

“Comparison Between the Effectiveness of Lidocaine Nebulization with Dexmedetomidine–Lidocaine Nebulization in ANI for the Patients Undergoing General Anaesthesia”

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Abstract

Background: Awake nasotracheal intubation (ANI) is often necessary in scenarios where managing the airway poses challenges or where precise control of hemodynamic responses is essential, as laryngoscopy and tracheal intubation can trigger significant and potentially detrimental cardiovascular reactions. Consequently, this study sought to evaluate the efficacy of lidocaine nebulization in comparison to dexmedetomidine–lidocaine nebulization in mitigating hemodynamic and airway responses during ANI in patients receiving general anesthesia.

Methods: This prospective observational cross-sectional study was conducted at the Department of Anesthesiology, Combined Military Hospital (CMH), Dhaka, Bangladesh, and involved 140 adults undergoing elective surgery under general anesthesia. Participants were randomly assigned to receive either dexmedetomidine–lidocaine or 10% lidocaine nebulization prior to nasotracheal intubation. Hemodynamic parameters, airway responses, medication usage, and adverse events were documented and analyzed using SPSS v25.

Results: Among the 140 patients, the DL and L groups were comparable in terms of age, gender, and BMI, although the DL group exhibited a higher incidence of difficult airway predictors (68.6% vs 28.6%, $p < 0.0001$). Heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were similar; however, the mean arterial pressure (MAP) was slightly lower in the DL group at 3–4 minutes. The DL group experienced a higher rate of bradycardia (14.3% vs 4.3%) and tachycardia (81.4% vs 61.4%). Intubation conditions were superior in the DL group ($p \leq 0.01$), with reduced usage of fentanyl (1.0 vs 1.2 mcg/kg) and propofol (1.2 vs 1.3 mg/kg).

Conclusion: The use of dexmedetomidine–lidocaine nebulization enhances intubation conditions during general anesthesia when compared to the use of lidocaine alone.

Key words: Lidocaine, Dexmedetomidine, Nebulization, Awake Nasotracheal Intubation, Hemodynamic Responses.

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I. Introduction

Awake nasotracheal intubation (ANI) is frequently indicated in clinical scenarios where airway management presents challenges, or when careful modulation of hemodynamic responses is critical for patient safety. Laryngoscopy and endotracheal intubation represent the most stimulating components of airway management, provoking acute hemodynamic responses (HDR) that can persist for at least 10 minutes.[1,2] Mechanical stretching of the pharyngeal and laryngeal mucosa triggers a sympathoadrenal reaction, resulting in elevations of heart rate (HR), blood pressure (BP), and, in some cases, ischemic ST-segment changes due to catecholamine release.[3-5] While these responses are generally tolerated by young and healthy patients, they may have harmful consequences in individuals with compromised cardiac function.[1] Direct laryngoscopy followed by tracheal intubation elicits a stress response characterized by variable and often unpredictable hemodynamic

changes [6], typically lasting from 30 seconds to 10 minutes [7] and manifesting as tachycardia, increased blood pressure, and various cardiac arrhythmias [8].

Topical and systemic local anesthetics, particularly lidocaine, are commonly employed to attenuate these reflexive hemodynamic changes during airway instrumentation. Nebulized lignocaine has demonstrated effectiveness in blunting reflex-induced increases in BP and HR during airway manipulation. Nonetheless, its duration of action is limited, and its effects may be inadequate when used alone. Lidocaine exerts dose-dependent suppression of cardiovascular responses and cough reflexes and can be applied both topically and intravenously during intubation and LMA insertion [9,10]. Furthermore, its use has been associated with a reduced incidence of laryngospasm [11].

Dexmedetomidine, a selective α_2 -adrenergic agonist, has been studied as an adjunct to enhance airway topicalization. It provides sedation, analgesia, anxiolysis, and sympatholysis while largely preserving respiratory function [12]. Although intravenous administration effectively diminishes hemodynamic responses, it carries risks of hypotension and bradycardia [13]. Recent trials have investigated the nebulized form of dexmedetomidine, showing that it effectively moderates increases in HR and systolic BP during laryngoscopy and intubation without causing significant systemic adverse effects [14]. Dexmedetomidine is short-acting and possesses sedative, analgesic, antisialogogue, and sympatholytic properties [12]. Lidocaine can be given through various methods, producing different levels of bioavailability and causing minimal effects like bradycardia or low blood pressure when used in nebulization. However, there's a lack of clinical research comparing the effectiveness of lidocaine and dexmedetomidine-lidocaine nebulization in preventing ANI in patients receiving general anesthesia. Previous studies have looked at nebulized dexmedetomidine compared to saline or a control but have not included nebulized lignocaine. Moreover, no research has directly assessed the comparison of nebulized dexmedetomidine with nebulized lidocaine, both given with normal saline as a control, regarding their effects on hemodynamic responses during laryngoscopy and intubation. Consequently, this study aims to evaluate how effective lidocaine nebulization is in comparison to dexmedetomidine-lidocaine nebulization in reducing hemodynamic and airway responses during awake nasotracheal intubation for patients under general anesthesia.

