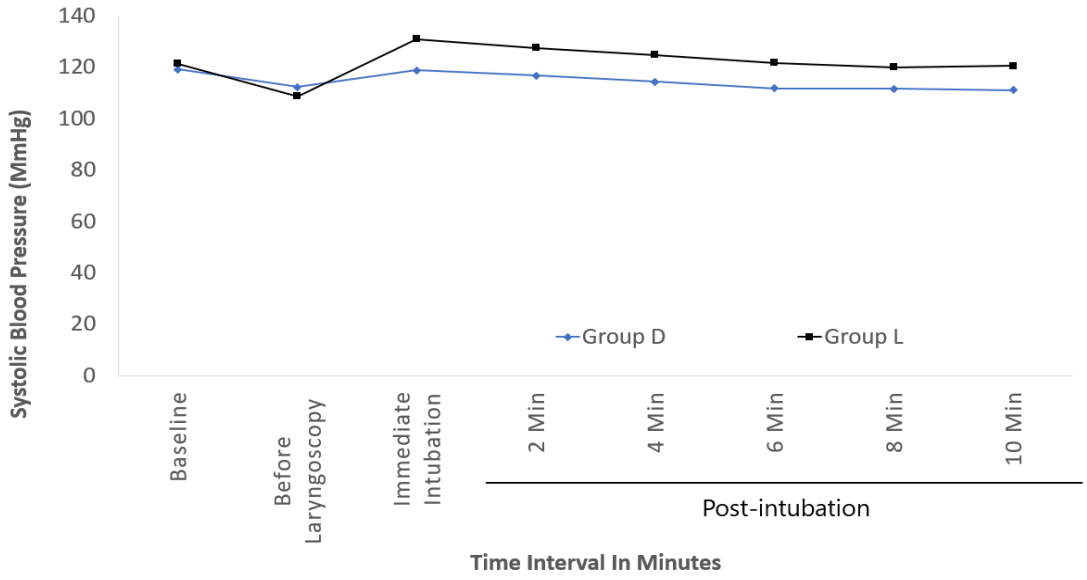

Figure 3. Depicting the mean values of SBP variation from baseline to 10 mins after intubation

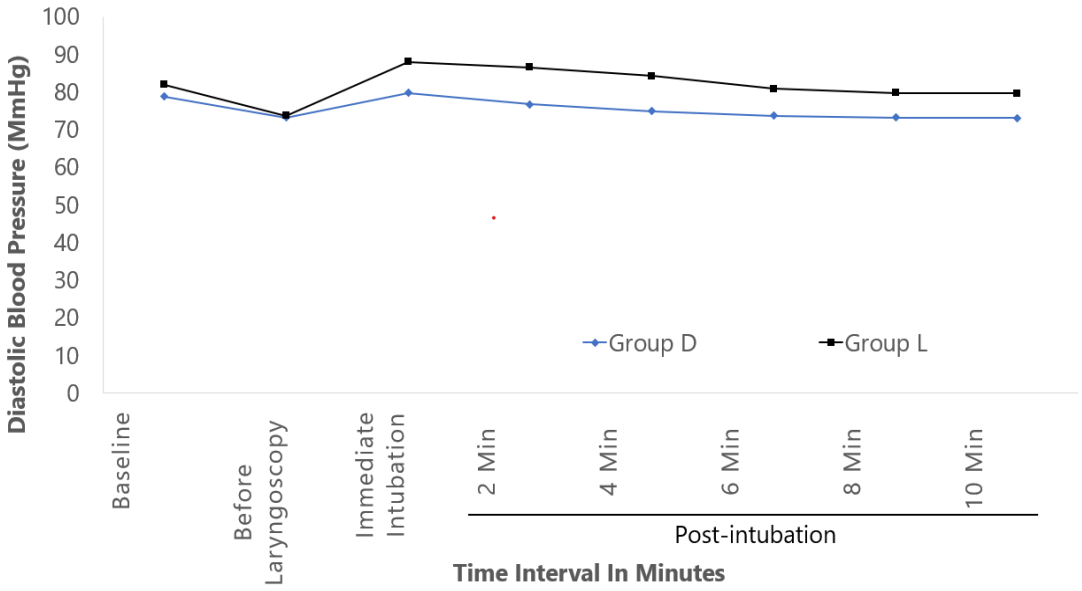

Figure 4. Depicting the mean values of DBP variation from baseline to 10 minutes after intubation

