

A Comparative Study Between Intravenous Dexmedetomidine Versus Nebulized Dexmedetomidine in Attenuating Laryngoscopy and Intubation Induced Sympathetic Response and Hemodynamic Changes in Coronary Artery Disease Patients Posted for Elective CABG Procedure

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Received: 01-12-2025 / Revised: 16-01-2026 / Accepted: 10-02-2026

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Conflict of interest: Nil

Abstract

Background: Laryngoscopy and intubation trigger sympathetic surges that increase heart rate (HR) and blood pressure (BP), posing significant risks for patients with coronary artery disease (CAD). Dexmedetomidine, a sympatholytic alpha-2 agonist, may mitigate these stress responses.

Aim: To compare the effectiveness and safety of intravenous (IV) versus nebulized dexmedetomidine in attenuating hemodynamic stress responses during laryngoscopy and intubation in CAD patients undergoing elective coronary artery bypass grafting (CABG).

Materials and Methods: Seventy-eight elective CABG patients were randomized into two groups (n=39 each). Group A received nebulized dexmedetomidine (1 µg/kg) over 10 minutes, while Group B received IV dexmedetomidine (1 µg/kg) over 10 minutes. HR, systolic BP, diastolic BP, and mean arterial pressure (MAP) were monitored at baseline and peri-intubation.

Results: Both routes effectively blunted the pressor response to laryngoscopy. However, the IV group experienced a more precipitous decline in MAP and a significantly higher incidence of bradycardia and hypotension. Nebulized administration maintained superior cardiovascular stability and was associated with a lower incidence of postoperative sore throat. Post-operative recovery times were comparable between groups.

Conclusion: While both routes attenuate hemodynamic responses during laryngoscopy and intubation in CAD patients, nebulized dexmedetomidine is a clinically advantageous, non-invasive alternative for high-risk CAD patients. Its superior safety profile—specifically the reduced risk of cardiovascular instability—makes it a viable and attractive option for perioperative management.

Keywords: Nebulization, Dexmedetomidine, CABG.

DOI: 10.25258/ijcpr.18.2.39

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Introduction

Pharmacological induction followed by direct laryngoscopy and tracheal intubation, to secure airway in general anaesthesia, incite remarkable stimulation of sympathetic nervous system leading to hemodynamic changes which are transient but significant. These hemodynamic changes are termed 'pressor responses' which arise within 30 seconds following direct laryngoscopy and endotracheal intubation and approaching baseline in 10 minutes [1-3]. This response may precipitate hypertensive episodes, including a rapid increase in heart rate (tachycardia), elevation in blood pressure (hypertension), and an increase in systemic vascular resistance sometimes even cardiac arrhythmias/ischemia/infarction particularly for patients with underlying coronary artery disease

(CAD) for whom these responses can be detrimental [4,5]. Hence, these noxious responses need to be attenuated. Several pharmacological agents like local anaesthetics, beta-adrenergic blockers, calcium channel antagonists, and opioids were used with varied success for the attenuation of intubation response [6]. Dexmedetomidine, a highly selective alpha 2 adrenergic agonist with an alpha 2: alpha 1 selectivity ratio of 1620:1. Its action on postsynaptic alpha 2 receptors inhibit the release of catecholamines and decreases sympathetic activity, has emerged as a promising pharmacological agent in managing perioperative hemodynamic responses [7,8]. Primarily mediated by activating presynaptic alpha 2 receptors in the locus coeruleus of the brainstem. This inhibits the release of

norepinephrine thereby curbing stress responses, analgesic effect produced by alpha 2 receptors in the substantia gelatinosa of the dorsal horn reduces the release of nociceptive neurotransmitters like substance P and glutamate and enhances opioid-induced analgesia, thereby significantly reducing opioid requirement, substantially better reduction of anxiety (anxiolysis) and provides hemodynamic stability during stressful events like intubation. Its major use during laryngoscopy and intubation by providing cardiovascular stability is by central sympatholytic and attenuation of stress responses thereby prevents significant fluctuations in hemodynamic parameters [9]. Dexmedetomidine can be administered through various routes, with the most common being intravenous (IV) administration [9]. The intravenous route allows for controlled and precise dosing, providing immediate effects and predictable pharmacokinetics so widely used by anesthesiologist, as it offers the advantage of rapid onset and titration, allowing for quick adjustments. An alternative administration route for dexmedetomidine is through nebulization [10]. It is well absorbed systemically through the oral mucosa and hence buccal route can be used as an effective non-invasive route of drug administration. The bioavailability of the buccal route is 73-92 % and 100% with the intravenous (IV) route and its half-life is 1.9 ± 0.5 hours. Nebulization route provides a more controlled and sustained effect [10]. However, nebulization requires specialized equipment, and the variability in drug delivery efficiency between patients may be a concern.

