

ORIGINAL ARTICLE

Comparison of the efficacy of intravenous lignocaine and intravenous dexmedetomidine in attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation.

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ABSTRACT... Objective: To compare the efficacy of intravenous lignocaine and dexmedetomidine in attenuating the hemodynamic stress response to laryngoscopy and endotracheal intubation. **Study Design:** Randomized Controlled Trial. **Setting:** Department of Anaesthesia, Fauji Foundation Hospital, Rawalpindi. **Period:** Jul-2025 to Sep-2025. **Methods:** A total of 170 patients aged 18 years or above, belonging to ASA I or II and planned for elective surgeries under general anesthesia were randomized into two groups of 85 patients each. In Group L, patients received IV lignocaine (1.5 mg/kg, 3 minutes before intubation) while patients in Group D received IV dexmedetomidine (1 µg/kg infused over 10 minutes before induction). Hemodynamic parameters (systolic and diastolic blood pressure, and HR) were recorded at baseline and at 1, 3, 5 and 10 minutes following intubation. Efficacy was defined as maintaining the hemodynamic parameters within 20% of baseline values while the primary outcome was set as the peak change in these hemodynamic parameters within the first 5 minutes. **Results:** Mean age of patients was 47.25±8.15 years. Male patients were 57.06% while female patients 42.94% of total study population. The results of primary outcomes showed that the peak change in systolic and diastolic blood pressure and heart rate were significantly lower in Group D compared to the Group L ($p < 0.0001$ for all parameters). Efficacy was achieved in 82.4% of patients in Group D versus 65.9% in Group L ($p = 0.01$). **Conclusion:** Dexmedetomidine is more effective than lignocaine in attenuating the hemodynamic stress response to laryngoscopy and intubation.

Key words: Blood Pressure, Dexmedetomidine, Intubation, Laryngoscopy, Lignocaine.

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INTRODUCTION

Laryngoscopy and endotracheal intubation are the fundamental techniques for airway management during induction of general anesthesia. While these techniques are essential to secure the airway and ensure adequate ventilation, they provoke significant physiological stress and sympathoadrenal responses. The catecholamine release during the process may result in hypertension, tachycardia, arrhythmias, and increased myocardial oxygen demand. These responses are transient and usually well tolerated in healthy individuals; they can however, cause a serious risk to patients with pre-existing cardiovascular (CV) comorbidities. Preventing these surges in blood pressure (BP) and heart rate (HR) is essential for ensuring intraoperative hemodynamic stability and reducing the associated risks of myocardial ischemia, cerebrovascular

events, pulmonary edema, or life-threatening arrhythmias.^{1,2} This hemodynamic stress response is typically transient and lasts for 5-10 minutes. However, its magnitude may be affected by multiple variables including the duration of laryngoscopy, CV status of patients and the depth of anesthesia.^{3,4}

A wide range of pharmacological agents have been investigated to address this hemodynamic response including opioids, β blockers, calcium antagonists, vasodilators, and local anesthetic agents. Recent investigations have particularly mentioned, intravenous (IV) lignocaine and IV dexmedetomidine (DEX) for this purpose due to their unique mechanisms of action and favorable safety profiles.⁵ Lignocaine (an amide-type local anesthetic with antiarrhythmic properties), has long been employed to mitigate the CV stress

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reaction produced by laryngoscopy and intubation. When administered IV, lignocaine is found to reduce sympathetic outflow, depress myocardial contractility, and induce peripheral vasodilation. These mechanisms collectively help to blunt the elevations in HR and BP. These effects are however, dose-dependent, relatively short-lived, and may vary in consistency across patient population.⁶ DEX being a highly selective alpha-2 adrenergic receptor agonist, offer a novel approach to perioperative hemodynamic stability. The central sympatholytic action of the drug reduces sympathetic outflow, while peripheral inhibition of norepinephrine release helps to attenuate stress-induced tachycardia and hypertension. Besides stabilizing the CV responses, DEX also provides sedation, anxiolysis, and analgesia. Additionally, DEX does not cause significant respiratory depression, and offers opioid-sparing effects, which makes it an attractive and increasingly utilized adjuvant in anesthetic practices.⁷

Studies have demonstrated the beneficial effects of both IV lignocaine and DEX in reducing this stress response during laryngoscopy and induction of intubation.^{8,9} Some studies comparing these two approaches have shown superior control of both systolic and diastolic BP as well as HR compared with DEX compared to lignocaine but the others have shared contrasting data.^{10,11} Further data are therefore needed to establish the comparative effectiveness and tolerability of these agents for optimizing patient care, particularly in high-risk populations.