Objective

- To compare the efficacy of lidocaine nebulization with that of dexmedetomidine–lidocaine nebulization for awake nasotracheal intubation of patients during general anesthesia.

II. Methodology & Materials

This prospective observational cross-sectional study was conducted at the Department of Anesthesiology, Combined Military Hospital (CMH), Dhaka, Bangladesh. A total of one hundred forty adult patients scheduled for surgeries that involved the administration of general anesthesia were chosen according to the inclusion / exclusion criteria described below. Patients were divided into 2 study groups: Group A (n=70) and Group B (n=70). Description of research results comparing the techniques of using lidocaine nebulization of cardiovascular and airway CRI during nasotracheal intubation under general anesthesia in patients who received dexmedetomidine–lidocaine nebulization was the research goal. The data will be helpful to determine the effectiveness and safety of using lidocaine nebulization and dexmedetomidine–lidocaine nebulization in patients undergoing elective surgery with endotracheal intubation.

Inclusion Criteria:

- Adult patients of 18-65 years old.
- Patients scheduled for elective surgery under general anesthesia with nasotracheal intubation.
- ASA physical status I or II.
- Written informed consent provided.

Exclusion Criteria:

- Patients who were 18 years old (or >65) or younger
- Patients with ASA physical status III or IV.
- Patients with a preoperative heart rate <45 beats per minute.
- Patients with known allergies to dexmedetomidine or local anesthetics.
- Pregnancy
- Patients who decline to participate.

Patients were randomly assigned to Group A (DL) or Group B (L) using a computer-generated randomization sequence, with both patients and investigators blinded to allocation; the code was unblinded only

after data collection. Group A received dexmedetomidine–lidocaine nebulization over 10 minutes at baseline, continued for 5 minutes up to intubation, while Group B received 10% lidocaine for the same duration. Anesthesia was induced with low-dose midazolam and fentanyl along with glycopyrrolate 0.02 mg/kg, with standard monitoring including pulse oximetry, three-lead ECG, and invasive arterial blood pressure via radial artery cannulation; ETCO₂ monitoring was established after intubation. Anesthesia was maintained with 0.8 MAC isoflurane in 50% FiO₂, with ventilation adjusted to maintain ETCO₂ 33–38 mmHg.

Demographic and clinical variables, airway parameters, hemodynamic responses (HR, SBP, DBP, MAP, SpO₂), drug requirements, and adverse events (bradycardia, tachycardia, hypotension, hypertension, laryngospasm, bronchospasm, or need for additional sedation/analgesia) were recorded. Bradycardia was defined as HR <50 bpm, tachycardia as >20% increase from baseline, hypotension as >20% decrease in MAP, hypertension as >20% increase in MAP, and refractory hypotension as requiring >3 boluses of ephedrine and >1 L crystalloid. Hemodynamic and airway parameters were recorded at baseline, pre-induction, 1 minute pre-intubation, and 0–5 minutes post-intubation (T0–T5), with immediate management of adverse events and withdrawal of patients in severe cases.

Data were analyzed using SPSS v25, with categorical variables presented as frequencies/percentages and continuous variables as mean ± SD or median (IQR). Group comparisons used Chi-square or Fisher’s exact test for categorical variables and independent t-test for continuous variables; repeated measures of HR, SBP, DBP, and MAP were analyzed with generalized estimating equations (GEE). Statistical significance was set at $p < 0.05$. The study was conducted according to the WMA Declaration of Helsinki. Informed consent was obtained from all participants, who retained the right to refuse enrollment. Confidentiality was strictly maintained, access to medical records was limited to the research team, and ethical approval was obtained from the Ethical Review Board of Combined Military Hospital (CMH), Dhaka.