In our study, we compared the efficacy of the inhalational (nebulization) route to the IV route of dexmedetomidine administration and hypothesized that dexmedetomidine, when used through the inhalational route, attenuates the intubation response with a better hemodynamic profile in comparison with IV dexmedetomidine with minimal adverse effects [6]. Patients with CAD posted for CABG present unique challenges in perioperative anaesthetic management due to their compromised cardiovascular function. The surgical stress of CABG procedures, combined with the additional stress of intubation and laryngoscopy, can trigger harmful hemodynamic responses that may lead to adverse outcomes so it is crucial to prevent ischemia, arrhythmias, or other cardiovascular complications that can impair the patient's recovery or even threaten their survival [4,5]. In this context, dexmedetomidine has the potential to provide significant benefits by mitigating the sympathetic nervous system's overreaction to laryngoscopy and intubation [6]. Although both routes of administration have shown promise, their relative efficacy and safety profiles remain underexplored. The complexity of cardiovascular management in CAD patients [4,5] underscores the importance of investigating these two administration methods to

determine which offers superior control over hemodynamic stability, better patient outcomes, and fewer complications

Primary Objective

This study is aimed to evaluate the hemodynamic responses during laryngoscopy and intubation and assess the effectiveness of two different routes in attenuating the sympathoadrenal response in patients undergoing elective CABG surgery by administering the drugs 30 minutes prior to anaesthesia induction and measuring hemodynamic response based on heart rate and blood pressure at various time points.

Methodology

After obtaining Institutional Ethical Committee approval, prospective randomized controlled study was conducted at Madras Medical College and Rajiv Gandhi Government General hospital from April 2025 to October 2025. The study was conducted as per the guidelines of the 'declaration of Helsinki, 2013. The study was a prospective randomized controlled Study aimed at comparing administration of intravenous (IV) and nebulized dexmedetomidine in attenuating the sympathetic response in patients scheduled for elective coronary artery bypass grafting (CABG) surgery. Informed consent was obtained from all participants before enrolment.

Seventy-eight patients aged between 18-60 years American Society of Anesthesiologist (ASA) Physical Status (PS) II and III patients scheduled for elective CABG surgery, who provided valid informed consent were selected. Patients with history of allergy to dexmedetomidine, severe uncontrolled hypertension or hypotension, patients with pacemakers or intracardiac devices, hepatorenal disease, predicted or anticipated difficult airway, Ejection fraction < 40%, Heart rate < 60/min were excluded from the study. A comprehensive pre-anaesthetic assessment was performed for all participants and the patients were explained about the study protocol and written informed consent was taken. During this visit, all patients were examined for any nasal pathology which was recorded in the pre -anaesthetic evaluation sheet. The patients were kept nil per oral for six hours before surgery. Patients were given IV pantoprazole 40 mg the previous night and IV ondansetron 4 mg on the day of surgery. The participants were then randomly assigned to one of two groups using a computer-generated randomization system. Allocation concealment was done using sealed opaque envelopes and was handed to the anesthesiologist on the day of surgery

The study groups were as follows:

- Group A (N=39): Patients who received intravenous dexmedetomidine. intravenous dexmedetomidine was administered at a dose of 1 µg/kg body weight over a period of 10

minutes.