This study was planned to compare the efficacy of IV lignocaine and IV DEX in reducing the hemodynamic stress response during laryngoscopy and intubation in our local population. These findings will be helpful in guiding anesthesiologists working in our local health care institutions for selecting more effective and safe agent in patients undergoing this procedure.

METHODS

This randomized controlled trial was conducted in the Department of Anaesthesia, Fauji Foundation Hospital, Rawalpindi, from Jul-2025 to Sep-2025 over a period of three months after getting ethical committee approval (872/RC/FFH/RWP-19-9-24).

Sample size was calculated using the WHO calculator taking a significance level of 5% (two sided) and power of 80%. Based expected efficacy of 74% in IV lignocaine group and 90.4% in IV DEX group, the estimated sample size was determined to be 170 with 85 patients in each group.¹¹

A total of 170 patients (aged ≥ 18 years, having ASA physical status Grade I or II, and with Mallampati classification I or II) scheduled for elective surgeries and requiring general anesthesia with laryngoscopy and endotracheal intubation were included in this study through consecutive sampling. Patients were then divided into two equal groups of 85 patients each, Group L (Lignocaine group) and Group D (DEX group), through computer generated sheet. Exclusion criteria was set as patients with anticipated difficult airway requiring awake intubation, any pre-existing severe bradycardia (< 60 bpm) or higher-degree atrioventricular (AV) block. Patients with any decompensated cardiac failure, severe hepatic dysfunction, and chronic therapy with clonidine or DEX were also excluded from the study.

Written consent was taken from patient/guardian prior to inclusion in the study.

All the demographics (age and gender) and baseline clinical characteristics (BMI, ASA class, and Mallampati class) were taken and recorded for each study participant.

Standard monitoring was established for each patient upon their arrival in the operation theater including their pulse rate, BP, respiratory rate (RR), and oxygen saturation. A preload of 500ml of lactated Ringer's solution was administered to each patient.

Patients then received standardized premedication which consisted of IV intravenous dexamethasone (0.08 mg/kg), nalbuphine (0.1 mg/kg), and midazolam (0.02 mg/kg) prior to preoxygenation.

Patients in the Group L received 100ml of 0.9% normal saline as premedication, ten minutes later intravenous (IV) lignocaine was administered (1.5 mg/kg, three minutes prior to laryngoscopy). Similarly, patients in Group D received DEX which

was completed 10 minutes before the induction (1 mcg/kg dissolved in 100ml of 0.9% normal saline administered IV over 10 minutes).

For both groups, propofol was used for anesthetic induction. Muscle relaxation was obtained using atracurium (0.5 mg/kg) which was administered three minutes before laryngoscopy. A Macintosh laryngoscope was used to induce laryngoscopy and orotracheal intubation.

Anesthesia was maintained with inhalational agents while intermittent doses of atracurium were used as per requirement.

Hemodynamic parameters were recorded for each patient, including systolic BP, diastolic BP and heart rate (HR). These recordings were noted at baseline, immediately after completing induction, and then at 1, 3, 5 and 10 minutes after intubation.

The efficacy of the drugs was defined as the ability to attenuate the hemodynamic stress response, assessed by maintaining of systolic and diastolic BP, and HR within 20% of their baseline values during the first 10 minutes after the laryngoscopy and intubation. The primary outcome was set as the peak change in systolic BP, diastolic BP, and HR within the first 10 minutes following intubation, and the proportion of patients in whom the rise remained $\leq 20\%$ of baseline values within this duration. The secondary outcomes were the incidence of hypotension (MAP < 65 mmHg or need for vasopressors), bradycardia (HR < 60 bpm or requirement of atropine), arrhythmias, or need for these mentioned rescue medications.

