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Original Research Article

Comparison of Dexmedetomidine Versus Midazolam as Premedication for Attenuation of Hemodynamic Response to Laryngoscopy and Intubation

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Abstract:

Background: Laryngoscopy and endotracheal intubation are associated with a significant sympathetic response resulting in tachycardia and hypertension. Attenuation of this hemodynamic response is particularly important in patients with limited cardiovascular reserve. Dexmedetomidine and midazolam are commonly used premedicants, but their comparative effectiveness in blunting intubation-induced hemodynamic changes remains an area of clinical interest.

Objective: To compare dexmedetomidine and midazolam as premedication for attenuation of hemodynamic responses to laryngoscopy and intubation.

Methods: This prospective comparative study included 100 adult patients undergoing elective surgery under general anesthesia. Patients received either dexmedetomidine (Group D) or midazolam (Group M) as premedication. Hemodynamic parameters including heart rate (HR) and mean arterial pressure (MAP) were recorded at baseline, after premedication, at laryngoscopy, and at 1, 3, and 5 minutes post-intubation. Data were analyzed statistically.

Results: Dexmedetomidine produced significantly lower heart rate and blood pressure responses during and after intubation compared to midazolam ($p < 0.001$).

Conclusion: Dexmedetomidine is superior to midazolam in attenuating the hemodynamic response to laryngoscopy and intubation.

Keywords: Dexmedetomidine, Midazolam, Laryngoscopy, Intubation, Hemodynamic response.

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Introduction

Laryngoscopy and tracheal intubation are known to provoke marked sympathetic stimulation resulting in transient hypertension, tachycardia, and arrhythmias [1]. These responses are mediated by catecholamine release following stimulation of the oropharyngeal and laryngeal structures [2]. While healthy individuals usually tolerate these changes, they can be detrimental in patients with coronary artery disease, hypertension, or cerebrovascular pathology [3].

Various pharmacological agents such as opioids, beta-blockers, vasodilators, and sedative-hypnotics have been used to blunt the pressor response to intubation [4]. Benzodiazepines like midazolam are frequently employed due to their anxiolytic and sedative properties, although their ability to suppress sympathetic responses is limited [5].

Dexmedetomidine, a highly selective α2-adrenergic agonist, provides sedation, anxiolysis, and sympatholysis without significant respiratory depression [6]. By reducing central sympathetic outflow, dexmedetomidine has been shown to attenuate hemodynamic responses to stressful stimuli including laryngoscopy [7].

Several studies have compared dexmedetomidine with other agents, demonstrating its efficacy in maintaining cardiovascular stability during anesthesia induction [8–10]. However, limited prospective observational data are available from tertiary care centers in Eastern India.

The present study was designed to compare dexmedetomidine and midazolam as premedication agents in attenuating hemodynamic responses to laryngoscopy and intubation.

Materials and Methods

Study Design

Prospective comparative study.

Study Duration: January 2025 to October 2025

Study Population: One hundred adult patients aged 18–60 years, ASA physical status I–II, scheduled for elective surgery under general anesthesia.

Group Allocation

- **Group D (n = 50):** Dexmedetomidine 1 µg/kg IV over 10 minutes
- **Group M (n = 50):** Midazolam 0.05 mg/kg IV

Hemodynamic Parameters

Heart rate (HR) and mean arterial pressure (MAP) were recorded at:

- Baseline (T0)
- After premedication (T1)
- At laryngoscopy (T2)
- 1, 3, and 5 minutes post-intubation (T3–T5)

Statistical Analysis: Continuous variables were expressed as mean ± SD and compared using Student's t-test. Categorical variables were compared using chi-square test. A p-value < 0.05 was considered statistically significant.

Results

Baseline Demographic and Clinical Characteristics: A total of 100 patients were included in the study, with 50 patients in Group D (Dexmedetomidine) and 50 patients in Group M (Midazolam). The two groups were comparable with respect to baseline demographic variables.

The mean age in Group D was 39.2 ± 8.4 years, while in Group M it was 40.1 ± 7.9 years, with no statistically significant difference between the groups (p = 0.56). Sex distribution was also comparable, with 28 males and 22 females in Group D and 30 males and 20 females in Group M (p = 0.68). Mean body weight was similar between the two groups (62.4 ± 6.8 kg vs 61.9 ± 7.1 kg; p = 0.71).

These findings indicate that both groups were demographically comparable at baseline (Table 1).

Table 1: Baseline Demographic Characteristics

Parameter	Group D (n = 50)	Group M (n = 50)	p-value
Age (years), mean ± SD	39.2 ± 8.4	40.1 ± 7.9	0.56
Male/Female (n)	28 / 22	30 / 20	0.68
Weight (kg), mean ± SD	62.4 ± 6.8	61.9 ± 7.1	0.71

Heart Rate Changes: Baseline heart rate was comparable between Group D (78 ± 6 beats/min) and Group M (79 ± 7 beats/min), with no statistically significant difference (p = 0.44).

