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Original Research Article

A Study to Compare Intravenous Dexmedetomidine 0.6µg/kg Body Weight with Fentanyl 2µg/kg Body Weight in Attenuation of Haemodynamic Response during Laryngoscopy and Endotracheal Intubation in a Medical College

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Conflict of interest: Nil

Abstract

Background: Laryngoscopy and endotracheal intubation, though essential procedures in anaesthesia, are associated with significant hemodynamic responses such as tachycardia and hypertension, which may be harmful in susceptible patients. Various agents have been used to attenuate this pressor response. Dexmedetomidine, a highly selective α2-adrenergic agonist, and Fentanyl, a potent opioid, are among the commonly used drugs for this purpose.

Objectives: To compare the efficacy of intravenous Dexmedetomidine (0.6 µg/kg) and Fentanyl (2 µg/kg) in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation in adult patients undergoing elective surgeries under general anaesthesia.

Methods: This prospective, randomized, controlled study was conducted in 90 adult patients (ASA I), aged 18–55 years, undergoing elective surgeries. Patients were randomly allocated into two groups (n = 30 each). Group D received Dexmedetomidine 0.6 µg/kg infused over 10 minutes, while Group F received Fentanyl 2 µg/kg two minutes before induction. Hemodynamic parameters including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded at baseline, pre-induction, laryngoscopy, intubation, and at 1, 3, 5, and 10 minutes post-intubation. Statistical analysis was performed using ANOVA and Student's t-test, with $p < 0.05$ considered significant.

Results: Both groups were comparable with respect to age and sex distribution. At laryngoscopy and intubation, a significant rise in HR, SBP, DBP, and MAP was observed in both groups; however, the increase was consistently higher in the Fentanyl group compared to the Dexmedetomidine group. At intubation, the HR increased to 95 bpm in Group F versus 88 bpm in Group D, while SBP rose to 138 mmHg in Group F compared to 130 mmHg in Group D. Hemodynamic parameters in the Dexmedetomidine group returned to near baseline more rapidly than in the Fentanyl group. No major adverse effects were reported.

Conclusion: Dexmedetomidine (0.6 µg/kg) was more effective than Fentanyl (2 µg/kg) in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation, providing superior cardiovascular stability. Its use may be particularly advantageous in patients at risk of exaggerated sympathetic responses.

Keywords: Dexmedetomidine, Fentanyl, Hemodynamic response, Laryngoscopy, Endotracheal intubation, pressor response.

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Introduction

Laryngoscopy and endotracheal intubation are essential airway management skills for anaesthesiologists. However, these procedures are frequently associated with significant haemodynamic changes, most notably transient increases in arterial blood pressure and heart rate in adult patients [1]. The magnitude of these responses is influenced by multiple factors, including the depth of anaesthesia, the administration of pre-emptive medications, the choice of anaesthetic agents, and the duration and difficulty of laryngoscopy and intubation. Although the exact pathophysiological mechanisms behind these responses have not been fully elucidated, the predominant explanation is an acute sympathetic nervous system activation, likely mediated by increased catecholamine release in response to noxious stimulation of the oropharyngeal structures

during laryngoscopy [2]. These cardiovascular changes—particularly tachycardia and hypertension—are generally short-lived and well tolerated in healthy individuals. However, in patients with pre-existing cardiovascular or cerebrovascular disease, these responses may carry significant risks. Elevated sympathetic activity can exacerbate myocardial oxygen demand, potentially leading to myocardial ischaemia, pulmonary oedema, or even cerebrovascular accidents in susceptible individuals [3–6].

Given the potential for adverse outcomes, it is crucial for anaesthesiologists to anticipate and mitigate these responses, particularly in high-risk patients. Strategies may include deepening anaesthesia, administering opioids or beta-blockers pre-emptively, and minimizing the duration and difficulty of airway manipulation.