- Group B (N=39): Patients who received nebulized dexmedetomidine. nebulized dexmedetomidine was prepared by diluting 1 µg/kg body weight in 4 mL of normal saline and was administered over 10 minutes using a nebulizer

All the patients were examined in the preoperative room and nil per oral status was confirmed. Standard ASA monitors such as an electrocardiogram (ECG), non-invasive blood pressure (NIBP), and pulse-oximeter were connected, and baseline vitals like heart rate (HR), systolic (SBP), diastolic (DBP), mean arterial pressure (MAP), oxygen saturation (SpO2), respiratory rate (RR) were recorded. IV Ringer lactate was started at a maintenance rate of 10 ml/kg/hr through an 18G peripheral venous cannula. The dexmedetomidine preparations were administered 30 minutes prior to the induction of anaesthesia. Additionally, end-tidal CO2 monitoring were used to ensure appropriate anaesthesia depth. Hemodynamic Monitoring includes heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) monitoring, and SPO2 which were recorded at the following time points:

1. Baseline: Prior to the administration of dexmedetomidine.
2. After dexmedetomidine administration: Immediately after the nebulized or intravenous dexmedetomidine was given.
3. After induction of anaesthesia: Following the induction of anaesthesia and prior to intubation.
4. Immediately after intubation: As a part of the post-intubation response.

Subsequently every 5-minute intervals for the first hour and at 10-minute intervals for the second hour after intubation. This timeline was selected to assess both the immediate and sustained effects of dexmedetomidine on hemodynamic stability during the perioperative period. Any episodes of hypotension defined as a reduction of MAP > 20% from baseline, bradycardia (HR < 50bpm), and oxygen desaturation (SpO2 < 92%) were documented and treated accordingly.

All the patients were adequately pre-oxygenated

with 100% oxygen. General anaesthesia was induced with IV fentanyl (2 mcg/kg) and IV propofol 20 mg boluses titrated to loss of verbal response. The patients were paralyzed with 0.1mg/kg of vecuronium. After adequate bag-mask ventilation, laryngoscopy and intubation were done using a Macintosh laryngoscope, and the trachea was intubated with an appropriate-sized endotracheal tube.

All hemodynamic parameters were recorded immediately after induction and intubation were noted meticulously. Anaesthesia was maintained with Sevoflurane with 50% Oxygen and nitrous oxide mixture. Intermittent doses of IV vecuronium 0.02 mg/kg were given to ensure adequate muscle paralysis to facilitate intermittent positive pressure ventilation and maintain EtCO2 around 32-35 mmHg. An additional dose of fentanyl (1mcg/kg) was given as needed. Following the completion of the surgery, patient shifted to post anaesthetic care unit for elective post operative ventilation and were observed for any side effects for up to 24 hours.

Statistical Analysis

Data were analyzed using SPSS version 28.0:

- Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range, IQR), depending on the data distribution.
- Categorical variables were expressed as frequencies and percentages.
- For comparison between groups, the independent t-test was used for normally distributed continuous data, and the Mann-Whitney U test was used for non-normally distributed data.
- Within-group comparisons were made using the paired t-test for normally distributed data, and the Wilcoxon signed-rank test was used for non-normally distributed data.
- A p-value of < 0.05 was considered statistically significant.

Observations and Results

The patients in both groups had similar demographics and similar baseline hemodynamic parameter (Table 1).

Table 1: Demographic Variation

Sex	Group A	Group B	p value
	No of Cases	No of Cases	
Age			
18 – 50	5	7	> 0.05
51 – 60	21	21	
61 – 70	13	11	
Male/female	23/16	25/14	> 0.05
ASA II/III	15/24	17/22	> 0.05

Heart Rate Distribution

Group A (nebulized) showed consistently higher heart rates compared to Group B (intravenous) across all time points (Table 2) (Fig 1). The p-values (<0.05) indicate significant differences between the two groups at each time point, suggesting that the method of treatment (nebulized vs intravenous) influenced heart rate responses.