III. Results

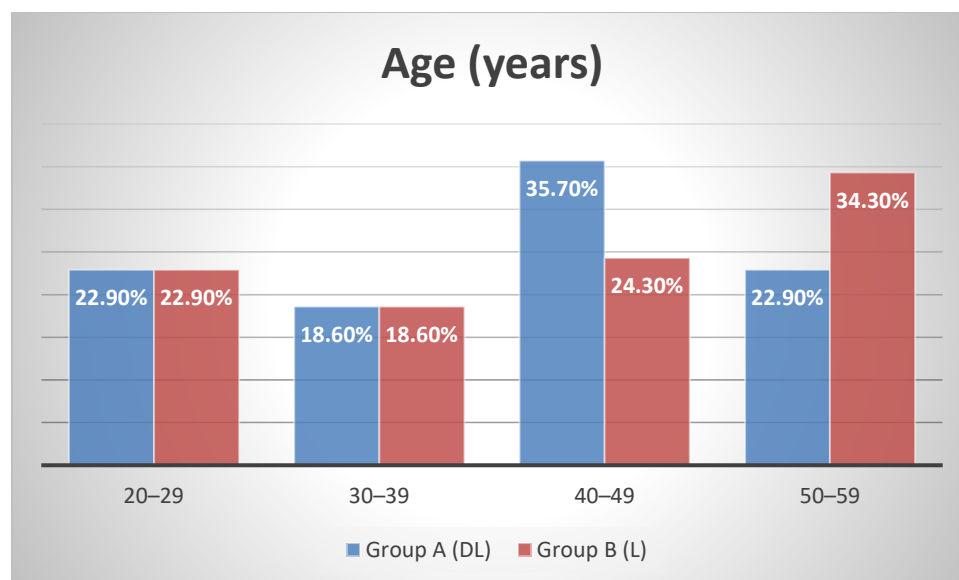


Figure 1: Age Distribution of Study Participants (n = 140)

Most patients were aged 40–49 years (35.7% vs 24.3%), followed by 50–59 years (22.9% vs 34.3%), 20–29 years (22.9% each), and 30–39 years (18.6% each), with mean ages 41.5 ± 10.8 vs 42.3 ± 10.2 years ($p=0.65$).

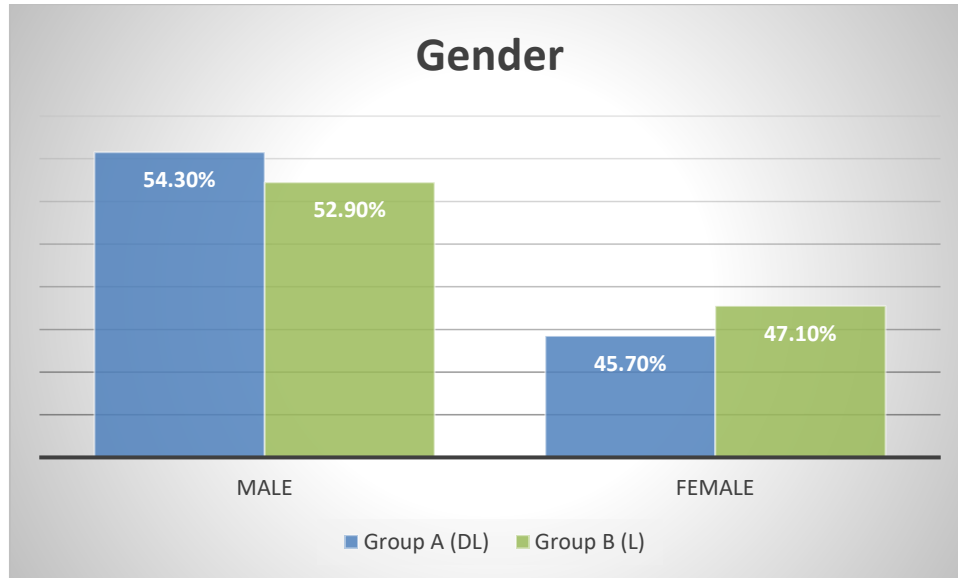


Figure 2: Gender Distribution of Study Participants (n = 140)

Male participants were 38 (54.3%) in Group A (DL) and 37 (52.9%) in Group B (L), while female participants were 32 (45.7%) and 33 (47.1%), respectively. There was no statistically significant difference in gender distribution between the two groups ($p = 0.86$).

