e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(1); 1703-1710

Original Research Article

Effect of Nebulized Dexmedetomidine on Attenuation of Hemodynamic Response to Laryngoscopy and Endotracheal Intubation: A Randomized Double-Blind Controlled Trial

Hanmantraya Lalsangi[1], Puneet Sharma[2], Srishti Bhojwani[3], Yashwant Dhawale[4]

[1]Senior resident, Department of Anesthesiology, Gandhi medical College, Bhopal Madhya Pradesh
[2]2nd yr RMO Anaesthesiology, Department of Anesthesiology, Gandhi medical College Bhopal, Madhya Pradesh
[3]2nd yr RMO Anaesthesiology, Department of Anesthesiology, Gandhi medical College Bhopal, Madhya Pradesh
[4]Professor, Department of Anesthesiology, Gandhi medical College, Bhopal Madhya Pradesh.

Received: 01-10-2025 / Revised: 15-11-2025 / Accepted: 21-12-2025
Corresponding author: Dr. Puneet Sharma
Conflict of interest: Nil

Abstract

Background: Laryngoscopy and endotracheal intubation are associated with transient sympathetic stimulation resulting in tachycardia and hypertension, which may increase perioperative morbidity in susceptible patients. Nebulized dexmedetomidine has emerged as a non-invasive premedication capable of attenuating these hemodynamic responses while minimizing systemic adverse effects.

Objective: To evaluate the effect of preoperative nebulized dexmedetomidine on attenuation of the hemodynamic response to laryngoscopy and endotracheal intubation in adult patients undergoing elective surgery under general anesthesia.

Methods: This prospective randomized double-blind controlled trial included 120 adult patients (ASA physical status I–II) scheduled for elective surgery under general anesthesia. Participants were randomized into two equal groups. Group D received nebulized dexmedetomidine (1 μg/kg), while Group C received nebulized normal saline 30 minutes before induction. Heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were recorded at predefined peri-intubation intervals. Intraoperative anesthetic and opioid requirements, extubation time, postoperative sedation, postoperative nausea and vomiting, sore throat, and adverse events were also assessed.

Results: Baseline demographic and clinical characteristics were comparable between the groups. Group D demonstrated significantly lower heart rate (80.5 ± 8.6 vs. 89.2 ± 9.8 beats/min; $p<0.001$) and mean arterial pressure (94.6 ± 6.8 vs. 104.5 ± 7.5 mmHg; $p<0.001$) immediately after intubation. Propofol (108.4 ± 16.8 vs. 124.7 ± 18.3 mg) and fentanyl (118.5 ± 18.7 vs. 142.6 ± 22.5 μg) requirements were significantly reduced ($p<0.001$). The incidence of postoperative sore throat was also lower in Group D (10.0% vs. 26.7%; $p=0.02$), while adverse events remained comparable between groups.

Conclusion: Nebulized dexmedetomidine effectively attenuated the hemodynamic response to laryngoscopy and endotracheal intubation, reduced anesthetic requirements, and improved postoperative outcomes without increasing clinically significant adverse effects, supporting its use as an effective non-invasive premedication in elective surgical patients.

Keywords: Dexmedetomidine; Nebulization; Laryngoscopy; Endotracheal intubation; Hemodynamic response; General anesthesia.

DOI: 10.25258/ijcpr.18.1.291

Introduction

Laryngoscopy and endotracheal intubation are essential procedures during the induction of general anesthesia but are associated with marked sympathetic stimulation resulting from mechanical stimulation of the laryngeal and tracheal structures. This reflex response leads to transient increases in heart rate (HR) and arterial blood pressure due to catecholamine release [1]. Although these changes are generally well tolerated in healthy individuals, they may precipitate myocardial ischemia, cardiac arrhythmias, acute hypertension, heart failure, and increased intracranial or intraocular pressure in

patients with cardiovascular or cerebrovascular disease. Therefore, attenuation of the hemodynamic response to laryngoscopy and endotracheal intubation remains an important objective of modern anesthetic practice.[2] Several pharmacological agents, including opioids, intravenous lignocaine, β-blockers, calcium channel blockers, vasodilators, and α2-adrenergic agonists, have been evaluated to blunt this pressor response [3]. Although these agents have demonstrated varying degrees of effectiveness, their clinical use may be limited by hypotension, bradycardia, respiratory depression, excessive sedation, or delayed recovery. Consequently, there is continued interest in identifying safer and more effective alternatives that provide optimal hemodynamic stability with minimal adverse effects.[4]