Table 2: Heart Rate Distribution

Heart Rate (rpm)	Group A (Nebulized)		Group B (Intravenous)		p value
	Mean	SD	Mean	SD	
Baseline	70.4	8.4	67.2	8.7	< 0.05
After Intervention	71.3	9.3	67.5	8.6	< 0.05
Induction	70.7	9.2	68.9	9.3	< 0.05
After Intubation	70.7	8.9	67.9	9.3	< 0.05
5 Min	71.9	8.7	68.4	8.8	< 0.05
10 Min	71.3	10.0	69.7	10.0	< 0.05
15 Min	70.2	8.2	68.4	9.4	< 0.05
20 Min	70.1	9.3	67.7	8.5	< 0.05
25 Min	71.2	9.8	72.6	9.5	< 0.05
30 Min	70.2	9.0	76.6	8.7	< 0.05
35 Min	70.1	9.3	77.9	8.4	< 0.05
40 Min	72.3	7.9	77.5	9.6	< 0.05
45 Min	76.9	8.2	72.4	9.3	< 0.05
50 Min	78.3	8.1	77.1	9.1	< 0.05
55 Min	79.4	9.4	79.5	8.0	< 0.05
60 Min	72.3	9.8	70.3	8.4	< 0.05
70 Min	70.2	8.5	72.4	9.7	< 0.05
80 Min	72.4	9.6	70.5	10.0	< 0.05
90 Min	71.8	9.9	70.3	9.5	< 0.05
100 Min	70.8	9.2	71.4	9.6	< 0.05
110 Min	72.8	8.9	72.4	9.7	< 0.05
120 Min	73.9	9.3	74.6	9.5	< 0.05

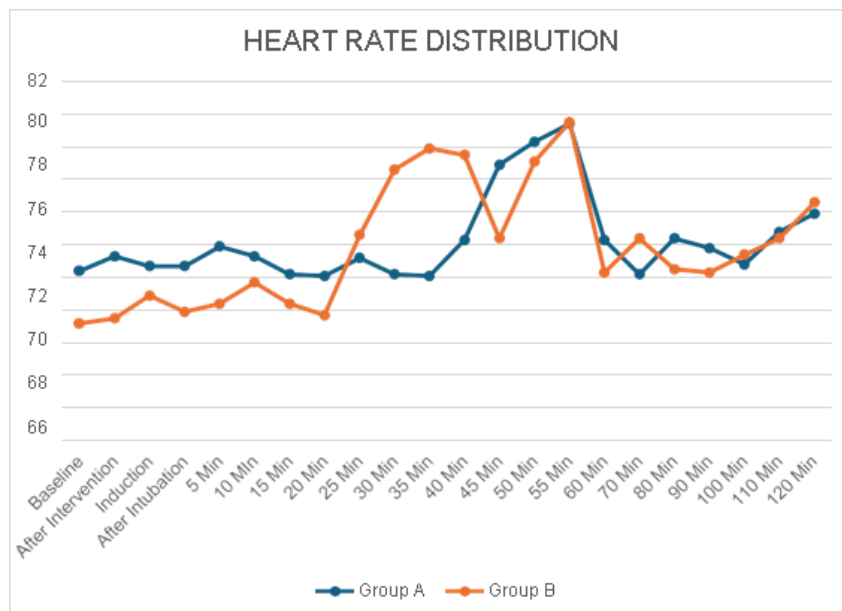


Figure 1: Heart Rate Distribution

Systolic Blood Pressure Distribution

Group B had a higher SBP at baseline (113.1 mmHg vs 115.5 mmHg) but showed a more significant decrease after intervention (Table 3, Fig 2). Group A had lower SBP after intervention but showed a gradual increase afterward. The p-values (<0.05) indicate significant differences in SBP between the two groups throughout the observation period.