Data were analyzed using SPSS version 26. Descriptive statistics were employed where frequencies and percentages were used to express qualitative variables (gender, residential status, ASA class, Mallampati class, and efficacy) while mean $\pm$ standard deviation were used to present the quantitative variables (age and BMI). For primary outcomes, independent t-test was applied to compare mean peak change in systolic and diastolic BP, and HR between the two groups (in case of non-normal distribution assessed by using Shapiro-Wilk

test, the Mann–Whitney U test was used). For the categorical variables (efficacy outcome in shape of proportion of patients with $\leq 20\%$ rise in SBP, DBP, and HR), Chi-square or Fisher's exact test was applied.

For secondary categorical outcomes (hypotension, bradycardia, arrhythmias, rescue medication) Chi-square or Fisher's exact test were applied as appropriate. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Mean age of patients in this study was 47.25 ± 8.15 years (ranged from 32 to 62 years). The number of males was 97 (57.06%) while females were 73 (42.94%) in overall study population. Group wise details of demographics and baseline clinical profiles are shown in Table-I.

TABLE-I

Demographics and clinical characteristics n= 170

Demographics and Clinical Characteristics		Group L (n=85)	Group D (n=85)
Age (Mean $\pm$ SD) years		46.48 $\pm$ 8.47	48.01 $\pm$ 7.79
Gender	Male n (%)	47 (55.29)	38 (58.82)
	Female n (%)	50 (58.82)	35 (41.18)
BMI (Mean $\pm$ SD) Kg/m ²		25.82 $\pm$ 2.97	26.24 $\pm$ 2.52
ASA Class	I n (%)	56 (65.88)	54 (63.53)
	II n (%)	29 (34.12)	31 (36.47)
Mallampati Class	I n (%)	52 (61.2)	55 (64.7)
	II n (%)	33 (38.8)	30 (35.3)

The results of primary outcomes of the study showed that the change in hemodynamic parameters within the first 10 minutes after intubation, including systolic BP, diastolic BP, HR were significantly lower in Group D in comparison to Group L. Similarly, efficacy was achieved in significantly more number of patients in Group D as shown in Table-II.

The results of secondary outcomes show that bradycardia was significantly more frequent ($p=0.03$) in Group D, while no statistically significant difference was present between the groups for hypotension, arrhythmia and need for rescue medications. Details of observed events are shared in Table-III.

TABLE-II

Peak hemodynamic changes after intubation within first 10 minutes n= 170

Primary Outcomes	Group L (n=85)	Group D (n=85)	P-Value
Δ Systolic BP (mean ± SD) mmHg	16.44±3.94	9.6±3.56	<0.0001
Δ Diastolic BP (mean ± SD) mmHg	8.67±1.24	7.18±1.36	<0.0001
Δ HR (mean ± SD) beats / min	11.07±2.47	8.57±2.2	<0.0001
Patients achieving efficacy n (%)	56 (65.88)	70 (82.35)	0.01

TABLE-III

Secondary Outcomes including hemodynamic events and complications n = 170

Secondary Outcome	Group L (n=85)	Group D (n=85)	P-Value
Hypotension n (%)	5 (5.88)	7 (8.24)	0.55
Bradycardia n (%)	2 (2.4)	9 (10.59)	0.03
Arrhythmia n (%)	3 (3.5)	2 (2.4)	0.65
Need for rescue medication n (%)	4 (4.7)	6 (7.1)	0.52

DISCUSSION

Mean age of patients in our study was 47.25±8.15 years with higher proportion of male patients 97 (57.06%) than the female patients 73 (42.94%) in overall study population. The results of primary outcomes showed that the peak change in systolic and diastolic BP and HR were significantly lower in Group D in comparison to Group L ($p<0.0001$ for all parameters). Efficacy was achieved in 82.4% of patients in Group D versus 65.9% in Group L ($p=0.01$). The results of secondary outcomes show that bradycardia was significantly more frequent ($p=0.03$) in Group D, while hypotension, arrhythmia and need for rescue medications were not significantly different between the groups. These findings are consistent with studies conducted previously on this topic and mentioned the superior efficacy of DEX over lignocaine in attenuating the hemodynamic stress response. Most of these studies also highlighted the tendency of DEX to cause bradycardia as a considerable adverse effect to be monitored.