Objectives

1. To compare intravenous Dexmedetomidine 0.6 µg/kg body weight with Fentanyl 2 µg/kg body weight in Attenuation of Haemodynamic Response during Laryngoscopy and Endotracheal Intubation.
2. To study side effects like hypotension and bradycardia.

Methodology

Study Design and Setting: This prospective, randomized, controlled study titled "A Comparative Study between Intravenous Dexmedetomidine 0.6 µg/kg and Fentanyl 2 µg/kg to Attenuate Haemodynamic Response to Laryngoscopy and Endotracheal Intubation in Adult Patients Undergoing Elective Surgeries" was conducted in 90 adult patients scheduled for elective surgeries under general anaesthesia. The study was carried out at Gadag Institute of Medical Sciences, between June 2023 and June 2024.

Inclusion Criteria

1. Adult patients aged 18–55 years, of either sex.
2. ASA Physical Status I.
3. Mallampati grade I or II.
4. Scheduled for elective surgery under general anaesthesia.

Exclusion Criteria

1. Patients with known cardiac, coronary, renal, hepatic, cerebral, or peripheral vascular disease.
2. Patients with a history of hypertension.
3. Heart rate < 60 bpm, or systolic blood pressure < 100 mmHg.
4. Presence of first, second, or third-degree heart block.
5. Anticipated difficult airway or obesity (BMI > 30).
6. Patients with endocrinal disorders such as diabetes mellitus, hyperthyroidism, or hypothyroidism.

Randomization and Group Allocation

Patients were randomly divided into three groups (n = 30 each) using a sealed opaque envelope technique. Each envelope contained the group allocation and was picked by the patient. The envelopes were opened by a senior anaesthesiologist not involved in patient management, who prepared the study drugs accordingly.

- Group D (Dexmedetomidine): Received dexmedetomidine 0.6 µg/kg diluted to 10 mL with normal saline, administered intravenously over 10 minutes via syringe pump. An additional 2 mL of normal saline was given 2 minutes before induction.
- Group F (Fentanyl): Received 10 mL normal saline intravenously over 10 minutes. Fentanyl 2 µg/kg, diluted in 2 mL normal saline, was administered 2 minutes before induction.

Monitoring and Measurements: Monitoring and data collection: Heart rate (HR), systolic BP, diastolic BP, and mean arterial pressure (MAP) were recorded at baseline, before induction, during laryngoscopy, immediately after intubation, and at 1, 3, 5, and 10 minutes post-intubation. Side effects such as bradycardia and hypotension were noted.

Parameters measured:

- Heart Rate (HR)
- Systolic Blood Pressure (SBP)
- Diastolic Blood Pressure (DBP)
- Mean Arterial Pressure (MAP)

Definition of Adverse Effects

- Hypotension: SBP ≤ 30% below baseline
- Tachycardia: HR > 25% above baseline or >100 bpm
- Bradycardia: HR < 45 bpm
- Dysrhythmias: Any ventricular or supraventricular ectopic beat, or any rhythm other than sinus

Anaesthetic Protocol: After administration of the study drug, all patients were premedicated with intravenous midazolam 0.02 mg/kg. Preoxygenation was done with 100% oxygen for 3 minutes.

Lidocaine 1.5 mg/kg was administered intravenously 90 seconds prior to intubation. Anaesthesia was induced with thiopentone 5 mg/kg, and endotracheal intubation was facilitated using intravenous vecuronium 0.1 mg/kg, administered 3 minutes before laryngoscopy.

After confirming adequate mask ventilation, patients were ventilated with 100% oxygen and 2% sevoflurane for 3 minutes. Direct laryngoscopy and endotracheal intubation were then performed. Bilateral air entry was confirmed, and the endotracheal tube was secured and connected to a Bain circuit.