Dexmedetomidine is a highly selective α2-adrenoceptor agonist with sedative, anxiolytic, analgesic, and sympatholytic properties. By suppressing central sympathetic outflow and reducing circulating catecholamine levels, it effectively attenuates the cardiovascular response to stressful perioperative stimuli while preserving respiratory function [5]. Intravenous dexmedetomidine has consistently been shown to reduce the hemodynamic response to laryngoscopy and tracheal intubation. However, its use may be associated with dose-dependent hypotension, bradycardia, and prolonged sedation, prompting the exploration of alternative routes of administration.[6]

Nebulization has recently emerged as a promising non-invasive route for dexmedetomidine administration. Drug absorption occurs through the highly vascular nasal, buccal, pharyngeal, and respiratory mucosa, providing satisfactory systemic bioavailability while avoiding first-pass metabolism. Nebulized dexmedetomidine offers painless administration, good patient acceptance, and more gradual systemic absorption, thereby potentially reducing the incidence of abrupt hypotension and bradycardia associated with intravenous administration.[7]

Recent randomized controlled trials have demonstrated that preoperative nebulized dexmedetomidine effectively attenuates the cardiovascular response to laryngoscopy and endotracheal intubation while reducing anesthetic and opioid requirements. [8] Furthermore, a recent systematic review and meta-analysis confirmed significant reductions in heart rate and blood pressure responses without increasing clinically significant adverse events. Nevertheless, the available evidence remains limited, warranting further well-designed randomized controlled studies to validate its efficacy and safety in diverse patient populations.[9,10] Therefore, the present randomized double-blind controlled trial was un to evaluate the effect of preoperative nebulized dexmedetomidine (1 μg/kg) on attenuation of the hemodynamic response to laryngoscopy and endotracheal intubation in adult patients undergoing elective surgery under general anesthesia.

Materials and Methods

This prospective, randomized, double-blind, placebo-controlled trial was conducted in the Department of Anaesthesiology of a tertiary care teaching hospital.

Study Setting and Duration: The study was conducted at Gandhi Medical College, Bhopal, a tertiary care teaching hospital, for 7 months duration.

Study Population: A total of 120 adult patients scheduled for elective surgeries under general anesthesia requiring endotracheal intubation were enrolled in the study.

Inclusion Criteria

- Patients aged 18–60 years.
- Either sex.
- American Society of Anesthesiologists (ASA) physical status I or II.
- Scheduled for elective surgery under general anesthesia requiring endotracheal intubation.
- Patients providing written informed consent.

Exclusion Criteria

- Anticipated difficult airway (Mallampati grade III or IV).
- Body mass index (BMI) >35 kg/m².
- History of hypertension, ischemic heart disease, arrhythmias, heart block, or heart failure.
- Significant hepatic, renal, respiratory, or neurological disease.
- Pregnancy or lactation.
- Known allergy or hypersensitivity to dexmedetomidine.
- Patients receiving β-blockers, calcium channel blockers, clonidine, antiarrhythmic drugs, or other medications affecting cardiovascular responses.
- Patients requiring more than one attempt at laryngoscopy or intubation.
- Emergency surgeries.

Randomization and Blinding: Patients were randomly allocated into two equal groups (n=60 each) using a computer-generated randomization sequence. Allocation concealment was achieved using sequentially numbered opaque sealed envelopes. The study drug was prepared by an anesthesiologist not involved in patient management or data collection. Both the patient

and the anesthesiologist responsible for intraoperative management and outcome assessment were blinded to group allocation throughout the study.

Group D (Dexmedetomidine Group): Patients received nebulized dexmedetomidine 1 µg/kg diluted with normal saline to a total volume of 5 mL, administered via ultrasonic nebulizer over approximately 15 minutes, 30 minutes before induction of anesthesia.

Group C (Control Group): Patients received 5 mL of nebulized normal saline administered using an identical nebulization technique.

Anaesthetic Technique: All patients were kept fasting according to standard preoperative guidelines and received routine premedication as per institutional protocol. Standard monitoring including electrocardiography, non-invasive blood pressure, pulse oximetry, and capnography was instituted upon arrival in the operating room. Baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded before nebulization. Following completion of nebulization, patients were preoxygenated with 100% oxygen for 3 minutes. General anesthesia was induced using intravenous fentanyl (2 µg/kg), propofol titrated until loss of consciousness, and vecuronium (0.1 mg/kg) to facilitate endotracheal intubation. After 3 minutes of neuromuscular blockade, direct laryngoscopy and tracheal intubation were performed by an experienced anesthesiologist within 15 seconds using an appropriately sized cuffed endotracheal tube.

Anesthesia was maintained with oxygen, nitrous oxide, isoflurane/sevoflurane (institutional protocol), and intermittent doses of vecuronium. Ventilation was adjusted to maintain end-tidal carbon dioxide between 35 and 40 mmHg.