Table 3: Systolic Blood Pressure Distribution

SBP mmHg	Group A (Nebulized)		Group B (Intravenous)		p value
	Mean	SD	Mean	SD	
Baseline	115.5	10.7	113.1	7.5	< 0.05
After Intervention	90.3	10.6	101.2	8.4	< 0.05
Induction	105.0	14.3	110.6	13.4	< 0.05
After Intubation	100.5	14.2	107.0	11.7	< 0.05
5 Min	106.0	14.7	95.2	13.7	< 0.05
10 Min	98.9	13.8	97.4	14.4	< 0.05
15 Min	90.9	11.3	98.9	11.2	< 0.05
20 Min	95.3	12.2	110.5	12.3	< 0.05
25 Min	105.5	12.9	105.6	10.2	< 0.05
30 Min	116.0	12.8	117.8	12.3	< 0.05
35 Min	116.5	12.6	115.7	12.9	< 0.05
40 Min	125.5	10.5	124.3	14.1	< 0.05
45 Min	112.5	9.6	120.6	13.6	< 0.05
50 Min	119.1	10.4	121.7	12.6	< 0.05
55 Min	121.6	10.7	120.8	11.6	< 0.05
60 Min	117.1	9.5	118.7	12.7	< 0.05
70 Min	116.1	11.8	115.9	12.1	< 0.05
80 Min	124.2	12.5	118.5	13.0	< 0.05
90 Min	120.8	11.6	118.5	12.0	< 0.05
100 Min	113.2	10.5	116.7	17.5	< 0.05
110 Min	120.5	9.8	118.6	15.6	< 0.05
120 Min	118.2	8.9	119.5	14.9	< 0.05

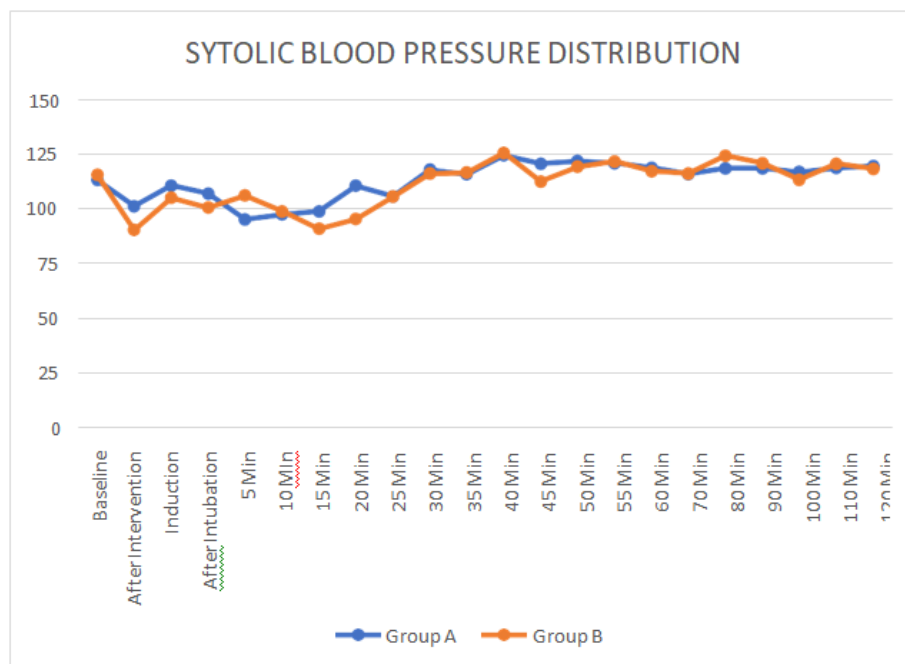


Figure 2: Systolic Blood Pressure Distribution

Diastolic Blood Pressure Distribution

The results shows that intravenous dexmedetomidine led to a more significant and immediate decrease in diastolic blood pressure (DBP) compared to nebulized dexmedetomidine, especially in the early stages after drug administration and during intubation. However, while both groups showed a decrease in DBP from

baseline, nebulized dexmedetomidine resulted in a more gradual and sustained effect over time (Fig 3, Table 4).

This suggests that intravenous dexmedetomidine provides quicker and stronger control of DBP, whereas nebulized dexmedetomidine offers a smoother and more gradual reduction in blood pressure during the perioperative period.