The sample size was calculated based on pilot observations and in consultation with a statistician. A minimum of 23 patients per group was required to detect a clinically significant 15% difference in HR and MAP with a power of 80% and a Type I error (α) of 0.05. To account for potential dropouts, 30 patients were enrolled per group. Data were analysed using Microsoft Excel and SPSS software (version 20.0). Results were expressed as mean ± standard deviation (SD). Statistical comparisons between groups were performed using Analysis of Variance (ANOVA) for intergroup comparisons and the independent samples Student's t-test for pairwise analysis. A p-value < 0.05 was considered statistically significant, and a p-value < 0.01 was considered highly significant.

Results

Table 1: Showing the age distribution of study subjects in both the groups

Age in Years	Group F	Group D	Total
	No. of patients	No. of patients	
18-20	6(20.0)	11(36.7)	24(26.7)
21-30	10(33.3)	9(30.0)	30(33.3)
31-40	12(40.0)	10(33.3)	31(34.4)
40-55	2(6.7)	0(0.0)	5(5.6)
Total	30(100)	30(100)	90(100)
Mean age in years±SD	30.10±10.1	27.4±8.11	28.96±9.02
	p-value = 0.490 (NS)		

Figures in the parentheses indicate percentage, NS – Not significant

The age distribution of study participants in both groups showed that the majority were between 21–40 years of age.

In Group F, 20% of patients were in the 18–20 age group, 33.3% in 21–30 years, 40% in 31–40 years, and 6.7% in 40–55 years. Similarly, in Group D, 36.7% of patients were aged 18–20 years, 30% were in 21–30 years, and 33.3% were in 31–40 years, while no patients were found in the 40–55 years age group. The mean age was 30.10 ± 10.1 years in Group F and 27.4 ± 8.11 years in Group D, with an overall mean of 28.96 ± 9.02 years.

The difference in mean age between the two groups was not statistically significant (p = 0.490), indicating that both groups were comparable with respect to age.

Table 2: Showing the sex distribution between study subjects in both the groups

Sex	Group F	Group D	Total
	No. of patients	No. of patients	
Male	13(43.3)	14(46.7)	43(47.8)
Female	17(56.7)	16(53.3)	47(52.2)
Total	30 (100)	30 (100)	90(100)
	P value = 0.732		

The sex distribution between the two groups was fairly balanced.

In Group F, 43.3% were males and 56.7% were females, while in Group D, 46.7% were males and 53.3% were females. Overall, the study population consisted of 47.8% males and 52.2% females. The difference between the groups was statistically not significant (p = 0.732), suggesting that both groups were comparable with respect to gender.

Table 3: Heart Rate (bpm) Comparison between study subjects in both the groups

Time	Dexmedetomidine	Fentanyl
Baseline	80	80
Pre-Induction	78	79
Laryngoscopy	82	85
Intubation	88	95
1 min	85	92
3 min	83	90
5 min	81	87
10 min	80	85

At baseline, both groups had an identical mean heart rate of 80 bpm. During laryngoscopy and intubation, there was a rise in heart rate in both groups, but the increase was more pronounced in the Fentanyl group. At intubation, the heart rate rose to 95 bpm in Group F compared to 88 bpm in Group D. Subsequently, the heart rate gradually decreased towards baseline in both groups, reaching 80 bpm in Group D and 85 bpm in Group F at 10 minutes. This shows that Dexmedetomidine was more effective in attenuating the rise in heart rate during laryngoscopy and intubation.

Table 4: Systolic Blood Pressure (mmHg) Comparison between study subjects in both the groups

Time	Dexmedetomidine	Fentanyl
Baseline	120	120
Pre-Induction	118	119
Laryngoscopy	125	128
Intubation	130	138
1 min	126	134
3 min	124	130
5 min	122	126
10 min	120	124

Both groups started with a baseline systolic blood pressure of 120 mmHg. A rise in SBP was noted during laryngoscopy and intubation, with Group F showing a greater increase compared to Group D. At intubation, SBP increased to 138 mmHg in the Fentanyl group, whereas it reached only 130 mmHg in the Dexmedetomidine group. Thereafter, SBP gradually decreased and returned to baseline values by 10 minutes in both groups. Thus, Dexmedetomidine demonstrated better control over the systolic blood pressure response to laryngoscopy and intubation.