Table 1: Baseline Clinical and Risk Profile of Study Participants (n = 140)

Variable		Group A (DL) (n=70)	Group B (L) (n=70)	p-value
BMI (kg/m ²)	Underweight (<18.5)	2 (2.9%)	4 (5.7%)	0.81
	Normal (18.5–24.9)	32 (45.7%)	30 (42.9%)	
	Overweight (25–29.9)	32 (45.7%)	30 (42.9%)	
	Obese (≥ 30)	4 (5.7%)	6 (8.6%)	
	Mean $\pm$ SD	25.5 $\pm$ 4.2	25.6 $\pm$ 4.1	0.88
Pre-existing Conditions	None	35 (50.0%)	40 (57.1%)	0.02
	Hypertension (HTN)	19 (27.1%)	7 (10.0%)	
	Diabetes Mellitus (DM)	10 (14.3%)	10 (14.3%)	
	Hypothyroidism	3 (4.3%)	7 (10.0%)	
	Multiple Conditions	9 (12.9%)	0 (0%)	
	Missing/Other	0 (0%)	6 (8.6%)	
ASA Physical Status	ASA I	29 (41.4%)	40 (57.1%)	0.03
	ASA II	41 (58.6%)	27 (38.6%)	
	Missing	0 (0%)	3 (4.3%)	

Mean BMI 25.5 $\pm$ 4.2 vs 25.6 $\pm$ 4.1 ($p=0.88$). No comorbidity was present in 50.0% vs 57.1%, hypertension 27.1% vs 10.0%, diabetes 14.3% each, hypothyroidism 4.3% vs 10.0%, multiple conditions 12.9% vs 0% ($p=0.02$). ASA I was 41.4% vs 57.1% and ASA II 58.6% vs 38.6% ($p=0.03$).

Table 2: Airway Assessment and Intubation Characteristics of the Study Participants

Parameter		Group A (DL) (n=70)	Group B (L) (n=70)	p-value
Mouth Opening	2 fingers	6 (8.6%)	3 (4.3%)	0.18
	3 fingers	16 (22.9%)	10 (14.3%)	
	4 fingers	32 (45.7%)	40 (57.1%)	
	5 fingers	16 (22.9%)	13 (18.6%)	
	Missing	0 (0%)	4 (5.7%)	
Modified Mallampati Grade	Class II	22 (31.4%)	43 (61.4%)	<0.0001
	Class III	35 (50.0%)	17 (24.3%)	
	Class IV	13 (18.6%)	0 (0%)	
	Missing	0 (0%)	10 (14.3%)	
Neck Extension	Grade 1 ($\leq 80^\circ$)	3 (4.3%)	3 (4.3%)	0.46
	Grade 2 (80–90°)	51 (72.9%)	43 (61.4%)	
	Grade 3 ($>90^\circ$)	16 (22.9%)	20 (28.6%)	
	Missing	0 (0%)	4 (5.7%)	
Thyromental Distance	Grade 1 (<6 cm)	3 (4.3%)	3 (4.3%)	0.60
	Grade 2 (6–6.5 cm)	54 (77.1%)	47 (67.1%)	

	Grade 3 (>6.5 cm)	13 (18.6%)	17 (24.3%)	
	Missing	0 (0%)	3 (4.3%)	
Prominent Buck Teeth	No	48 (68.6%)	60 (85.7%)	0.003
	Yes	22 (31.4%)	7 (10.0%)	
	Missing	0 (0%)	3 (4.3%)	
Intubation Attempts	1 attempt	48 (68.6%)	50 (71.4%)	0.21
	2 attempts	19 (27.1%)	17 (24.3%)	
	3 attempts	3 (4.3%)	0 (0%)	
	Missing	0 (0%)	3 (4.3%)	
Difficult Airway Predictors	Present	48 (68.6%)	20 (28.6%)	<0.0001

Mouth opening of 4 fingers was most common (45.7% vs 57.1%), followed by 3 fingers (22.9% vs 14.3%), 5 fingers (22.9% vs 18.6%), and 2 fingers (8.6% vs 4.3%) ($p=0.18$). Mallampati Class II was 31.4% vs 61.4%, Class III 50.0% vs 24.3%, and Class IV 18.6% vs 0% ($p<0.0001$). Neck extension Grade 2 predominated (72.9% vs 61.4%) ($p=0.46$). Thyromental distance Grade 2 was most frequent (77.1% vs 67.1%) ($p=0.60$). Prominent buck teeth were present in 31.4% vs 10.0% ($p=0.003$). Single intubation attempt occurred in 68.6% vs 71.4% ($p=0.21$). Difficult airway predictors were present in 68.6% vs 28.6% ($p<0.0001$).

