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Original Research Article

A Comparative Study to Evaluate the Efficacy of 1mcg/kg of Dexmedetomidine Versus 0.75mcg/kg of Dexmedetomidine Given via Nasal Atomizer on Hemodynamic Response Among Adult Patients Undergoing Elective Surgery

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Abstract

Background: Laryngoscopy and endotracheal intubation are associated with significant sympathetic stimulation leading to tachycardia and hypertension, which may result in adverse cardiovascular events. Dexmedetomidine, a selective α2-adrenergic agonist, has been widely used to attenuate this stress response. Intranasal administration offers a non-invasive alternative with good bioavailability and patient compliance.

Objective: To compare the efficacy of two different doses of intranasal dexmedetomidine (1 µg/kg and 0.75 µg/kg) administered via nasal atomizer in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation, and to evaluate sedation and postoperative outcomes.

Methodology: A randomized comparative study was conducted among 72 adult patients (ASA I–II) undergoing elective surgery under general anaesthesia. Patients were divided into two groups: Group A received 1 µg/kg and Group B received 0.75 µg/kg intranasal dexmedetomidine 45 minutes prior to induction. Hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded at predefined intervals. Sedation was assessed using Ramsay Sedation Score, and postoperative nausea and vomiting (PONV) were evaluated in the post-anaesthesia care unit.

Results: Both groups showed attenuation of hemodynamic response; however, Group A demonstrated better clinical stability with comparatively lower heart rate and blood pressure values during and after intubation. The differences between groups were not statistically significant ($p > 0.05$). Sedation levels were adequate and comparable in both groups without respiratory depression, as SpO_2 remained stable. The incidence of PONV was slightly higher in Group A in the early postoperative period but resolved within one hour.

Conclusion: Intranasal dexmedetomidine is an effective and safe premedication for attenuating the hemodynamic response to laryngoscopy and intubation. The higher dose (1 µg/kg) provides better clinical attenuation and hemodynamic stability without significant adverse effects, making it a suitable non-invasive alternative in anaesthetic practice.

Keywords: Dexmedetomidine; Intranasal; Hemodynamic response; Laryngoscopy; Intubation; Sedation; PONV; General anaesthesia

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Introduction

Direct laryngoscopy and endotracheal intubation are among the most critical steps during induction of general anaesthesia and are associated with a transient but significant hemodynamic stress response. This response is mediated by sympathetic stimulation leading to increased catecholamine release, resulting in tachycardia, hypertension, and increased myocardial oxygen demand. These changes typically occur within 30 seconds of intubation and may persist for up to 5–10 minutes, and although transient, they can precipitate serious complications such as myocardial ischemia, arrhythmias, cerebrovascular events, and raised intracranial pressure, especially in vulnerable patients (1).

Various pharmacological agents have been used to attenuate this pressor response, including opioids, beta-blockers, vasodilators, calcium channel blockers, lignocaine, and α2-adrenergic agonists. Among these, dexmedetomidine has gained

prominence due to its unique pharmacological profile. Dexmedetomidine is a highly selective α2-adrenoceptor agonist that produces sedation, anxiolysis, analgesia, and sympatholysis by inhibiting norepinephrine release and reducing central sympathetic outflow (2). Its action on the locus coeruleus contributes to sedation resembling natural sleep without significant respiratory depression (3).

Dexmedetomidine has been shown to provide hemodynamic stability during perioperative periods by attenuating stress responses to laryngoscopy and intubation. Intravenous administration has been widely studied; however, alternative routes such as intranasal delivery are gaining attention due to their non-invasive nature and improved patient compliance. Intranasal administration bypasses first-pass metabolism and allows rapid absorption through the nasal mucosa, resulting in high bioavailability and predictable pharmacokinetics (4,5).

The use of a mucosal atomization device enhances drug delivery by producing fine particles (30–100 μm), facilitating better absorption across the nasal mucosa (5). Studies have demonstrated that intranasal dexmedetomidine at a dose of 1 μg/kg produces adequate sedation within approximately 45 minutes, with good patient tolerance and minimal adverse effects (6). Furthermore, it reduces preoperative anxiety and provides smoother induction and recovery profiles.