Outcome Measures

Primary Outcome: Heart rate response following laryngoscopy and endotracheal intubation.

Secondary Outcomes

- Systolic blood pressure (SBP).
- Diastolic blood pressure (DBP).
- Mean arterial pressure (MAP).
- Propofol requirement during induction.
- Intraoperative fentanyl consumption.
- Time to extubation.
- Ramsay sedation score in the postoperative period.
- Incidence of postoperative nausea and vomiting (PONV).
- Incidence of postoperative sore throat.
- Adverse events including bradycardia (HR <50 beats/min), hypotension (MAP reduction >20% from baseline), hypertension, tachycardia, and oxygen desaturation.

Hemodynamic Measurements

Heart rate, SBP, DBP, MAP, and SpO_2 were recorded at the following time points:

- Baseline (before nebulization)
- After completion of nebulization
- Before induction
- Immediately before laryngoscopy
- Immediately after intubation
- 1 minute after intubation
- 3 minutes after intubation
- 5 minutes after intubation
- 10 minutes after intubation

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The normality of data distribution was assessed using the Shapiro–Wilk test. Continuous variables were compared using the independent Student's t-test, whereas categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. Repeated measures analysis of variance (Repeated Measures ANOVA) followed by Bonferroni post hoc analysis was used to compare hemodynamic variables over time between the two groups. A p-value <0.05 was considered statistically significant.

Results

A total of 120 patients were assessed for eligibility and randomly allocated into two equal groups. Sixty patients received nebulized dexmedetomidine (Group D), while sixty received nebulized normal saline (Group C)..The baseline demographic and clinical characteristics are summarized (Table 1). Both groups were comparable with respect to age, gender distribution, body mass index, ASA physical status, duration of surgery, and duration of laryngoscopy (all $p>0.05$), confirming successful randomization.

Peri-intubation hemodynamic parameters are presented (Table 2). Baseline heart rate (HR) and mean arterial pressure (MAP) were similar between the two groups ($p>0.05$). Following nebulization, Group D showed significantly lower HR (73.4 ± 7.6 vs. 78.5 ± 8.2 beats/min, $p<0.001$) and MAP (87.8 ± 5.9 vs. 91.2 ± 6.3 mmHg, $p=0.003$) than Group C. These differences persisted before induction (both $p<0.001$). Following laryngoscopy and endotracheal intubation, both groups demonstrated increases in HR and MAP; however, the rise was significantly attenuated in the

dexmedetomidine group. Immediately after intubation, HR was significantly lower in Group D than in Group C (80.5 ± 8.6 vs. 89.2 ± 9.8 beats/min, p<0.001), while MAP was also significantly lower (94.6 ± 6.8 vs. 104.5 ± 7.5 mmHg, p<0.001). Significant differences persisted at 1, 3, and 5 minutes after intubation (all p<0.001), before gradually approaching baseline values by 10 minutes, although HR (p=0.004) and MAP (p=0.01) remained significantly lower in Group D (Table 2). Intraoperative anesthetic requirements are summarized (Table 3). Patients receiving nebulized dexmedetomidine required significantly lower induction doses of propofol (108.4 ± 16.8 mg vs. 124.7 ± 18.3 mg, p<0.001) and lower total fentanyl consumption (118.5 ± 18.7 µg vs. 142.6 ± 22.5 µg, p<0.001). Additional muscle relaxant requirement and extubation time were comparable between the groups (p>0.05). Postoperative outcomes are presented (Table 4). A significantly greater proportion of patients in Group D achieved a Ramsay Sedation Score ≥3 (30.0% vs. 10.0%, p=0.006). The incidence of postoperative sore throat was significantly lower in Group D (10.0% vs. 26.7%, p=0.02). Although postoperative nausea and vomiting occurred less frequently in Group D (8.3% vs. 16.7%), the difference was not statistically significant (p=0.17). Bradycardia and hypotension were infrequent and comparable between groups, and no patient experienced oxygen desaturation (Table 4, Figure 5).Correlation analysis between peri-intubation hemodynamic responses and anesthetic drug requirements is presented (Table 5). In Group D, weak-to-moderate positive correlations were observed between peak HR and propofol induction dose (r=0.238, p=0.067), total fentanyl consumption (r=0.291, p=0.024), and peak MAP (r=0.514, p<0.001). Peak MAP also showed a weak positive correlation with fentanyl consumption (r=0.276, p=0.032). In contrast, Group C demonstrated stronger positive correlations between peak HR and propofol requirement (r=0.516, p<0.001), fentanyl consumption (r=0.603, p<0.001), peak MAP (r=0.693, p<0.001), and between peak MAP and fentanyl consumption (r=0.548, p<0.001). The scatter plots with regression lines further demonstrate that these relationships were consistently weaker in the dexmedetomidine group (Table 5, Figure 6).Multiple linear regression analysis is summarized (Table 6). In Group D, duration of laryngoscopy (β=0.31, p=0.002), propofol induction dose (β=0.18, p=0.031), and total fentanyl consumption (β=0.26, p=0.006) independently predicted peak HR after intubation, whereas age, gender, BMI, and ASA physical status were not significant predictors. In Group C, duration of laryngoscopy (β=0.46, p<0.001), propofol induction dose (β=0.37, p<0.001), and total fentanyl consumption (β=0.44, p<0.001) were stronger independent predictors. The regression model demonstrated greater explanatory power in the control group (Adjusted R^2=0.53) than in the dexmedetomidine group (Adjusted R^2=0.34), indicating greater attenuation of peri-intubation sympathetic responses following dexmedetomidine premedication (Table 6).