Seangrung R et al. compared the change in mean

Systolic BP, diastolic BP, MAP and HR from baseline in DEX group and lignocaine plus propofol group and found that the lignocaine- propofol group was largely non-inferior for BP control; however, Group D consistently demonstrated a lower HR. Notably, Group D, experienced significantly higher incidences of bradycardia (18.87% vs. 0%, $p = 0.001$). The incidence of hypotension was also higher in Group D compared to lignocaine-propofol group (52.83% vs. 15.09%, $P < 0.001$).¹² Supporting these findings, Parvin S et al. further reinforced the efficacy of DEX by comparing IV DEX (1µg/kg) to lignocaine (1.5mg/kg) for hemodynamic stability after intubation. DEX was significantly more effective, resulting in lower HR (72.58 vs 84.28 bpm) and SBP (104.70 vs 120.16 mmHg) in post intubation phase ($p<0.001$). The drug also provided superior CV stability without severe adverse events and proved to be a safer, more reliable choice for attenuating the hemodynamic stress response.¹³

In a different approach, Priyaranjan et al. compared adding DEX versus adrenaline+ lignocaine. Results showed that DEX combination had a significantly faster onset and longer duration of action ($P < 0.05$) with no major hemodynamic changes indicating the potential safety profile of DEX in these procedures.¹⁴

Research has also focused on different doses to find an optimal dose of DEX that attenuates a better hemodynamic response. A study by Ye Q et al. determined that 0.6µg/kg of DEX optimally maintains hemodynamic stability, producing significantly smaller BP and HR fluctuations.¹⁵ Another study conducted in Pakistan with the same aim, compared 0.5 µg/kg and 1.0 µg/kg DEX infusions in 60 surgical patients to attenuate intubation-induced hemodynamic responses. DEX 1.0 µg/kg showed significantly lower MAP at 3 minutes (82.46±6.46 vs. 85.83±5.80 mmHg, $p=0.03$) and reduced HR at 3 minutes (81.33±6.03 vs.

85.16±6.25 bpm, $p=0.01$), confirming it as an optimal dose compared to 0.5 µg/kg in our population.¹⁶

Superior efficacy of DEX has been consistently replicated across different populations and demographics. Singh G et al. reported greater HR reduction (9.28% vs 13.40%) and MAP decrease

(5.49% vs 10.72%) with DEX compared to lignocaine in Indian population.¹⁷

Studies from Pakistan have also yielded comparable results. In a study conducted in Pakistan, comparison of lignocaine and DEX was made in attenuating CV stress during intubation. DEX demonstrated superior effectiveness compared to lignocaine in these cases (90% vs 74% respectively, $p=0.009$).¹¹ Further supporting evidence from the Pakistani population was shared by S Tariq et al. at CMH Rawalpindi, where lignocaine (1.5 mg/kg) was compared with DEX (1 µg/kg) for attenuating the intubation-induced stress. DEX proved to be more effective and showed significantly lower rise in HR (14.14% vs 37.66%) and increase in mean arterial pressure (1.07% vs 22.6%) than the comparative drug.¹⁸

However, some studies have shared superior efficacy of lignocaine, contrary to these findings. Kavaklı AS and Kitapçioğlu D demonstrated that both lignocaine and DEX provided similar insertion success and conditions, however, lignocaine caused significantly less BP and HR changes than DEX. These results indicate the need for future studies on this research topic.¹⁰

The results of our study and the study discussed above predominantly support the efficacy of DEX over lignocaine in attenuating hemodynamic responses during intubation, despite some conflicting results. In short, DEX demonstrates better CV stability and stress response attenuation following laryngoscopy and intubation techniques.

The study was a single-center study which limits its generalizability as a national scale data. Moreover, long-term outcome assessment was not planned, that may have yielded useful information.

CONCLUSION

DEX is more effective than lignocaine in attenuating the hemodynamic stress response to laryngoscopy and endotracheal intubation in shape of providing better BP control and HR. The study therefore establishes DEX as a preferred option in patients where blunting of CV responses is clinically important. However, the drug is found to be associated with

an increased incidence of bradycardia, requiring careful monitoring during the first 10 minutes after intubation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Manahil Asghar Khan: Conceptualization, methodology, investigation, formal analysis, writing.
2	Manzoor Ahmed Faridi: Data curation, data analysis.
3	Zia un Nisa: Methodology, drafting.
4	Asma Sarwar: Critical revisions.
5	Muiza Faridi: Data entry.
6	Maryam Sajid: Proof reading.