Recent studies comparing different doses and routes of dexmedetomidine have shown promising results in attenuating hemodynamic responses. Deshmukh et al. reported that both intranasal and intravenous dexmedetomidine effectively suppressed the hemodynamic response, with intranasal administration providing more stable parameters (7). Similarly, Pradhan et al. demonstrated that higher doses of dexmedetomidine were associated with greater reduction in blood pressure without significant adverse effects (8).

Despite these findings, there remains limited evidence comparing different intranasal doses of dexmedetomidine delivered via atomization in adult surgical patients. Given its advantages of non-invasive administration, improved patient compliance, and effective attenuation of sympathetic responses, intranasal dexmedetomidine may serve as an ideal premedication agent.

This study aims to evaluate and compare the efficacy of intranasal dexmedetomidine administered in two different doses (1 μg/kg and 0.75 μg/kg) via nasal atomizer in attenuating the hemodynamic stress response to laryngoscopy and endotracheal intubation among adult patients undergoing elective surgery. The objectives are to assess and compare key hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation from the time of drug administration through the peri-intubation period; to evaluate the level of sedation before induction and in the postoperative period; and to compare secondary outcomes including postoperative nausea and vomiting (PONV) and overall hemodynamic stability. The justification for this study lies in the clinical importance of minimizing the sympathetic stress response associated with laryngoscopy and intubation, which can lead to serious complications such as arrhythmias, myocardial ischemia, and cerebrovascular events, particularly in high-risk patients. Although dexmedetomidine is widely used for this purpose, there is limited evidence comparing optimal intranasal dosing via atomization, which offers advantages such as non-invasive administration, better patient compliance, and improved bioavailability. Therefore, this study seeks to identify an effective and safe dose that provides adequate attenuation of stress response with minimal adverse effects. The expected future outcomes of this study include establishing an evidence-based intranasal dosing protocol for dexmedetomidine, improving perioperative hemodynamic stability, enhancing patient safety and comfort, reducing reliance on invasive drug administration, and contributing to the development of standardized anaesthesia practices in elective surgical procedures.

Materials and Methods

This study was conducted as a comparative randomized study among adult patients undergoing elective surgeries under general anaesthesia at hospitals attached to Bangalore Medical College and Research Institute, Bengaluru. The study was carried out over a defined study period after obtaining approval from the Institutional Ethics Committee. The study protocol was registered at clinicaltrials.gov (CTRI/2025/12/099802) and written informed consent from all participants was obtained. Patients aged between 18 and 60 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective surgeries requiring endotracheal intubation were included in the study. Patients with anticipated difficult airway, cardiac conduction abnormalities, nasal pathology, respiratory infections, or significant systemic illness were excluded.

Sample Size Calculation: The sample size was calculated based on comparison of two means using the following formula:

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \times (SD_1^2 + SD_2^2)}{d^2}$$

Where:

- n= sample size per group

- $Z_{1-\alpha/2}$ = standard normal variate at 95% confidence interval (1.96)
- $Z_{1-\beta}$ = standard normal variate at 90% power (1.28)
- SD_1, SD_2= standard deviations of the two groups
- d= expected mean difference

Based on previous study data (MAP values), with standard deviations of 7.03 and 8.92 and mean difference of 6.16, the calculated sample size was approximately 36 patients per group. Considering feasibility, a total sample size of 72 patients (36 in each group) was included in the study.

A total of 72 patients were enrolled and randomly allocated into two groups using a computer-generated randomization sequence. Group A received 1 µg/kg of dexmedetomidine, while Group B received 0.75 µg/kg of dexmedetomidine, both administered via a nasal mucosal atomization device 45 minutes prior to induction of anaesthesia. The drug was diluted to 1 ml with normal saline and administered equally into both nostrils in a supine head-down position. Blinding was maintained using colour-coded syringes. Baseline hemodynamic parameters including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded before drug administration.