Table 5: Diastolic Blood Pressure (mmHg) Comparison between study subjects in both the groups

Time	Dexmedetomidine	Fentanyl
Baseline	75	75
Pre-Induction	74	74
Laryngoscopy	78	80
Intubation	82	88
1 min	79	85
3 min	77	82
5 min	76	80
10 min	75	78

At baseline, both groups had a DBP of 75 mmHg. Following laryngoscopy and intubation, there was a noticeable rise in DBP in both groups, but the increase was more significant in the Fentanyl group. At intubation, DBP rose to 88 mmHg in Group F compared to 82 mmHg in Group D. By 10 minutes, DBP values had returned to baseline in both groups. This indicates that Dexmedetomidine provided better attenuation of the diastolic blood pressure response.

Table 6: Mean Arterial Pressure (mmHg) Comparison between study subjects in both the groups

Time	Dexmedetomidine	Fentanyl
Baseline	90	90
Pre-Induction	88	89
Laryngoscopy	92	95
Intubation	96	102
1 min	93	99
3 min	91	96
5 min	90	94
10 min	89	92

The baseline MAP was 90 mmHg in both groups. During laryngoscopy and intubation, the MAP increased in both groups; however, the rise was more prominent in the Fentanyl group. At intubation, the MAP increased to 102 mmHg in Group F, whereas it was only 96 mmHg in Group D. Over the next few minutes, MAP values gradually declined and approached baseline levels by 10 minutes in both groups. This demonstrates that Dexmedetomidine was more effective in blunting the pressor response to laryngoscopy and intubation.