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Variable	Group D (n=60)	Group C (n=60)	p-value
Age (years)	38.9 ± 10.6	39.7 ± 9.8	0.67
Male/Female	34/26	36/24	0.71
BMI (kg/m²)	24.1 ± 2.9	24.5 ± 3.2	0.48
ASA I	36 (60.0%)	34 (56.7%)	0.71
ASA II	24 (40.0%)	26 (43.3%)	
Duration of surgery (min)	94.8 ± 22.4	97.2 ± 24.8	0.58
Duration of laryngoscopy (sec)	13.2 ± 2.4	13.5 ± 2.5	0.49

Statistical test: Independent t-test / Chi-square test

Table 2: Comparison of Hemodynamic Parameters at Different Time Intervals

Time	HR (beats/min) Group D	HR Group C	p-value	MAP (mmHg) Group D	MAP Group C	p-value
Baseline	78.6 ± 8.5	79.2 ± 7.9	0.68	91.4 ± 6.2	91.8 ± 6.6	0.74
After nebulization	73.4 ± 7.6	78.5 ± 8.2	<0.001	87.8 ± 5.9	91.2 ± 6.3	0.003
Before induction	71.8 ± 7.4	77.6 ± 8.0	<0.001	86.6 ± 5.6	90.8 ± 6.2	<0.001
Immediately after intubation	80.5 ± 8.6	89.2 ± 9.8	<0.001	94.6 ± 6.8	104.5 ± 7.5	<0.001
1 min	79.2 ± 8.2	88.1 ± 9.4	<0.001	93.1 ± 6.5	102.4 ± 7.2	<0.001
3 min	76.8 ± 7.5	84.9 ± 8.6	<0.001	91.5 ± 6.1	99.8 ± 6.8	<0.001
5 min	74.9 ± 7.1	82.1 ± 8.2	<0.001	89.2 ± 5.9	96.5 ± 6.6	<0.001
10 min	73.8 ± 6.9	77.9 ± 7.4	0.004	88.4 ± 5.7	91.3 ± 6.1	0.01

Statistical test: Repeated Measures ANOVA

Table 3: Comparison of Intraoperative Drug Requirements

Variable	Group D	Group C	p-value
Propofol induction dose (mg)	108.4 ±16.8	124.7 ±18.3	<0.001
Total fentanyl dose (µg)	118.5 ±18.7	142.6 ±22.5	<0.001
Additional muscle relaxant (mg)	4.2 ±1.3	4.5 ±1.5	0.26
Extubation time (min)	8.6 ±1.3	7.9 ±1.2	0.06