At the time of laryngoscopy, heart rate increased in both groups; however, the increase was significantly lower in Group D (82 ± 5 beats/min) compared to Group M (96 ± 8 beats/min). This difference was statistically highly significant (p < 0.001).

At 1 minute post-intubation, mean heart rate was 80 ± 5 beats/min in Group D and 94 ± 7 beats/min in Group M (p < 0.001). At 3 minutes, heart rate decreased to 78 ± 4 beats/min in Group D, while remaining elevated at 90 ± 6 beats/min in Group M (p < 0.001). At 5 minutes post-intubation, heart rate returned close to baseline in Group D (76 ± 4 beats/min) but remained significantly higher in Group M (88 ± 6 beats/min), and this difference remained statistically significant (p < 0.001).

These findings demonstrate superior attenuation of heart rate response with dexmedetomidine (Table 2, Figure 1).

Table 2: Heart Rate Changes at Different Time Intervals (beats/min)

Time Interval	Group D	Group M	p-value
Baseline	78 ± 6	79 ± 7	0.44
Laryngoscopy	82 ± 5	96 ± 8	<0.001
1 min post-intubation	80 ± 5	94 ± 7	<0.001
3 min post-intubation	78 ± 4	90 ± 6	<0.001
5 min post-intubation	76 ± 4	88 ± 6	<0.001

Blood Pressure Changes

Mean Arterial Pressure (MAP): Baseline mean arterial pressure was comparable between Group D (92 ± 6 mmHg) and Group M (93 ± 7 mmHg), with no statistically significant difference (p = 0.62).

At laryngoscopy, MAP increased to 96 ± 5 mmHg in Group D and 110 ± 8 mmHg in Group M. The rise in MAP was significantly lower in the dexmedetomidine group compared to the midazolam group (p < 0.001).

At 1 minute post-intubation, MAP was 94 ± 5 mmHg in Group D and 108 ± 7 mmHg in Group M (p < 0.001). At 3 minutes, MAP decreased to 92 ± 4 mmHg in Group D but remained elevated at 104 ± 6

mmHg in Group M ($p < 0.001$). At 5 minutes post-intubation, MAP further decreased to 90 ± 4 mmHg in Group D, while it remained significantly higher in Group M (102 ± 6 mmHg), with a statistically significant difference ($p < 0.001$).

These results indicate better blood pressure stability in the dexmedetomidine group (Table 3, Figure 2).

Table 3: Mean Arterial Pressure Changes (mmHg)

Time Interval	Group D	Group M	p-value
Baseline	92 ± 6	93 ± 7	0.62
Laryngoscopy	96 ± 5	110 ± 8	<0.001
1 min post-intubation	94 ± 5	108 ± 7	<0.001
3 min post-intubation	92 ± 4	104 ± 6	<0.001
5 min post-intubation	90 ± 4	102 ± 6	<0.001