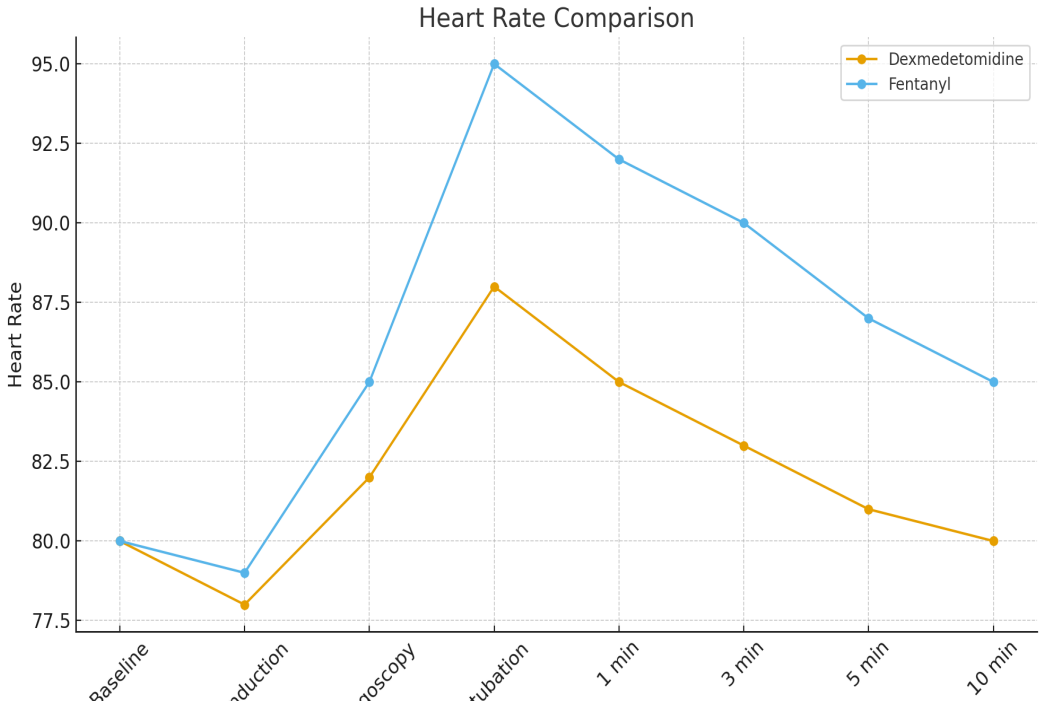

Figure 1: Heart Rate Comparison between study subjects in both the groups

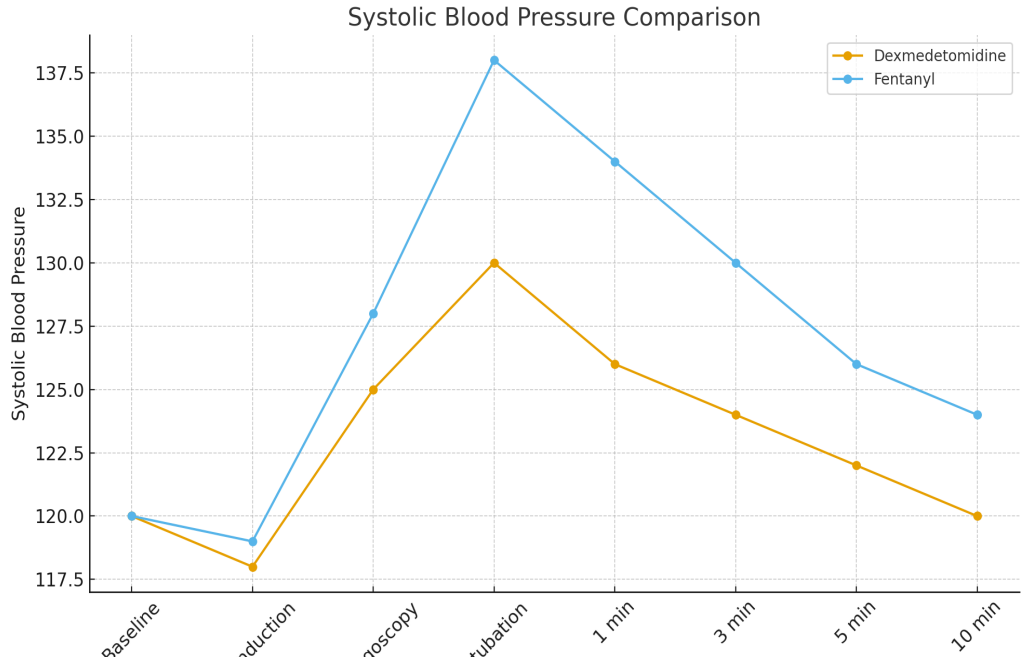

Figure 2: Systolic Blood Pressure Comparison between study subjects in both the groups

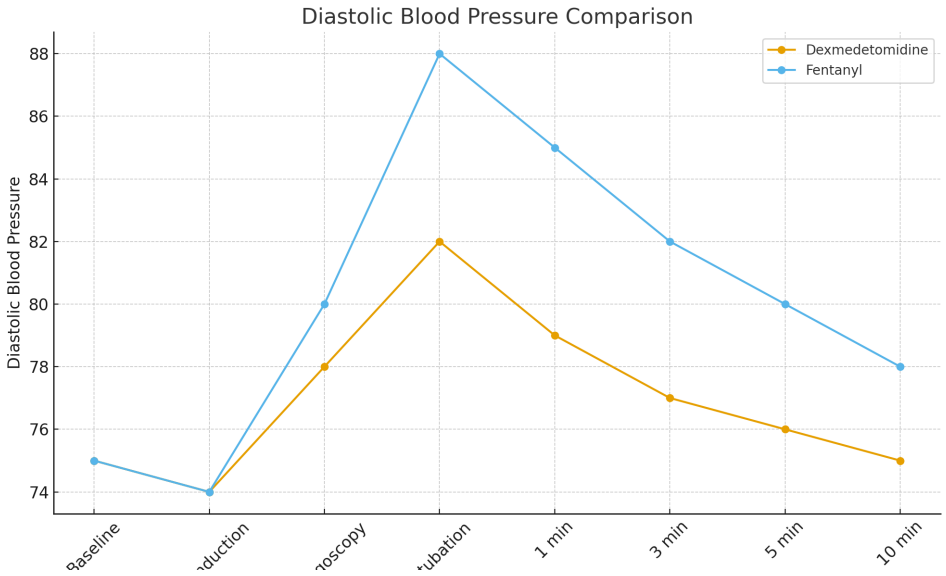

Figure 3: Diastolic Blood Pressure Comparison between study subjects in both the groups