Statistical test: Independent t-test

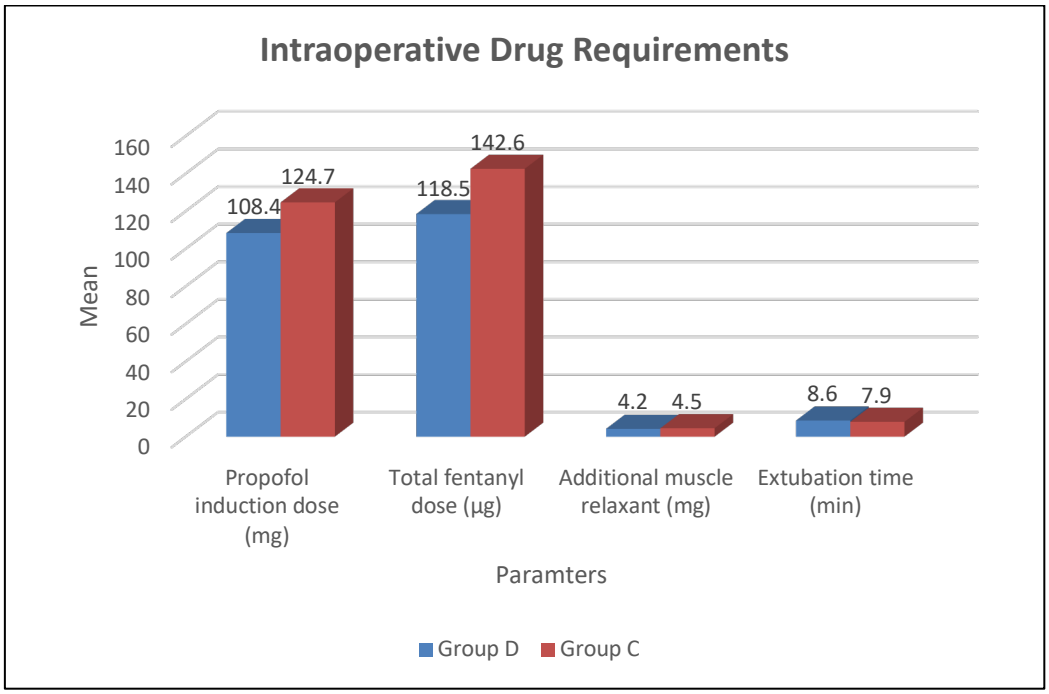

Figure 1: Comparison of Intraoperative Drug Requirements

Table 4: Postoperative Outcomes

Outcome	Group D n (%)	Group C n (%)	p-value
Ramsay sedation score ≥3	18 (30.0)	6 (10.0)	0.006
Postoperative nausea & vomiting	5 (8.3)	10 (16.7)	0.17
Sore throat	6 (10.0)	16 (26.7)	0.02
Bradycardia	3 (5.0)	0	0.24
Hypotension	2 (3.3)	1 (1.7)	0.56
Oxygen desaturation	0	0	—

Statistical test: Chi-square/Fisher's exact test

Table 5: Correlation between Hemodynamic Response and Anesthetic Drug Requirement in the Two Study Groups

Variables	Group D (Dexmedetomidine) Pearson's r	p-value	Group C (Control) Pearson's r	p-value
Peak HR after intubation vs Propofol induction dose	0.238	0.067	0.516	<0.001
Peak HR after intubation vs Total fentanyl consumption	0.291	0.024	0.603	<0.001
Peak MAP after intubation vs Propofol induction dose	0.184	0.159	0.472	<0.001
Peak MAP after intubation vs Total fentanyl consumption	0.276	0.032	0.548	<0.001
Peak HR after intubation vs Peak MAP after intubation	0.514	<0.001	0.693	<0.001

Statistical test: Pearson correlation coefficient.

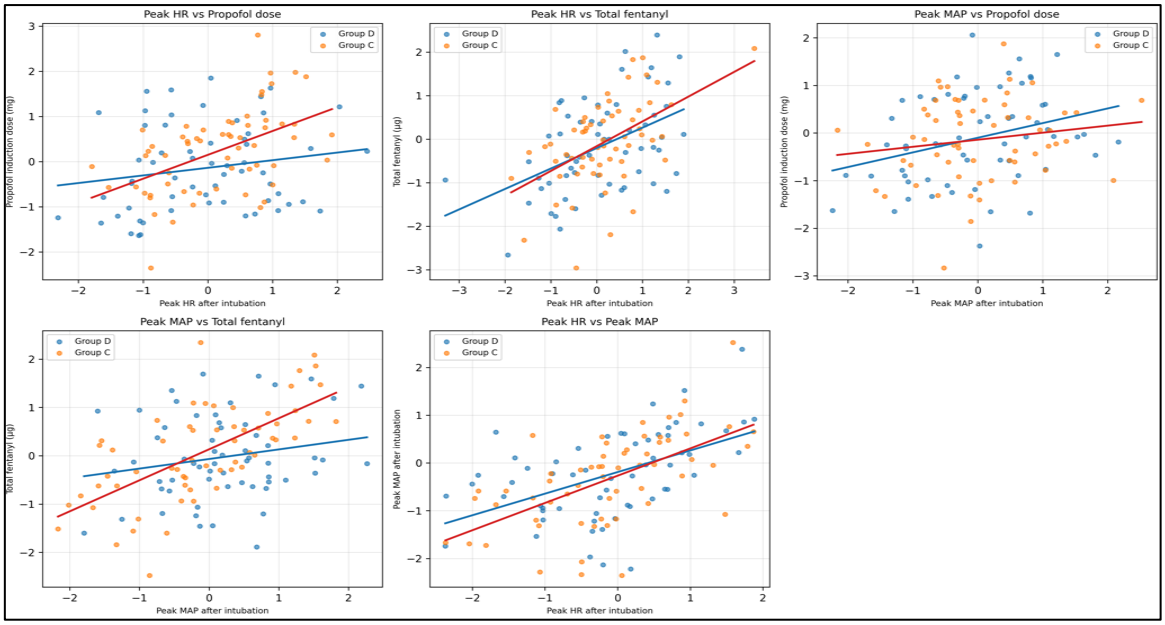

Figure 2: Correlation between Hemodynamic Response and Anesthetic Drug Requirement in the Two Study Groups