Table 2. Mean baseline hemodynamic parameters

	Group D	Group L	P-value
HR ± SD	85.13 ± 8.95	88.10± 10.45	0.241
SBP ± SD	119.30 ± 8.85	121.53± 1.07	0.392
DBP ± SD	78.83 ± 6.64	82.00 ± 6.26	0.062
MAP ± SD	92.16 ± 6.29	94.46 ± 7.31	0.196

HR: heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure

Table 3. Post operative sore throat

Postoperative Sore Throat		Group D	Group L	Total
Yes	N (%)	6 (20)	7 (23.33)	13(21.66)
No	N (%)	24(80)	23(76.66)	47(78.33)
P-value			0.754	

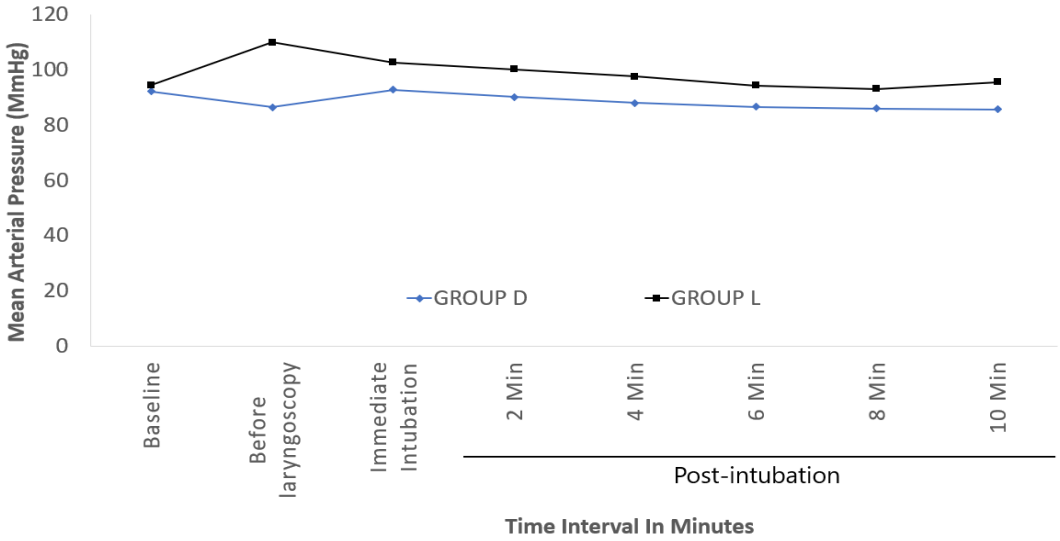

Figure 5. Depicting the mean values of MAP variation from baseline to 10 mins after intubation

Table 4. Post operative sedation score at 6 hours.

Postoperative sedation score (Ramsay sedation score)	Group D	Group L	p-value
Score 1	4(13.3%)	3(10)	
Score 2	16(53.33)	15(50%)	
Score 3	7(23.33%)	8(26.66%)	
Score 4	3(10%)	4(13.33%)	0.943
Score 5	0(0%)	0(0%)	
Score 6	0(0%)	0(0%)	
Total	30(100%)	30(100%)	