All patients were premedicated and induced using a standardized anaesthesia protocol. Following preoxygenation, patients received glycopyrrolate, fentanyl, and propofol for induction, followed by atracurium to facilitate intubation. Direct laryngoscopy and endotracheal intubation were performed by an experienced anaesthesiologist. Hemodynamic parameters were recorded at predefined intervals: before induction, after drug administration, immediately after intubation (0 minute), and at 1, 5, 10, 20, and 30 minutes post-intubation. Anaesthesia was maintained using oxygen, air, isoflurane, and muscle relaxants. At the end of surgery, neuromuscular blockade was reversed, and patients were extubated after meeting standard criteria.

Postoperative monitoring was conducted in the post-anaesthesia care unit (PACU), where hemodynamic parameters were recorded at 15, 30, and 45 minutes, and at 1 and 2 hours. Sedation was assessed using the Ramsay Sedation Score before induction and in the postoperative period. Postoperative nausea and vomiting (PONV) and postoperative sore throat (POST) were assessed at 2 hours postoperatively and recorded as present or absent.

The collected data were entered into Microsoft Excel and analyzed using statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequency and percentage. Independent sample t-test or Mann–Whitney U test was used for comparison between groups, and Chi-square or Fisher's exact test was applied for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

The present study compared the efficacy of two different doses of intranasal dexmedetomidine (1 µg/kg and 0.75 µg/kg) in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation. Baseline hemodynamic parameters, including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation, were comparable between the two groups. Following drug administration, both groups showed a gradual reduction in heart rate and blood pressure, indicating the onset of the sympatholytic effect of dexmedetomidine.

During laryngoscopy and intubation, a rise in hemodynamic parameters was observed in both groups; however, the increase was comparatively lower in Group A (1 µg/kg) than in Group B (0.75 µg/kg). For example, at the time of intubation, heart rate was 84 bpm in Group A compared to 98 bpm in Group B, and systolic blood pressure was 132 mmHg versus 144 mmHg respectively. Similarly, mean arterial pressure and diastolic blood pressure also showed better control in Group A throughout the peri-intubation period. Although these differences were not statistically significant ($p > 0.05$), a consistent trend of improved hemodynamic stability was observed with the higher dose.

Post-intubation, both groups demonstrated a gradual return of hemodynamic parameters toward baseline values, with Group A maintaining relatively lower values throughout the observation period. Oxygen saturation remained stable (99–100%) in both groups at all time intervals, indicating the absence of respiratory depression. Sedation levels, assessed using Ramsay Sedation Score, were adequate and comparable in both groups, with no evidence of oversedation or delayed recovery.

In the postoperative period, the incidence of postoperative nausea and vomiting (PONV) was slightly higher in Group A during the early phase (15–30 minutes); however, symptoms resolved completely in both groups within one hour. Overall, the findings suggest that while both doses of intranasal dexmedetomidine are effective, the higher dose (1 µg/kg) provides better clinical attenuation of the hemodynamic stress response without significant adverse effects.

Table 1: Comparison of Hemodynamic Parameters (HR, SBP, DBP, MAP)

Time Interval	HR (A/B)	SBP (A/B)	DBP (A/B)	MAP (A/B)	p value
Baseline	86 / 92	130 / 136	86 / 80	92 / 90	>0.05
10 min	83 / 92	130 / 134	84 / 80	91 / 89	>0.05
20 min	83 / 90	130 / 134	83 / 80	90 / 89	>0.05
30 min	80 / 86	124 / 132	80 / 78	87 / 87	>0.05
40 min	76 / 84	124 / 132	80 / 78	87 / 87	>0.05
Intubation (0 min)	84 / 98	132 / 144	88 / 96	94 / 97	>0.05
1 min	83 / 96	132 / 140	86 / 94	92 / 97	>0.05
5 min	82 / 94	130 / 138	84 / 90	91 / 97	>0.05
10 min	76 / 94	126 / 136	80 / 88	88 / 92	>0.05
20 min	74 / 94	122 / 136	78 / 88	84 / 92	>0.05
30 min	74 / 92	122 / 136	78 / 88	84 / 92	>0.05
PACU 15 min	83 / 96	130 / 138	84 / 90	90 / 94	>0.05
30 min	84 / 98	130 / 138	84 / 90	90 / 94	>0.05
45 min	86 / 99	132 / 138	86 / 90	92 / 94	>0.05
1 hour	92 / 98	134 / 136	90 / 86	96 / 92	>0.05
2 hours	91 / 102	134 / 140	88 / 90	94 / 96	>0.05