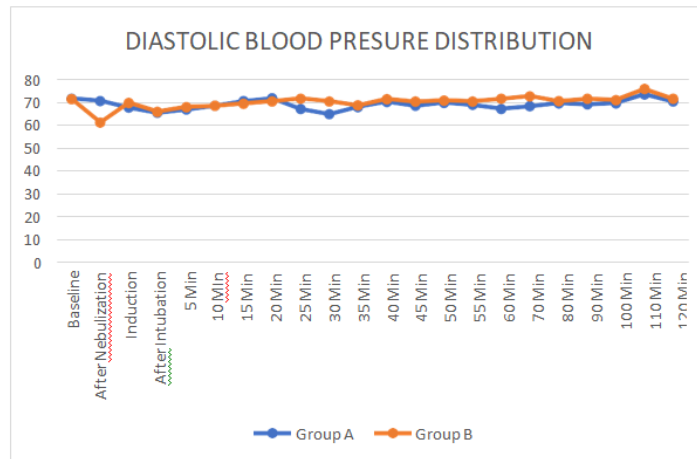


Figure 3: Diastolic Blood Pressure Distribution

Table 4: Diastolic Blood Pressure Distribution

DBP mmHg	Group A (Nebulized)		Group B (Intravenous)		p value
	Mean	SD	Mean	SD	
Baseline	71.6	8.3	71.3	9.9	< 0.05
After Nebulization	70.5	9.4	61.1	11.0	< 0.05
Induction	67.6	9.1	69.7	11.0	< 0.05
After Intubation	65.3	8.9	65.8	9.3	< 0.05
5 Min	66.7	8.4	67.9	9.0	< 0.05
10 Min	68.4	7.9	68.4	9.4	< 0.05
15 Min	70.4	6.9	69.3	9.4	< 0.05
20 Min	71.7	7.4	70.3	10.7	< 0.05
25 Min	66.9	6.9	71.6	10.6	< 0.05
30 Min	64.7	7.2	70.3	8.8	< 0.05
35 Min	67.9	8.1	68.6	8.6	< 0.05
40 Min	70.1	9.3	71.3	9.7	< 0.05
45 Min	68.4	10.2	70.2	9.3	< 0.05
50 Min	69.7	9.3	70.7	11.0	< 0.05
55 Min	68.8	10.4	70.3	11.0	< 0.05
60 Min	67.1	9.5	71.5	9.8	< 0.05
70 Min	68.2	10.4	72.6	9.4	< 0.05
80 Min	69.5	8.9	70.4	9.7	< 0.05
90 Min	69.0	7.50	71.5	9.3	< 0.05
100 Min	69.5	9.4	70.9	8.8	< 0.05
110 Min	73.4	10.9	75.7	10.6	< 0.05
120 Min	70.2	10.4	71.5	12.7	< 0.05

Mean Arterial Pressure Distribution

Table 5: Mean Arterial Pressure Distribution

MAP mmHg	Group A (Nebulized)		Group B (Intravenous)		p value
	Mean	SD	Mean	SD	
Baseline	100.8	7.8	85.2	8.5	< 0.05
After Intervention	80.6	8.9	74.5	7.8	< 0.05
Induction	93.2	7.9	83.3	4.1	< 0.05
After Intubation	88.9	9.2	79.5	5.7	< 0.05
5 Min	93.3	8.4	77.0	4.3	< 0.05
10 Min	88.7	9.3	78.1	4.7	< 0.05
15 Min	83.7	10.7	79.2	4.3	< 0.05
20 Min	87.0	9.6	83.7	5.1	< 0.05
25 Min	90.2	9.5	82.9	3.8	< 0.05
30 Min	90.8	8.6	86.1	2.8	< 0.05

35 Min	90.5	6.5	84.3	4.1	< 0.05
40 Min	91.4	7.3	89.0	6.5	< 0.05
45 Min	98.4	8.6	87.0	4.2	< 0.05
50 Min	93.0	7.4	87.7	3.8	< 0.05
55 Min	94.5	6.3	87.1	3.1	< 0.05
60 Min	91.9	7.2	87.2	2.5	< 0.05
70 Min	91.6	8.1	87.0	4.8	< 0.05
80 Min	96.3	8.0	86.4	2.4	< 0.05
90 Min	94.4	7.5	87.2	3.5	< 0.05
100 Min	94.1	7.8	86.2	3.3	< 0.05
110 Min	95.6	8.3	90.0	3.5	< 0.05
120 Min	92.6	8.2	87.5	4.6	< 0.05

Group A had higher baseline MAP compared to Group B. However, after intervention, Group B showed a more considerable decrease in MAP, while Group A had relatively smaller decrease (Table 5, Fig 4). The p-values (<0.05) suggest significant differences between the groups at every time point, indicating that the methods of treatment affected MAP differently.