Table 6: Multiple Linear Regression Analysis for Predictors of Peak Heart Rate Following Intubation in the Two Study Groups

Predictor Variable	Group D (Dexmedetomidine) β (95% CI)	p-value	Group C (Control) β (95% CI)	p-value
Age (years)	−0.06 (−0.19 to 0.07)	0.35	−0.08 (−0.22 to 0.05)	0.24
Male gender	0.09 (−1.18 to 2.94)	0.41	0.12 (−1.05 to 3.42)	0.29
BMI (kg/m²)	0.07 (−0.16 to 0.31)	0.52	0.11 (−0.09 to 0.38)	0.27
ASA physical status II	0.11 (−1.36 to 3.18)	0.33	0.18 (−0.74 to 4.25)	0.18
Duration of laryngoscopy (sec)	0.31 (0.12 to 0.51)	0.002	0.46 (0.29 to 0.64)	<0.001
Propofol induction dose (mg)	0.18 (0.02 to 0.34)	0.031	0.37 (0.20 to 0.55)	<0.001
Total fentanyl consumption (µg)	0.26 (0.08 to 0.43)	0.006	0.44 (0.28 to 0.61)	<0.001
Model R^2	0.39	—	0.57	—
Adjusted R^2	0.34	—	0.53	—

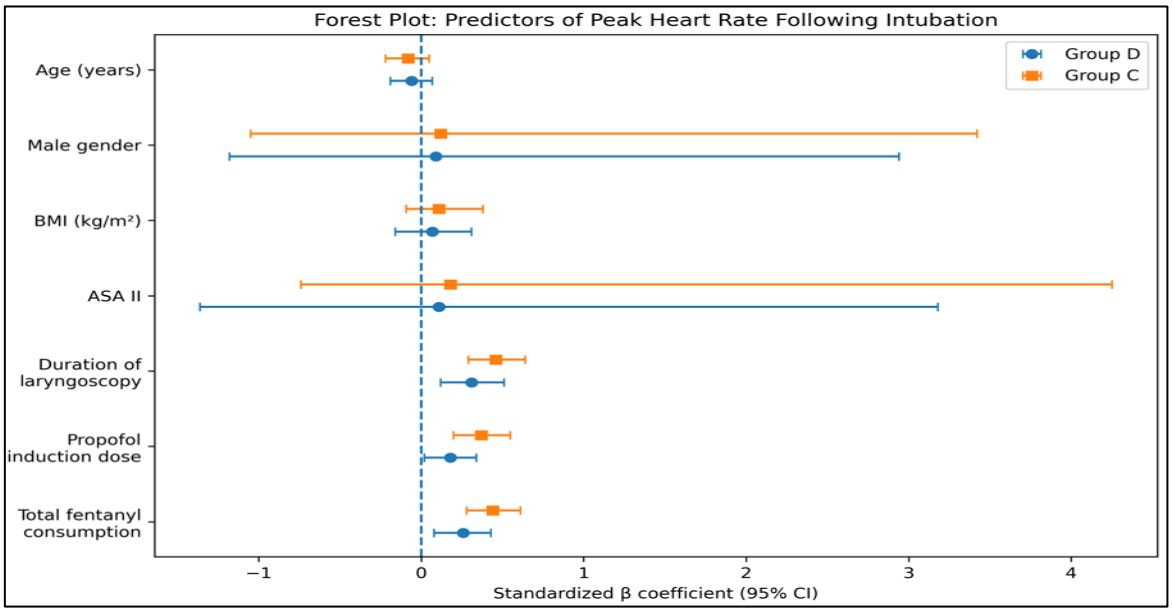

Figure 3: Multiple Linear Regression Analysis for Predictors of Peak Heart Rate Following Intubation in the Two Study Groups