Table 2: Comparison of Oxygen Saturation (SpO_2)

Time Interval	Group A (%)	Group B (%)	p value
Baseline	99	98	NS
Intraoperative	99–100	98–100	NS
Postoperative	99	99	NS

Table 3: Summary of Clinical Outcomes

Parameter	Group A (1 µg/kg)	Group B (0.75 µg/kg)
Hemodynamic stability	Better attenuation	Less attenuation
HR response	Lower post-intubation	Higher
BP control	More stable	Fluctuating
Sedation	Adequate	Adequate
SpO_2	Maintained	Maintained
PONV	Slightly higher early	Lower
Overall outcome	More effective	Moderately effective

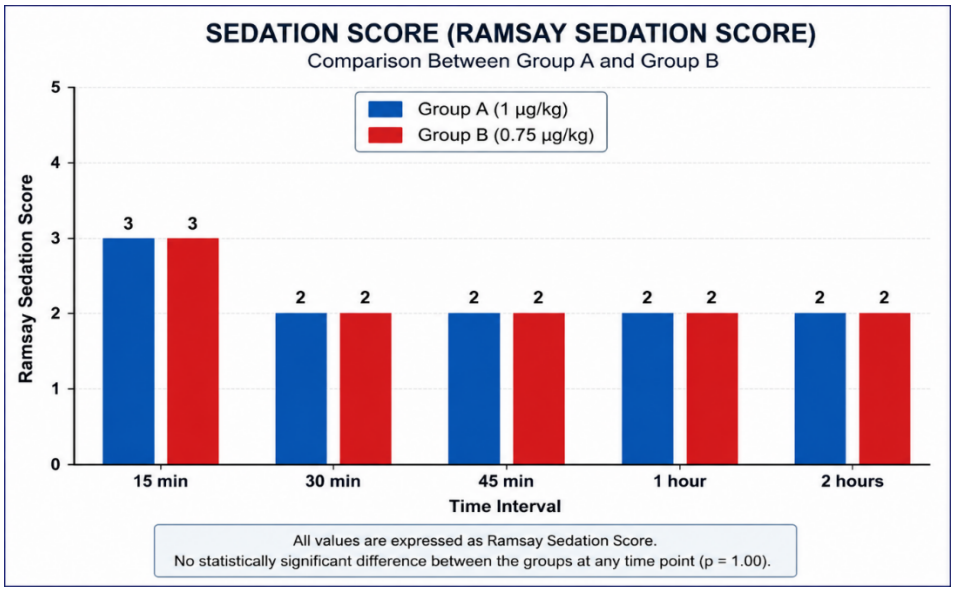

Figure 1: Comparison of Ramsay Sedation Score Between Both Groups

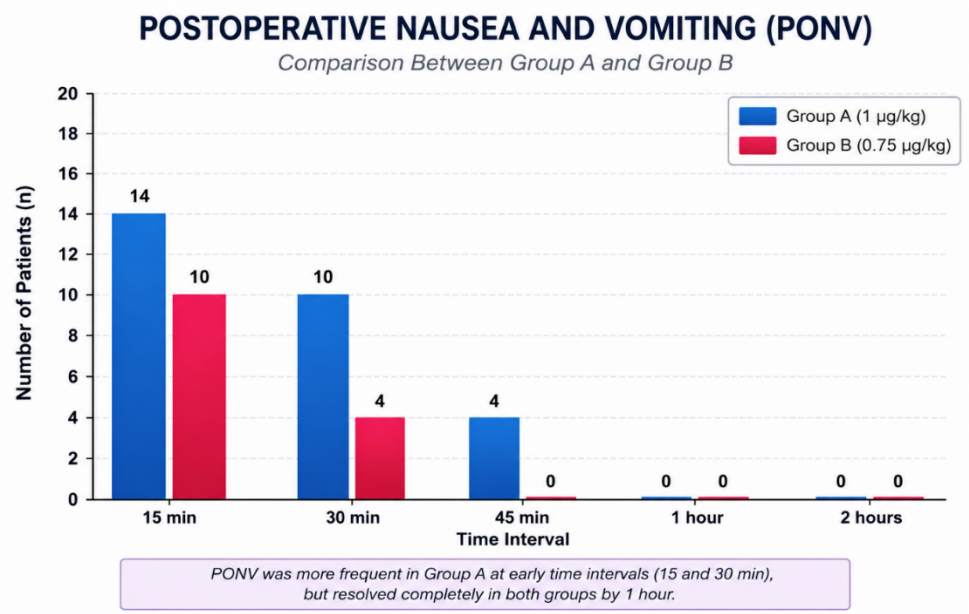

Figure 2: Comparison of Post-Operative Nausea and Vomiting Between Both Groups

Discussion

The present study evaluated the efficacy of two different doses of intranasal dexmedetomidine (1 µg/kg vs 0.75 µg/kg) in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation. The findings demonstrated that although the intergroup differences were not statistically significant ($p > 0.05$), a consistent clinical trend of better attenuation of heart rate and blood pressure was observed in Group A (1 µg/kg) compared to Group B, suggesting a dose-dependent sympatholytic effect.

In the present study, heart rate increased following intubation in both groups; however, Group A showed relatively lower values (84 bpm vs 98 bpm at intubation). These findings are comparable to those reported by Deshmukh et al. (7), who observed significant attenuation of tachycardia with intranasal dexmedetomidine, demonstrating improved hemodynamic stability compared to other routes. Similarly, Chamadia et al. (10) highlighted the dose-dependent pharmacokinetic and pharmacodynamic properties of dexmedetomidine, supporting the observed trend of better heart rate control with higher dosing.