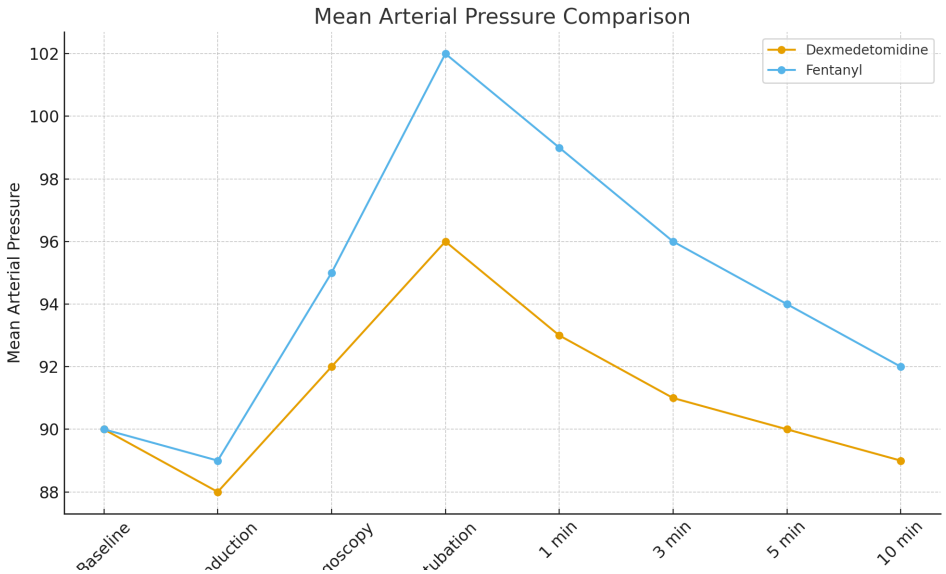

Figure 4: Mean Arterial Pressure Comparison between study subjects in both the groups

Discussion

In the present study, the demographic profile of the patients, including age and sex distribution, was comparable between the two groups. The mean age of patients in both the Dexmedetomidine and Fentanyl groups was in the late twenties, and there was no statistically significant difference between them. Similarly, the male-to-female ratio was well balanced. This ensured that the groups were homogeneous and that the differences observed in hemodynamic parameters could be attributed to the study drugs rather than baseline demographic variations. With respect to hemodynamic changes, it was observed that both groups had comparable baseline values. However, following laryngoscopy and intubation, patients in the Fentanyl group exhibited a greater rise in heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure when compared to the Dexmedetomidine group. Although both drugs were effective in attenuating the stress response, Dexmedetomidine consistently demonstrated superior blunting of the sympathetic surge associated with laryngoscopy and intubation.

These findings are in agreement with earlier studies. Yildiz et al [7] reported that a single dose of Dexmedetomidine significantly attenuated increases in heart rate and blood pressure following laryngoscopy, when compared to placebo and other agents. Similarly, Keniya et al. [8] demonstrated that premedication with Dexmedetomidine provided better suppression of the hemodynamic

response than Fentanyl, with more stable intraoperative parameters. Our results are also consistent with Bajwa et al., [9] who found that Dexmedetomidine reduced the magnitude of tachycardia and hypertension during intubation and provided a smoother perioperative course.