Statistical Test: Multiple linear regression analysis

Discussion

In the present study, both groups were comparable with respect to age (38.9 ± 10.6 vs. 39.7 ± 9.8 years), gender distribution, BMI, ASA physical status, duration of surgery, and duration of laryngoscopy (all $p>0.05$), indicating successful randomization. Similar findings were reported by Misra et al. [7], who observed no significant differences in age, gender, BMI, ASA physical status, or duration of laryngoscopy between patients receiving nebulized dexmedetomidine and placebo. Likewise, Niyogi et al. [11] demonstrated comparable demographic and baseline clinical characteristics between intravenous and intranasal dexmedetomidine groups, ensuring that subsequent differences in hemodynamic responses were attributable to the study intervention rather than baseline confounding factors. The principal finding of the present study was that nebulized dexmedetomidine significantly attenuated the cardiovascular response to laryngoscopy and endotracheal intubation. Immediately after intubation, the mean heart rate was significantly lower in Group D than in Group C (80.5 ± 8.6 vs. 89.2 ± 9.8 beats/min, $p<0.001$), while the mean arterial pressure was also significantly lower (94.6 ± 6.8 vs. 104.5 ± 7.5 mmHg, $p<0.001$). These differences remained significant for up to five minutes following intubation. Misra et al. [7] similarly demonstrated that nebulized dexmedetomidine (1 µg/kg) significantly attenuated the increase in heart rate following laryngoscopy and reduced peri-intubation blood pressure responses compared with placebo while maintaining stable perioperative hemodynamics. Shahi et al. [8] also reported significantly lower heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure in patients receiving nebulized dexmedetomidine throughout the first five minutes after endotracheal intubation. Furthermore, Gupta et al.[10], in a systematic review and meta-analysis of six randomized controlled trials involving 480 patients, concluded that nebulized dexmedetomidine significantly reduced heart rate as well as systolic, diastolic, and mean arterial pressures following laryngoscopy without increasing adverse events. Comparable findings have also been observed with other routes of administration. Niyogi et al. [11] reported that both intravenous and intranasal dexmedetomidine effectively attenuated the pressor response to laryngoscopy, with intravenous administration producing a slightly greater reduction in heart rate while maintaining mean arterial pressure within acceptable limits. Similarly, Dogru et al. [12] demonstrated that intramuscular dexmedetomidine significantly blunted the cardiovascular response to tracheal intubation in hypertensive patients by reducing sympathetic stimulation during anesthesia induction.

In the present study, patients receiving nebulized dexmedetomidine required significantly lower doses of propofol (108.4 ± 16.8 mg vs. 124.7 ± 18.3 mg, $p<0.001$) and fentanyl (118.5 ± 18.7 µg vs. 142.6 ± 22.5 µg, $p<0.001$) than those in the control group. Misra et al. [7] similarly reported a significant reduction in propofol induction dose, fentanyl consumption, and inhalational anesthetic requirement following nebulized dexmedetomidine premedication. Niyogi et al. [11] also observed reduced anesthetic requirements with dexmedetomidine, particularly following intravenous administration, highlighting its anesthetic- and opioid-sparing properties attributable to central α_2-adrenoceptor activation. The present study demonstrated that nebulized dexmedetomidine significantly reduced the incidence of postoperative sore throat (10.0% vs. 26.7%, $p=0.02$), while postoperative nausea and vomiting occurred less frequently in the dexmedetomidine group (8.3% vs. 16.7%), although this difference was not statistically significant. Patients receiving dexmedetomidine also exhibited higher postoperative sedation scores without respiratory depression or delayed recovery. Niyogi et al. [11] reported significantly greater perioperative sedation with dexmedetomidine while maintaining adequate respiratory function. Similarly, Zanaty and El Metainy [13] demonstrated that nebulized dexmedetomidine provided effective preoperative sedation with excellent patient acceptance in pediatric patients undergoing ambulatory surgery. Abdel-Ghaffar et al. [14] also found nebulized dexmedetomidine to be superior to midazolam and comparable to ketamine for procedural sedation, with stable hemodynamics and minimal respiratory adverse effects.

The present study demonstrated weaker correlations between peak hemodynamic responses and anesthetic drug requirements in the dexmedetomidine group than in the control group, suggesting attenuation of sympathetic activation. Multiple linear regression further identified duration of laryngoscopy and fentanyl requirement as independent predictors of peak heart rate in the dexmedetomidine group, whereas duration of laryngoscopy, propofol dose, and fentanyl consumption independently predicted peak heart rate in the control group. Joffe and Deem [15] Explained that the magnitude of the cardiovascular response during laryngoscopy is directly related to the intensity and duration of airway stimulation. Likewise, Gupta et al. [10] suggested that the sympatholytic action of nebulized dexmedetomidine reduces catecholamine release, thereby attenuating the influence of perioperative

variables on heart rate and blood pressure responses.