Systolic and diastolic blood pressure in the present study showed an immediate rise following intubation, followed by gradual stabilization. Group A demonstrated better attenuation (SBP: 132 mmHg vs 144 mmHg at intubation), which is consistent with findings by Pradhan et al. (8), who reported that higher doses of dexmedetomidine resulted in significantly greater suppression of blood pressure responses. Although statistical significance was not achieved in our study, the clinical trend is in agreement with existing evidence, and this discrepancy may be attributed to the relatively smaller sample size and inter-individual variability.

Mean arterial pressure (MAP) trends in the current study also showed relatively better stability in Group A, particularly in the immediate post-intubation period. These observations are in line with Padmashree and Nelamangala (11), who reported that both intranasal and intravenous dexmedetomidine effectively attenuated MAP responses without significant intergroup differences, but with clear clinical benefit in reducing the pressor response. This supports the effectiveness of intranasal administration as a non-invasive alternative to intravenous route.

Oxygen saturation remained stable (99–100%) in both groups throughout the study period, indicating that dexmedetomidine does not produce significant respiratory depression. This finding is consistent with the pharmacological profile described by Weerink et al. (12), who reported that dexmedetomidine provides sedation without compromising respiratory function, making it a safer alternative to other sedative agents.

Sedation levels assessed using Ramsay Sedation Score were comparable in both groups, with adequate sedation achieved without oversedation. Similar results were observed by Patel et al. (13), who demonstrated that intranasal dexmedetomidine provides effective sedation with minimal respiratory compromise, supporting its role as an ideal premedication agent.

In terms of postoperative outcomes, the incidence of PONV in the present study was slightly higher in Group A during the early postoperative period (14

vs 10 at 15 minutes), but resolved completely within one hour in both groups. These findings are comparable to those reported by Tayung et al. (14), who observed no significant difference in postoperative complications between different doses of dexmedetomidine, confirming its safety profile.