Table 3: Comparison of Hemodynamic Parameters (Heart Rate, Blood Pressure, and Mean Arterial Pressure) Between Groups at Different Time Points

Parameter	Time Point	Group A (DL) (n=70)	Group B (L) (n=70)	p-value
HR (bpm)	Baseline	99.0 ± 14.5	96.5 ± 14.0	0.31
	Pre-intubation	88.9 ± 11.5	87.5 ± 11.2	0.47
	Peak (T1)	112.8 ± 10.5	111.2 ± 10.2	0.37
	5 min (T5)	93.8 ± 11.8	91.8 ± 11.5	0.31
	ΔHR (T1 – pre-intubation)	+23.9 ± 9.3	+23.7 ± 9.0	0.90
SBP (mmHg)	Baseline	128.5 ± 11.5	129.7 ± 11.8	0.54
	Pre-intubation	118.6 ± 9.5	119.2 ± 9.8	0.71
	Peak (T1)	140.1 ± 10.2	140.2 ± 10.5	0.96
	5 min (T5)	119.2 ± 10.0	119.4 ± 10.3	0.91
	ΔSBP (T1 – pre-intubation)	+21.5 ± 8.0	+21.0 ± 8.2	0.72
DBP (mmHg)	Baseline	79.2 ± 9.5	80.6 ± 10.0	0.4
	Pre-intubation	70.9 ± 8.2	73.0 ± 8.6	0.14
	Peak (T1)	87.6 ± 7.0	89.6 ± 7.3	0.1
	5 min (T5)	71.2 ± 9.0	73.4 ± 9.3	0.16
	ΔDBP (T1 – pre-intubation)	+16.7 ± 6.5	+16.6 ± 6.8	0.93
MAP (mmHg)	Baseline	96.5 ± 10.0	97.1 ± 10.5	0.73
	Pre-intubation	88.0 ± 8.5	88.8 ± 8.8	0.58
	Peak (T1)	105.7 ± 8.2	106.7 ± 8.5	0.48
	3 min (T3)	95.7 ± 8.6	98.7 ± 8.9	0.04
	4 min (T4)	91.5 ± 7.5	94.5 ± 7.8	0.02
	5 min (T5)	87.5 ± 9.2	90.3 ± 9.5	0.08
	ΔMAP (T1 – pre-intubation)	+17.7 ± 7.0	+17.9 ± 7.3	0.87

Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were comparable between the Dexmedetomidine–Lidocaine (DL) and Lidocaine (L) groups across all measured time points. Baseline HR was 99.0 ± 14.5 bpm in Group A and 96.5 ± 14.0 bpm in Group B ($p=0.31$), while peak HR at T1 was 112.8 ± 10.5 bpm vs 111.2 ± 10.2 bpm ($p=0.37$), with no significant difference in ΔHR (+23.9 ± 9.3 vs +23.7 ± 9.0; $p=0.90$). SBP remained similar at baseline (128.5 ± 11.5 vs 129.7 ± 11.8 mmHg; $p=0.54$), at peak T1 (140.1 ± 10.2 vs 140.2 ± 10.5 mmHg; $p=0.96$), and at 5 minutes (119.2 ± 10.0 vs 119.4 ± 10.3 mmHg; $p=0.91$), with comparable ΔSBP (+21.5 ± 8.0 vs +21.0 ± 8.2; $p=0.72$). DBP showed no significant differences at baseline (79.2 ± 9.5 vs 80.6 ± 10.0 mmHg; $p=0.40$), peak (87.6 ± 7.0 vs 89.6 ± 7.3 mmHg; $p=0.10$), or ΔDBP (+16.7 ± 6.5 vs +16.6 ± 6.8; $p=0.93$). MAP was also similar at baseline (96.5 ± 10.0 vs 97.1 ± 10.5 mmHg; $p=0.73$), peak (105.7 ± 8.2 vs 106.7 ± 8.5 mmHg; $p=0.48$), and ΔMAP (+17.7 ± 7.0 vs +17.9 ± 7.3; $p=0.87$), although statistically significant reductions were observed in Group A at T3 (95.7 ± 8.6 vs

98.7 ± 8.9; p=0.04) and T4 (91.5 ± 7.5 vs 94.5 ± 7.8; p=0.02). Overall, both groups demonstrated comparable hemodynamic responses to intubation, with only minor transient differences in MAP at later time points.