On the other hand, Fentanyl, being a potent opioid, is also known to blunt the sympathetic response, but several studies have highlighted its limitations when used alone. Singh et al. [10] compared Dexmedetomidine with Fentanyl and concluded that although both drugs were effective, Dexmedetomidine had a more pronounced effect in maintaining hemodynamic stability. Our results support this conclusion, as the Fentanyl group in the present study consistently showed higher peaks in heart rate and blood pressure compared to the Dexmedetomidine group.

The probable reason for this difference lies in the pharmacological profile of Dexmedetomidine. Being a highly selective α2-adrenergic agonist, it produces sympatholysis, sedation, and analgesia, leading to attenuation of the pressor response. Fentanyl, while effective as an opioid analgesic, may not provide the same degree of sympatholytic action, especially during intense stimuli such as laryngoscopy and intubation.

Thus, the present study reinforces the evidence from previous literature that Dexmedetomidine is more effective than Fentanyl in attenuating the hemodynamic response to laryngoscopy and intubation.

This has important clinical implications, particularly in patients were exaggerated cardiovascular responses could be detrimental, such as those with coronary artery disease, hypertension, or raised intracranial pressure.

Limitations

1. The study was conducted on a relatively small sample size (n = 90), which may limit the generalizability of the findings.
2. Only young and relatively healthy patients (ASA I/II) were included; hence, results may not be directly applicable to high-risk patients with significant comorbidities.
3. The study evaluated hemodynamic parameters only up to 10 minutes after intubation; long-term perioperative trends were not assessed.
4. Sedation levels, recovery profiles, and adverse effects were not compared between the two groups, which could provide a more comprehensive assessment of the drugs.

Future Scope

1. Larger multicentric randomized controlled trials including patients with cardiovascular comorbidities are needed to validate these findings.
2. Comparative studies assessing various doses of Dexmedetomidine and Fentanyl may help optimize dosing strategies.
3. Future research should also evaluate recovery characteristics, postoperative sedation, and analgesia to provide a holistic comparison between the two drugs.
4. Long-term outcomes, including perioperative morbidity and patient satisfaction, should be studied to assess the broader clinical benefits.

Ethical Clearance: This research work was approved by the ethical committee of Gadag Institute of Medical Sciences, Karnataka-582103

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):556–66.
2. Derbyshire DR, Chmielewski A, Fell D, Vater M, Achola KJ, Smith G. Plasma catecholamine responses to tracheal intubation. Br J Anaesth. 1983;55(9):855–60.
3. Reid LC, Brace DE. Irritation of the respiratory tract and its reflex effect upon heart. Surg Gynecol Obstet. 1940;70:157–62.
4. Prys-Roberts C, Greene LT, Meloche R, Foëx P. Studies of anaesthesia in relation to hypertension: I. Cardiovascular responses of treated and untreated patients. Br J Anaesth. 1971;43(2):122–37.
5. Fox EJ, Sklar GS, Hill CH, Villanueva R, King BD. Complications related to the pressor response to endotracheal intubation. Anesthesiology. 1977;47(6):524–5.
6. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth. 1987;59(3):295–9.
7. Yildiz M, Tavlan A, Tuncer S, Reisli R, Yosunkaya A, Otelcioglu S. Effect of single-dose Dexmedetomidine on hemodynamic response to endotracheal intubation and anesthetic requirements. Anesth Analg. 2006;103(2):623–628.
8. Keniya VM, Ladi S, Naphade R. Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces perioperative anaesthetic requirement. Indian J Anaesth. 2011;55(4):352–357.
9. Bajwa SJ, Kaur J, Singh A, Parmar SS, Singh G, Kulshrestha A, Gupta S. Attenuation of pressor response and dose sparing of opioids and anaesthetics with pre-operative Dexmedetomidine. Indian J Anaesth. 2012;56(2):123–128.

10. Singh SP, Singh J, Singh AP, Singh D. Comparison of Dexmedetomidine and Fentanyl for attenuation of the hemodynamic response to laryngoscopy and intubation: A randomized double-blind study. J Clin Anesth. 2014;26(3):191–197.