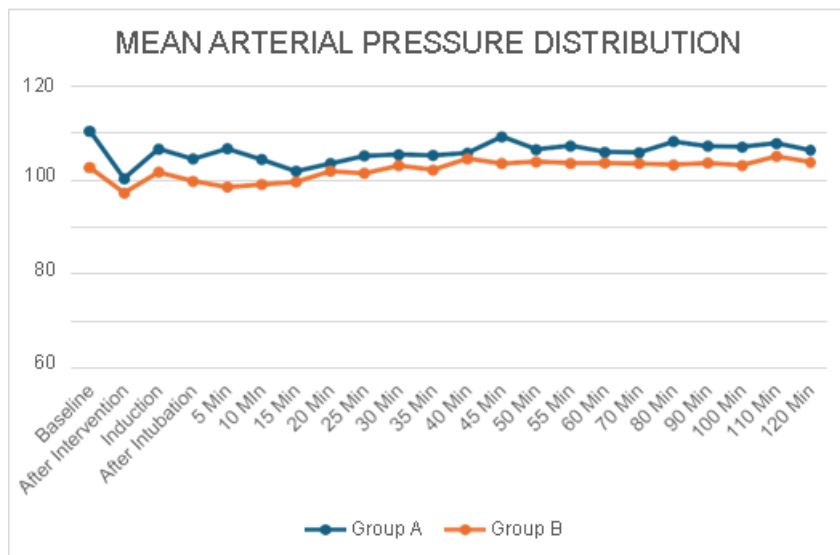


Figure 4: Mean Arterial Pressure Distribution

Discussion

Laryngoscopy and tracheal intubation is the most implemented technique in securing airway in order to administer general anaesthesia for the patients. The pressor responses caused by this technique triggers a rapid sympathetic surge, causing tachycardia and hypertension within 30 seconds. This response peaks at 1–2 minutes and typically resolves within 5–10 minutes [11,12]. Driven by elevated catecholamines, this sudden increase in heart rate, blood pressure and elevating the pressure-rate product worsens the myocardial oxygen supply-demand balance. Especially in patients with coronary artery disease (CAD), these hemodynamic shifts can precipitate coronary spasms, arrhythmias, myocardial ischemia, or heart failure. Attenuating this pressor response is critical to preventing perioperative infarction. Several pharmacological agents are used to attenuate such pressor response. Dexmedetomidine, a centrally acting highly specific alpha 2 adrenergic agonist is one useful drug among

them. It has many uses of which it's use as premedication in attenuation of stress response of laryngoscopy and intubation by anaesthesiologist has been playing a pivotal role in recent days [6,12].

Dexmedetomidine exhibits varying bioavailability (BA) across routes. While primarily administered intravenously (IV) 100% BA, alternatively non-IV routes include intranasal (65% - 82% BA), buccal (~82% BA), intramuscular (~104% BA), and oral (~16% BA) [13]. This study compared the effectiveness of administering dexmedetomidine to attenuate pressor response during laryngoscopy and intubation in CAD patients planned for cardiac surgeries through intra venous route and nebulized intra nasal route 30 minutes before procedure [14]. The study provides valuable insights similar to existing clinical study data highlighting how nebulised dexmedetomidine compared to intravenous administration for stabilizing hemodynamic during laryngoscopy and intubation [14,15]. Specifically, it underscores the drug's

effectiveness in blunting the stress response, keeping heart rate (HR), mean arterial pressure (MAP) and diastolic blood pressure (DBP) more consistent [16,17]

Heart Rate (HR)

This study demonstrated that intravenous dexmedetomidine triggered a more pronounced and immediate reduction in heart rate compared to its nebulized counterpart. These results mirror findings by Misra et al. (2021) [6,14], who noted that the intravenous route more effectively blunts the tachycardic response to laryngoscopy and intubation. Conversely, Kumar et al (2020) [14,18] observed that while nebulization offers less rigid heart rate control, it yields a superior safety profile with a lower incidence of bradycardia [19,20]. Ultimately, our data confirms that nebulized dexmedetomidine facilitates a more gradual hemodynamic transition, positioning it as a safer alternative for high-risk patients with cardiovascular comorbidities who are sensitive to abrupt physiological shifts [4,5].