Conclusion

Preoperative nebulized dexmedetomidine (1 μg/kg) effectively attenuated the hemodynamic response to laryngoscopy and endotracheal intubation by significantly reducing peri-intubation heart rate and blood pressure fluctuations. It also decreased intraoperative anesthetic and opioid requirements while improving postoperative comfort without increasing clinically significant adverse effects. Nebulized dexmedetomidine represents a safe, simple, and effective non-invasive premedication for patients undergoing elective surgery under general anesthesia.

Limitations: This was a single-center study with a relatively modest sample size, which may limit the generalizability of the findings. Additionally, serum dexmedetomidine concentrations and perioperative catecholamine levels were not measured to correlate pharmacokinetic and physiological responses.

References

1. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth. 1996;8(1):63–79.
2. Edwards ND, Alford AM, Dobson PM, Peacock JE, Reilly CS. Myocardial ischaemia during tracheal intubation and extubation. Br J Anaesth. 1994;73(4):537–539.
3. Singh H, Vichitvejpaisal P, Gaines GY, White PF. Comparative effects of lidocaine, esmolol, and nitroglycerin in modifying the hemodynamic response to laryngoscopy and intubation. J Clin Anesth. 1995;7(1):5–8.
4. Min JH, Chai HS, Kim YH, Chae YK, Choi SS, Lee A, et al. Attenuation of hemodynamic responses to laryngoscopy and tracheal intubation during rapid sequence induction: Remifentanil versus lidocaine with esmolol. Minerva Anestesiol. 2010;76(3):188–192.
5. Afonso J, Reis F. Dexmedetomidine: Current role in anesthesia and intensive care. Rev Bras Anestesiol. 2012;62(1):118–133.
6. Kumari K, Gombar S, Kapoor D, Sandhu HS. Clinical study to evaluate the role of preoperative dexmedetomidine in attenuation of hemodynamic response to direct laryngoscopy and tracheal intubation. Acta Anaesthesiol Taiwan. 2015;53(4):123–130.
7. Misra S, Behera BK, Mitra JK, Sahoo AK, Jena SS, Srinivasan A, et al. Effect of preoperative dexmedetomidine nebulization on the hemodynamic response to laryngoscopy and intubation: A randomized control trial. Korean J Anesthesiol. 2021;74(2):150–157.
8. Shahi V, Singh S, Kumar A, Kumar R, Singh M. Evaluation of nebulised dexmedetomidine given pre-operatively to attenuate hemodynamic response to laryngoscopy and endotracheal intubation: A randomised control trial. Cureus. 2022;14(6):e26206.
9. Balaji P, Rajendran S, Nandhini R, et al. Nebulized versus intravenously administered dexmedetomidine for obtunding hemodynamic responses to laryngoscopy and tracheal intubation: A randomized double-blind comparative study. Cureus. 2024;16:e56853.
10. Gupta M, Rohilla R, Gupta P, Tamilchelvan H, Joshi U, Kanwat J. Nebulized dexmedetomidine for attenuating hemodynamic response to laryngoscopy and endotracheal intubation in adult patients undergoing surgeries under general anaesthesia: A systematic review and meta-analysis of randomized controlled trials. BMC Anesthesiol. 2023;23:406.
11. Niyogi S, Biswas A, Chakraborty I, Chakraborty S, Acharjee A. Attenuation of haemodynamic responses to laryngoscopy and endotracheal intubation with dexmedetomidine: A comparison between intravenous and intranasal route. Indian J Anaesth. 2019;63(11):915-923.
12. Dogru K, Arik T, Yildiz K, Bicer C, Madenoglu H, Boyaci A. The effectiveness of intramuscular dexmedetomidine on hemodynamic responses during tracheal intubation and anesthesia induction of hypertensive patients: A randomized, double-blind, placebo-controlled study. Curr Ther Res Clin Exp. 2007;68(5):292-302.
13. Zanaty OM, El Metainy SA. A comparative evaluation of nebulized dexmedetomidine, nebulized ketamine, and their combination as premedication for outpatient pediatric dental surgery. Anesth Analg. 2015;121(1):167-171.
14. Abdel-Ghaffar HS, Kamal SM, El Sherif FA, Mohamed SA. Comparison of nebulised dexmedetomidine, ketamine, or midazolam for premedication in preschool children undergoing bone marrow biopsy. Br J Anaesth. 2018;121(2):445-452.
15. Joffe AM, Deem SA. Physiologic and pathophysiologic responses to intubation. In: Benumof J, Hagberg CA, editors. Airway Management. 3rd ed. Philadelphia: Elsevier Saunders; 2012. p. 184-195.