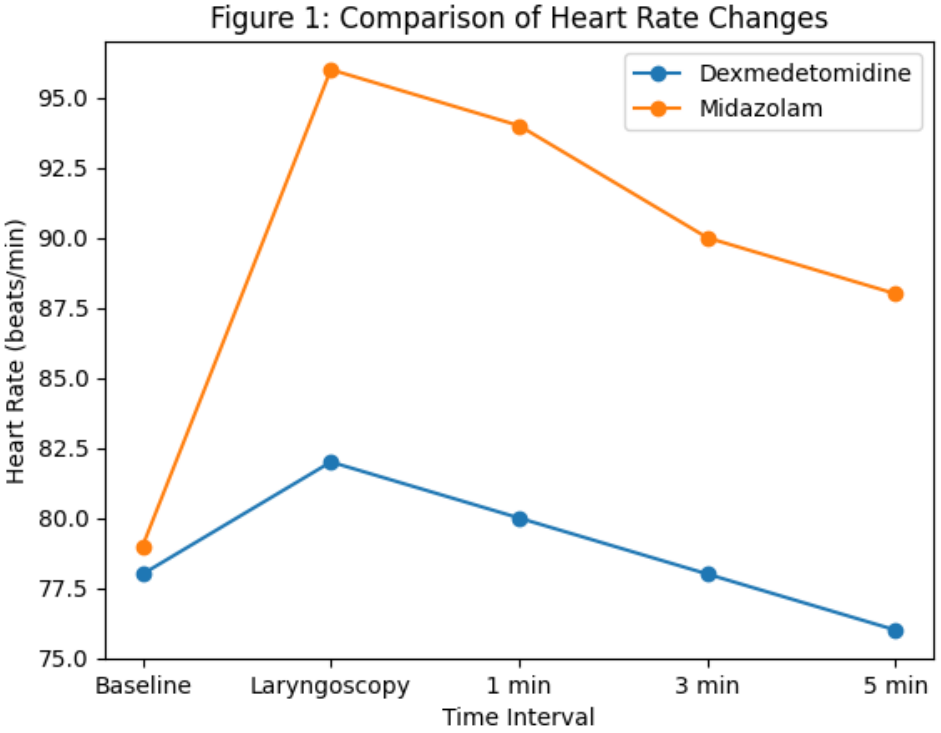

Figure 1: Comparison of heart rate changes between dexmedetomidine and midazolam groups at different time intervals.

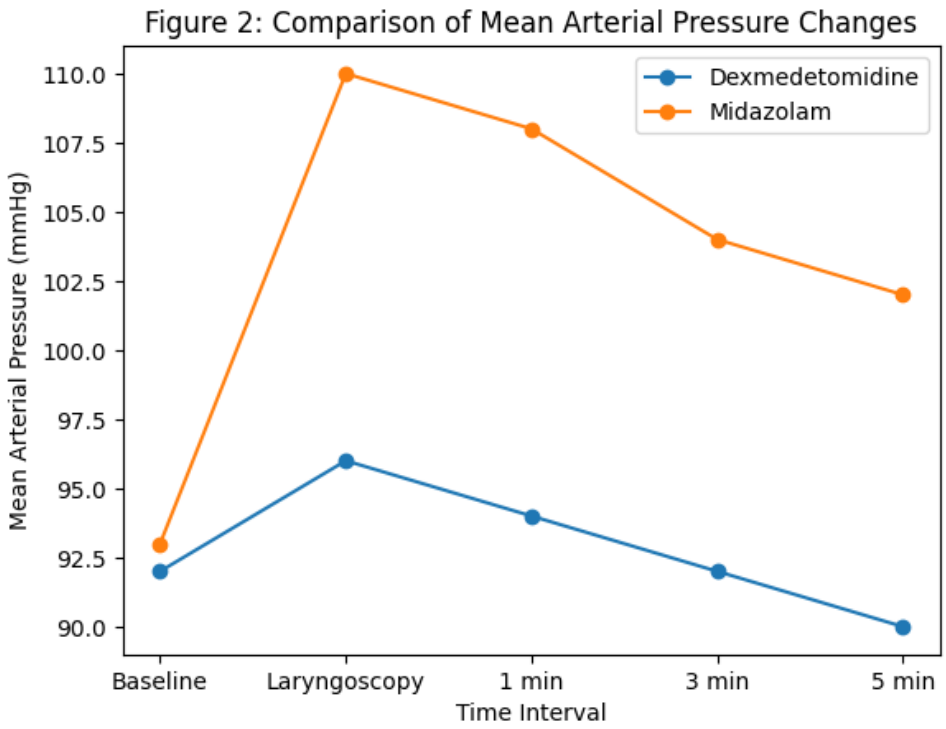

Figure 2: Comparison of mean arterial pressure changes between dexmedetomidine and midazolam groups at different time intervals.

Summary of Key Results: Dexmedetomidine provided significantly better attenuation of heart rate and blood pressure responses to laryngoscopy and intubation compared to midazolam. The differences between groups were statistically significant at all post-laryngoscopy and post-intubation time points ($p < 0.001$), indicating superior hemodynamic stability with dexmedetomidine.

Discussion

The present study demonstrates that dexmedetomidine is significantly more effective than midazolam in attenuating the hemodynamic response to laryngoscopy and intubation. The statistically significant reduction in heart rate and blood pressure observed in the dexmedetomidine group can be attributed to its central sympatholytic action mediated through α2-adrenergic receptor stimulation [11,12].

Midazolam provides sedation and anxiolysis but lacks sufficient sympathetic suppression, resulting in inadequate control of intubation-induced cardiovascular responses [13]. Similar findings have been reported in previous studies comparing dexmedetomidine with benzodiazepines and other sedative agents [14–17].

Dexmedetomidine's ability to maintain cardiovascular stability without respiratory depression makes it an ideal premedication agent, particularly in patients at risk of adverse hemodynamic events [18–20]. The findings of this study are consistent with earlier reports demonstrating reduced catecholamine release and improved peri-intubation stability with dexmedetomidine use [21–25].

Conclusion

Dexmedetomidine is superior to midazolam as a premedication agent for attenuating the hemodynamic response to laryngoscopy and endotracheal intubation. Its use results in better heart rate and blood pressure control and improved peri-intubation cardiovascular stability.

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