DISCUSSION

Laryngoscopy and endotracheal intubation often lead to hemodynamic instabilities like tachycardia, hypertension, and arrhythmia, leading to unexpected complications, which have attracted the interest of anesthesiologists for a long time.[1] This autonomic response results mainly due to sympatho-adrenal stimulation related to laryngoscopy and endotracheal intubation. A study by Harris et al. has observed that the sympathetic response of laryngoscopy and endotracheal intubation is because of intense sympathetic response due to stimulation of the larynx and laryngopharynx.[2] So, to avoid such cardiovascular complications, these pressure responses have to be blunted specifically in patients who are hypertensive, have ischemic heart disease, intracranial aneurysms, and cerebrovascular diseases as it can result in intracerebral hemorrhage, and cardiovascular complications like ventricular dysrhythmias, myocardial ischemia, pulmonary edema and left ventricular failure. A study conducted by Smith et al. comparing hemodynamic response to only laryngoscopy verses laryngoscopy with intubation. The authors observed a significant increases in blood pressure and circulating catecholamines following laryngoscopy in both study groups, but there was significant rise in heart rate in the intubation only group only.[8] Nebulization, though not very common, is a noninvasive alternative method for attenuating stress response to intubation, which is rapid in onset and easy and has less effect on hemodynamics than the IV route.[9] Another study by Carron et al. on neurocirculatory responses of intubation by comparing endotracheal tube or laryngeal mask airway showed that the intubation group resulted in a 27% increase in HR and a 42% increase in MAP compared to the Laryngeal mask airways (LMA) group, which showed a 12% increase in HR and 23% increase in MAP. They have also seen that sympathetic neuron activity increased to 600% in the intubation group compared to the LMA group ($p < 0.01$). The time at which MAP and HR values returned to 20% and 10% of baseline values was significantly longer in the intubation group than in the LMA group ($p< 0.01$).[10]

So, in our study, we have used nebulization as a method of drug administration. Demographically, both groups were comparable. We noted that the mean baseline HR between the two groups was comparable, but the mean HR before laryngoscopy showed a significant decrease in group D compared to group L ($P<0.001$). Similarly, the mean HR immediately after was significantly lower in group D compared to group L ($p < 0.001$) as per **Table 2.** However, bradycardia was not found in any of the patients that needed Atropine injection. Our study shows that the mean SBP values at baseline and before laryngoscopy were non-significant between the two groups (table 4). But immediately after intubation, the mean SBP was 118.93±7.70 mmHg in group D compared to group L, which was 131.10±9.20 mmHg, significantly higher ($p< 0.001$). Similarly, at 2,4,6,8 and 10 minutes post-intubation, we observed that though there was an increase in mean SBP in both the groups, the rate of rise in mean SBP was lower in group D than in group L with P value < 0.001 (**Table 2**). By 10 mins postintubation, the mean SBP was 111.26±6.54 mmHg in group D and 120.63±7.26 mmHg in group L. However, there were no incidences of significant hypotension, which required treatment, as the drop in MAP was never beyond 20% of baseline values. Also, the mean DBP in our study showed no significant difference between the two groups at the baseline and before laryngoscopy. After intubation, the mean DBP values before laryngoscopy and at 2, 4-, 6-, 8-, and 10-minutes post-intubation showed that group D patients had significantly less increase in DBP compared to group L. Similarly, we found that the mean MAP in our study showed no significant difference between the two groups at the baseline and before laryngoscopy. The decrease in mean MAP immediately after intubation up to 10 minutes was greater in Group D than in

Group L. Post-operative sore throat and sedation scores were recorded for both groups, and no significant differences were observed.

Gulabani et al. compared Lignocaine (1.5 mg/kg) and Dexmedetomidine at two different doses (0.5 µg/kg and 1 µg/kg) used IV for blunting hemodynamic response. They found that Dexmedetomidine in both doses was better than Lidocaine in controlling the hemodynamic responses to intubation.[11] We also had similar responses in the Dexmedetomidine group, where it was used for nebulization. In another study, Udupi et al. compared IV Lignocaine 2% (1.5 mg/kg) versus nebulized 4% (5 ml). However, in this study, the authors didn't find any significant differences in hemodynamic changes during laryngoscopy and intubation in any of the groups.[12] A study similar to ours, conducted by Kumar et al., involved two groups: Group C (control group, n=50) received normal saline, and Group D (study group, n=50) received nebulized Dexmedetomidine at a dose of 1 µg/kg (5 ml). This study concluded that nebulized Dexmedetomidine at 1 µg/kg is effective in mitigating the stress response to laryngoscopy compared to the control group.[13]

Further multicentric studies with larger sample size and targeted plasma concentration of Dexmedetomidine and Lignocaine measurement can be done to validate the results obtained from the current analysis.