Although most parameters in the present study did not achieve statistical significance, the consistent clinical trend favoring the higher dose (1 µg/kg) supports a dose-dependent effect. This is further supported by Iirola et al. (4), who demonstrated that intranasal dexmedetomidine has good bioavailability and predictable pharmacokinetics, contributing to its effectiveness in attenuating sympathetic responses.

Overall, the findings of this study are in agreement with existing literature, suggesting that intranasal dexmedetomidine is an effective, safe, and non-invasive premedication for attenuating the hemodynamic response to laryngoscopy and intubation. The higher dose (1 µg/kg) appears to provide better clinical control without significant adverse effects, although larger multicentric studies are required to establish statistical superiority and optimize dosing protocols.

References

1. King BD, Harris LC Jr, Greifenstein FE, Elder JD Jr, Dripps RD. Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anesthesia. Anesthesiology. 1951;12(5):556–566. doi:10.1097/00000542-195109000-00002
2. Kamibayashi T, Maze M. Clinical uses of α2-adrenergic agonists. Anesthesiology. 2000;93(5):1345–1349. doi:10.1097/00000542-200011000-00030
3. Nelson LE, Lu J, Guo T, Saper CB, Franks NP, Maze M. The α2-adrenoceptor agonist dexmedetomidine converges on an endogenous sleep-promoting pathway. Anesthesiology. 2003;98(2):428–436. doi:10.1097/00000542-200302000-00024
4. Iirola T, Vilo S, Aantaa R, Wendelin-Saarenhovi M, Neuvonen PJ, Scheinin M. Bioavailability of dexmedetomidine after intranasal administration. Eur J Clin Pharmacol. 2011;67(8):825–831. doi:10.1007/s00228-011-1002-y
5. Djupesland PG. Nasal drug delivery devices: characteristics and performance in a clinical perspective. Ther Deliv. 2013;4(3):317–332. doi:10.4155/tde.12.147
6. Li BL, Zhang N, Huang JX, Qiu QQ, Tian H, Chen L. A comparison of intranasal dexmedetomidine for sedation in children administered either by atomiser or by drops. Anaesthesia. 2016;71(5):522–528. doi:10.1111/anae.13407
7. Deshmukh KM, Bhargava SV, Bhure AR, Mone AA, Dhoble KR, Rode AA. Effectiveness of intranasal versus intravenous dexmedetomidine for attenuation of hemodynamic responses during laryngoscopy and endotracheal intubation. Indian J Clin Anaesth. 2025;12(1):50–58.
8. Pradhan A, Sahoo SR, Sahoo RK, Senapathi LK, Samanta P. Efficacy of two different doses of nebulized dexmedetomidine for attenuation of hemodynamic response to laryngoscopy and intubation: A randomized controlled trial. Indian J Clin Anaesth. 2025;12(1):28–35.
9. Abouleish AE, Leib ML, Cohen NH. ASA provides examples to each ASA physical status class. ASA Monitor. 2015;79:38–39.
10. Chamadia S, Pedemonte JC, Hobbs LE, et al. A pharmacokinetic and pharmacodynamic study of oral dexmedetomidine. Anesthesiology. 2020;133(6):1223–1233. doi:10.1097/ALN.0000000000003568
11. Padmashree MK, Nelamangala K. A comparative study between intranasal and intravenous dexmedetomidine and hemodynamic responses during endotracheal intubation. Cureus. 2023;15(2):e35196. doi:10.7759/cureus.35196
12. Weerink MAS, Struys MMRF, Hannivoort LN, Barends CRM, Absalom AR, Colin P. Clinical pharmacokinetics and pharmacodynamics of dexmedetomidine. Clin Pharmacokinet. 2017;56(8):893–913. doi:10.1007/s40262-017-0507-7
13. Patel JB, Nadkarni AS, Shah CH, Tailor RM, Thomas SM. Intranasal dexmedetomidine versus clonidine: A comparative study. Indian J Clin Anaesth. 2025;12(1):59–65.
14. Tayung RP, Bijilani K, Borah S, Gohain M, Singh SK. Dexmedetomidine for attenuation of intubation response. Eur J Cardiovasc Med. 2024;14(2):1179–1187.