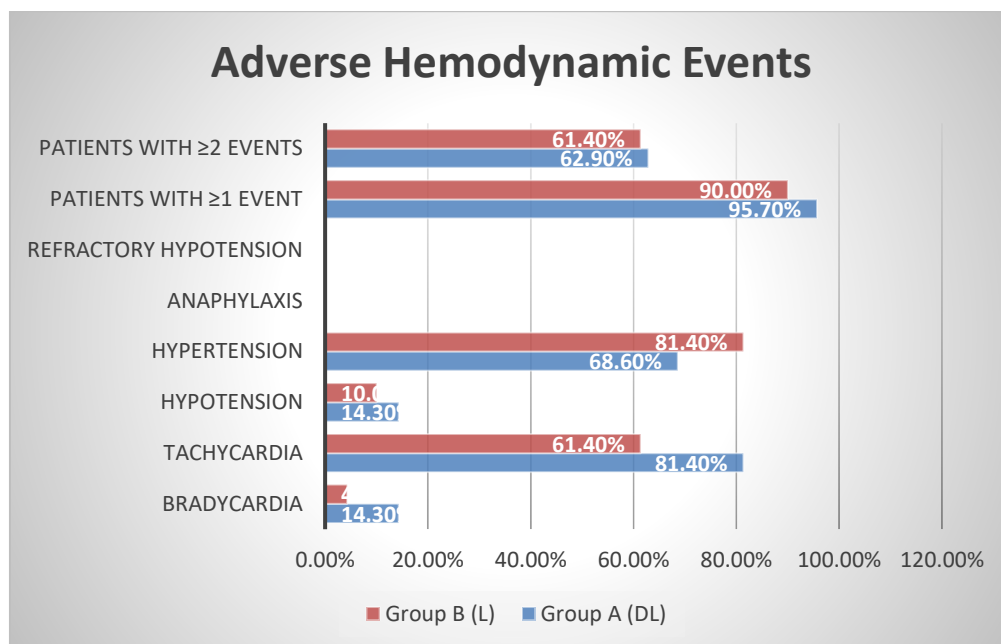


Figure 3: Comparison of Adverse Hemodynamic Events Between Groups

Bradycardia occurred in 14.3% vs 4.3% (p=0.04), tachycardia in 81.4% vs 61.4% (p=0.01), hypotension in 14.3% vs 10.0% (p=0.45), and hypertension in 68.6% vs 81.4% (p=0.07). No cases of anaphylaxis or refractory hypotension were observed. ≥1 event occurred in 95.7% vs 90.0% (p=0.19), and ≥2 events in 62.9% vs 61.4% (p=0.86).

Table 4: Comparison of Intubation Conditions and Airway Responses Between Groups

Parameter		Group A (DL) (n=70)	Group B (L) (n=70)	p-value
Cough/Gag Grading Scale	Score 0	29 (41.4%)	20 (28.6%)	0.04
	Score 1	35 (50.0%)	47 (67.1%)	
	Score 2	3 (4.3%)	0 (0%)	
	Mean ± SD	0.62 ± 0.59	0.70 ± 0.47	0.01
Vocal Cord Position	Score 0	29 (41.4%)	10 (14.3%)	0.0004
	Score 1	38 (54.3%)	57 (81.4%)	
	Score 2	0 (0%)	0 (0%)	
	Mean ± SD	0.57 ± 0.51	0.85 ± 0.37	<0.0001
Intubation Condition Assessment	Score 0	29 (41.4%)	13 (18.6%)	0.0005
	Score 1	29 (41.4%)	50 (71.4%)	
	Score 2	10 (14.3%)	3 (4.3%)	
	Mean ± SD	0.71 ± 0.72	0.85 ± 0.49	0.003
Laryngospasm	Yes	3 (4.3%)	13 (18.6%)	0.008
	No	67 (95.7%)	57 (81.4%)	
Bronchospasm	Yes	0 (0%)	0 (0%)	1.00
	No	70 (100%)	70 (100%)	
Local Trauma	Yes	13 (18.6%)	10 (14.3%)	0.500
	No	57 (81.4%)	60 (85.7%)	
Intubation Unsuccessful	Yes	0 (0%)	0 (0%)	1.00
	No	70 (100%)	70 (100%)	

Cough/gag score 0 was 41.4% vs 28.6%, score 1 was 50.0% vs 67.1%, and score 2 was 4.3% vs 0% (mean 0.62 ± 0.59 vs 0.70 ± 0.47, p=0.01). Vocal cord score 0 was 41.4% vs 14.3% and score 1 was 54.3% vs 81.4% (mean 0.57 ± 0.51 vs 0.85 ± 0.37, p<0.0001). Intubation condition score 0 was 41.4% vs 18.6%, score 1 was 41.4% vs 71.4%, and score 2 was 14.3% vs 4.3% (mean 0.71 ± 0.72 vs 0.85 ± 0.49, p=0.003). Laryngospasm occurred in 4.3% vs 18.6% (p=0.008). No bronchospasm or failed intubation occurred. Local trauma was 18.6% vs 14.3% (p=0.50).