CONCLUSION

Our study concludes that nebulized Dexmedetomidine at a dose of 1 µg/kg is a superior method for reducing the hemodynamic response to laryngoscopy and tracheal intubation compared to nebulizing 4% Lignocaine when given 10 minutes prior to laryngoscopy, and it does not cause significant adverse effects.

ACKNOWLEDGMENT

CONFLICT OF INTEREST

The author declares there is no conflict of interest.

REFERENCES

1. Siddiqui N, Katznelson R, Friedman Z. Heart rate/blood pressure response and airway morbidity following tracheal intubation with direct laryngoscopy, GlideScope and Trachlight: a randomized control trial. *Eur J Anaesthesiol*. 2009;26(9):740-5. doi: 10.1097/EJA.0b013e32832b138d.
2. Joffe AM, Deem SA. Physiologic and pathophysiologic responses to intubation. In: Benumof J, Hagberg CA, editors. Benumof and Hagberg's Airway Management. 3rd ed. Philadelphia: Elsevier Saunders; 2012.
3. Henderson J. Airway management in the adult. In: Miller's Anaesthesia. 7th ed. Philadelphia: Churchill Livingstone; 2010.
4. Cusack B, Buggy DJ. Anaesthesia, analgesia, and the surgical stress response. *BJA Educ*. 2020;20(9):321-328. doi: 10.1016/j.bjae.2020.04.006.
5. Puntambekar SS, Vaishali V. Deshpande. A Comparative Study of Lignocaine Nebulization with Intravenous Lignocaine in Attenuation of Pressor Response to Laryngoscopy and Intubation. *Indian J Anesth Analg*. 2019;6(3):1030-1036.
6. Kumar NRR, Jonnavithula N, Padhy S, Sanapala V, Naik VV. Evaluation of nebulised dexmedetomidine in blunting haemodynamic response to intubation: A prospective randomised study. *Indian J Anaesth*. 2020;64(10):874-879. doi: 10.4103/ija.IJA_235_20.
7. Sale HK, Shendage VJ. Lignocaine and Dexmedetomidine in Attenuation of Pressor Response to Laryngoscopy and Intubation: A Prospective Study. *Int J Sci Stud*. 2015;3(9):155-160.
8. Smith P, Smith FJ, Becker PJ. Haemodynamic response to laryngoscopy with and without tracheal intubation. *SAJAA*. 2008; 14(3): 23-26.
9. Shrivastava P, Kumar M, Verma S, et al. Evaluation of Nebulised Dexmedetomidine Given Pre-operatively to Attenuate Hemodynamic Response to Laryngoscopy and Endotracheal Intubation: A Randomised Control Trial. *Cureus*. 2022;14(5):e25223. doi:10.7759/cureus.25223.
10. Carron M, Veronese S, Gomiero W, et al. Hemodynamic and hormonal stress responses to endotracheal tube and ProSeal Laryngeal Mask Airway™ for laparoscopic gastric banding. *Anesthesiology*. 2012;117(2):309-320. doi:10.1097/ALN.0b013ef31825b6a80
11. Gulabani M, Gurha P, Dass P, Kulshreshtha N. Comparative analysis of efficacy of lignocaine 1.5 mg/kg and two different doses of dexmedetomidine (0.5 µg/kg and 1 µg/kg) in attenuating the hemodynamic pressure response to laryngoscopy and intubation. *Anesth Essays Res*. 2015;9(1):5-14. doi:10.4103/0259-1162.150167
12. Udupi S, Asranna K, Kanakalaksmi ST, Mathew S. Hemodynamic response of lignocaine in laryngoscopy and intubation. *Trends Anaesth Crit Care*. 2020; 32:33-38.
13. Kumar NRR, Jonnavithula N, Padhy S, Sanapala V, Naik VV. Evaluation of nebulised dexmedetomidine in blunting haemodynamic response to intubation: A prospective randomised study. *Indian J Anaesth*. 2020;64(10):874-879. doi: 10.4103/ija.IJA_235_20