Mean Arterial Pressure (MAP)

Intravenous (IV) dexmedetomidine elicited a more precipitous and pronounced reduction in Mean Arterial Pressure (MAP) [19,20], consistent with observations by Kumar et al. (2020) [6,18]. and Shrivastava et al. (2022) [21]. While Misra et al. (2021) [6,14]. noted that nebulized administration is less potent in reducing MAP, they highlighted its superior capacity for hemodynamic preservation. Our findings corroborate this, demonstrating that nebulized dexmedetomidine facilitates a graduated and sustained MAP attenuation. This profile offers a distinct clinical advantage for maintaining circulatory equilibrium, particularly in patients with tenuous cardiac reserve who are highly susceptible to drug-induced hypotension [4,5].

Diastolic Blood Pressure (DBP)

Intravenous (IV) dexmedetomidine induced a rapid and pronounced decrease in diastolic blood pressure (DBP), most notably following intubation. These results align with Kumar et al (2020) [13,18], who demonstrated the superior efficacy of the IV route in attenuating hemodynamic surges during airway management. In contrast, nebulized administration facilitated a gradual and sustained DBP reduction, with its comparative stability becoming most evident during the immediate postoperative phase.

While IV administration ensures rapid titration, the nebulized route offers a favourable safety profile by preventing abrupt cardiovascular shifts, making it a viable alternative for patients sensitive to acute hemodynamic fluctuations [4,5].

Postoperative Sore Throat (POST)

A primary clinical merit of nebulized dexmedetomidine over intravenous administration is its ability to provide significant reduction in the incidence of postoperative sore throat (POST), as demonstrated by Thomas et al. (2020) [22]. This finding is corroborated by Shrivastava et al. (2022) [21], who identified nebulized delivery as a potent prophylactic strategy for mitigating intubation-related airway morbidity. By localizing the therapeutic effect, nebulization offers a superior alternative to systemic administration for patients at high risk of POST [22].

Safety Profile and Side Effects

Regarding safety, nebulized dexmedetomidine demonstrated a superior safety profile compared to intravenous administration. Our findings align with those of Misra et al. (2021) [6] and Kumar et al. (2020) [18], who observed a significantly lower incidence of bradycardia and hypotension with the nebulized route. By attenuating hemodynamic fluctuations, nebulized delivery minimizes cardiovascular complications, establishing it as a clinically prudent alternative for patients with pre-existing cardiovascular vulnerabilities or those sensitive to rapid hemodynamic shifts

Postoperative Recovery

One significant clinical advantage of nebulized dexmedetomidine over intravenous (IV) administration is its superior postoperative recovery profile. Research by Kumar et al [18] (2020) and Shrivastava et al. (2022) [21]. demonstrates that the nebulized route facilitates accelerated emergence and minimizes residual sedation. This makes it ideal for short-duration procedures or settings with limited monitoring. In contrast, IV dexmedetomidine often results in protracted sedation, delaying the patient's return to baseline consciousness and mobility.

Our findings, in conjunction with existing literature, demonstrate that nebulized dexmedetomidine serves as a robust and safer alternative to the intravenous (IV) route for attenuating the hemodynamic stress response during laryngoscopy and intubation [23,24]. While IV administration provides rapid, high-potency titration of cardiovascular parameters, the nebulized route offers a more gradual and sustained hemodynamic profile. Crucially, nebulization significantly minimizes the incidence of clinically significant bradycardia and hypotension [6]. Given its superior safety profile, including reduced postoperative sore throat and accelerated recovery, nebulized dexmedetomidine is particularly advantageous for patients with diminished cardiovascular reserve [25].

Conclusion

Both IV and nebulized dexmedetomidine effectively attenuate hemodynamic responses during

laryngoscopy and intubation in high-risk CABG patients.

While the IV route provides more rapid control, nebulized administration offers a safer profile with fewer cardiovascular side effects, faster recovery, and reduced postoperative sore throat. Selection should be tailored to the patient's specific cardiovascular risk and the clinical context.

Source of funding: Nil

Acknowledgement: Nil

Conflict of Interest: Nil

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