Table 5: Comparison of Drug Requirements Between Groups

Parameter	Group A (DL) (n=70)	Group B (L) (n=70)	p-value
Fentanyl (mcg/kg)	1.0 ± 0.4	1.2 ± 0.5	0.01
Propofol (mg/kg)	1.2 ± 0.3	1.3 ± 0.3	0.05
Glycopyrrolate (mcg/kg)	3.9 ± 0.5	4.0 ± 0.0	0.08
Increase in inhalational agents, n (%)	0 (0%)	0 (0%)	1.00

Fentanyl requirement was 1.0 ± 0.4 vs 1.2 ± 0.5 mcg/kg ($p=0.01$), propofol 1.2 ± 0.3 vs 1.3 ± 0.3 mg/kg ($p=0.05$), and glycopyrrolate 3.9 ± 0.5 vs 4.0 ± 0.0 mcg/kg ($p=0.08$). No patients required increased inhalational agents.

IV. Discussion

In this observational study aimed at assessing effectiveness, we compared the use of dexmedetomidine–lidocaine (DL) nebulization against lidocaine-only (L) nebulization in managing hemodynamic and airway reactions during nasotracheal intubation with general anesthesia. Our results indicated that both treatment methods created adequate conditions for intubation and maintained hemodynamic stability. However, DL nebulization provided better airway tolerance and diminished airway reflexes, although it did come with a slightly higher occurrence of bradycardia and tachycardia.

The demographic and clinical profiles of participants in the Dexmedetomidine–Lidocaine (DL) group were on par with those in the Lidocaine-only (L) group, showing no significant variations in average age (41.5 ± 10.8 vs 42.3 ± 10.2 years, $p=0.65$), gender ratio (male 54.3% vs 52.9%, $p=0.86$), or BMI (25.5 ± 4.2 vs 25.6 ± 4.1 kg/m², $p=0.88$), suggesting that the groups were well-matched at the start. Group A had a slightly higher prevalence of pre-existing conditions, particularly hypertension and multiple comorbidities, while Group B reflected a greater percentage of ASA I status ($p=0.03$). These results are consistent with earlier research on dexmedetomidine and lidocaine used in general anesthesia, where demographic factors such as age, BMI, gender, and ASA status were similar across intervention groups, ensuring the cohorts were balanced for evaluating outcomes. For example, Menshawi et al.[15], in a randomized controlled trial on elective gynecological surgeries, reported no significant differences in age, weight, or ASA classification between dexmedetomidine and lidocaine groups, while Mazhar et al.[16], in a prospective study of elective oral and maxillofacial surgeries, found age, gender, BMI, obesity status, and ASA class comparable across dexmedetomidine and lidocaine groups. Collectively, these studies support the robustness of our group allocation and validate the subsequent outcome comparisons.

Preoperative airway assessment in our study revealed comparable distributions of mouth opening, thyromental distance, and neck extension between the DL and L groups, with most participants demonstrating a mouth opening of 4 fingers and thyromental distance of 6–6.5 cm, while neck extension was predominantly Grade 2. Single intubation attempts were achieved in the majority of patients in both groups, though difficult airway predictors were slightly more prevalent in the DL group. These results are consistent with Gaikawad et al.[17], who reported similar distributions of Mallampati score and thyromental distance between groups receiving lignocaine with or without dexmedetomidine for awake nasal intubation. Patel et al.[18] similarly emphasized the importance of documenting airway parameters such as Mallampati score, thyromental distance, neck circumference, and mouth opening in elective surgical patients, supporting their role as standard predictors of intubation difficulty. Overall, these findings confirm balanced baseline airway characteristics, and the observed superior intubation performance in the DL group underscores its effectiveness in facilitating smoother airway management.

Hemodynamic comparisons showed that baseline heart rate (HR) was similar between DL and L groups, with the expected rise following intubation peaking at 1 minute (T1) and gradually normalizing over the subsequent five minutes. The magnitude of change from pre-intubation to peak HR (Δ HR) was nearly identical, and the incidence of tachycardia at T1 was comparable (90% in both groups). These trends mirror observations by Seangrung et al.[19], who reported that both dexmedetomidine and lidocaine attenuated post-intubation HR increases, with dexmedetomidine producing subtle additional blunting, and Mahjoubifard et al.[20], who noted similar HR patterns across multiple post-intubation time points influenced by dexmedetomidine, lidocaine, and fentanyl. This indicates that both DL and L regimens provide effective HR control during airway manipulation.

Systolic blood pressure (SBP) analysis demonstrated comparable baseline values and peri-intubation trends between groups, with SBP decreasing after induction, peaking post-intubation, and gradually returning toward baseline. These findings are in line with Seangrung et al.[19], who observed reductions in SBP from baseline with both dexmedetomidine and lidocaine, and Sriramka et al.[21], who reported well-controlled post-intubation SBP in patients receiving dexmedetomidine with nebulized lidocaine. Similarly, diastolic blood pressure (DBP) showed predictable rises post-intubation followed by gradual normalization, with no statistically significant differences between groups, consistent with the findings of Seangrung et al.[19] and Sriramka et al.[21].

Mean arterial pressure (MAP) patterns were comparable, with both groups showing expected post-intubation increases followed by gradual declines. Slightly lower MAP values were noted in the DL group at 3 and 4 minutes post-intubation, reaching statistical significance, reflecting a modest attenuation of the pressor response. These results align with Boksh et al.[22], who observed smoother and more stable MAP changes with dexmedetomidine versus lignocaine, and other studies reporting similar hemodynamic trends with dexmedetomidine-lignocaine combinations [23]. Overall, these findings suggest that DL nebulization provides effective peri-intubation MAP stability and modestly blunts the pressor response.

Adverse hemodynamic events showed higher rates of bradycardia in the DL group (14.3% vs 4.3%, $p=0.04$) and a higher incidence of tachycardia (81.4% vs 61.4%, $p=0.01$), whereas hypotension, hypertension, anaphylaxis, and refractory hypotension were comparable between groups. These findings are consistent with Paul et al.[24], who reported increased bradycardia with intravenous dexmedetomidine despite overall hemodynamic stability, and Ye et al.[25], who also observed bradycardia as a predictable side effect of dexmedetomidine while maintaining stable MAP and HR. These studies reinforce that bradycardia is a known, manageable effect of dexmedetomidine, without compromising overall hemodynamic safety.

Airway responses were superior in the DL group, with lower mean scores for cough/gag, improved vocal cord position, and better intubation condition assessment, alongside fewer laryngospasm events, while bronchospasm and local trauma remained comparable. These results are supported by Gaikawad et al.[17], who demonstrated enhanced cough suppression and ease of intubation with dexmedetomidine-lignocaine combinations, and Saidie et al.[26], who reported reduced cough frequency and attenuated airway reflexes with intravenous dexmedetomidine. Collectively, these findings confirm that dexmedetomidine enhances airway reflex suppression and facilitates smoother intubation.

Finally, drug requirements were modestly lower in the DL group, with reduced total fentanyl and propofol usage, while glycopyrrolate and additional inhalational agent use were comparable. This aligns with findings from Ghosal et al.[27], who reported lower opioid and hypnotic requirements with dexmedetomidine versus lidocaine during craniotomy, and Islam et al.[28], who observed similar opioid- and hypnotic-sparing effects with dexmedetomidine in elective abdominal surgeries. These results collectively underscore the value of dexmedetomidine as an adjunct to lignocaine nebulization, reducing anaesthetic and opioid requirements without compromising safety or airway management.

V. Limitations of the study

The study had a few limitations:

- The study was conducted at a single center, which may limit the generalizability of the findings to other populations or clinical settings.
- Only adult patients with ASA physical status I or II were included; higher status patients, who might respond differently to airway manipulation and pharmacological stimulation, were excluded;
- The study only followed up patients for a short time, only during intubation, and thus longer-term complications and outcomes were not considered.

VI. Conclusion

Airway management in association with awake nasotracheal intubation (ANI) remains a challenge, and the means of optimal intubation conditions are of particular interest. As the study comparing the effectiveness and safety profiles of lidocaine nebulization with dexmedetomidine–lidocaine nebulization showed that patients in both groups presented with comparable baseline characteristics and airway prediction scores, with slightly better results in the dexmedetomidine–lidocaine group, and similar hemodynamic parameters with only slight decreases in mean arterial pressure after intubation in both groups, dexmedetomidine–lidocaine appeared to be a safe and efficient method to improve intubation conditions, resulting in reduced cough and response and lower incidence of laryngospasm. Moreover, the dexmedetomidine–lidocaine group exhibited lower anesthetic and analgesic requirements without increased adverse event incidence. Thus, the study highlighted the clinical benefits of dexmedetomidine–lidocaine for ANI.

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