Section: Anaesthesiology

Original Research Article

A RANDOMIZED CONTROLLED STUDY COMPARED BETWEEN TWO DOSES OF INTRAVENOUS DEXMEDETOMIDINE (0.6 µg/kg and 1 µg/kg) FOR ATTENUATION OF THE HEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND INTUBATION

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Abstract

Background: Tachycardia and hypertension are common hemodynamic responses elicited by laryngoscopy and intubation, both of which are critical anesthetic procedures. These effects are particularly concerning in persons with underlying cardiovascular problems. Dexmedetomidine, an alpha-2 adrenergic agonist, has been found to reduce these responses. This study compares two dosages of intravenous dexmedetomidine (0.6 µg/kg and 1 µg/kg) to their effectiveness in lowering hemodynamic responses during laryngoscopy and intubation. **Materials and Methods:** A randomized controlled trial was conducted with 100 patients undergoing elective surgeries under general anesthesia. Patients were randomly assigned to receive either 0.6 µg/kg or 1 µg/kg of intravenous dexmedetomidine. Heart rate (HR), mean arterial pressure (MAP), diastolic blood pressure (DBP), systolic blood pressure (SBP), and pre-intubation blood pressure (DBP) were all measured. These measurements were also taken right after intubation, at 1, 3, 5, and 10 minutes following intubation. **Results:** Both doses of dexmedetomidine significantly attenuated the hemodynamic response to laryngoscopy and intubation. However, the 1 µg/kg group showed a more pronounced reduction in HR and BP compared to the 0.6 µg/kg group. The incidence of bradycardia and hypotension was higher in the 1 µg/kg group, but these effects were manageable. **Conclusion:** Dexmedetomidine at both doses effectively reduces hemodynamic responses to laryngoscopy and intubation. The 1 µg/kg dose offers greater attenuation but with a higher risk of bradycardia and hypotension. Clinical discretion is advised in dose selection based on patient-specific factors.

INTRODUCTION

Laryngoscopy and endotracheal intubation are integral procedures in airway management during general anesthesia.[1] However, these procedures are associated with reflex sympathetic activation, leading to significant hemodynamic changes such as tachycardia, hypertension, and increased myocardial oxygen demand.[2] These changes, while often transient, can pose risks in patients with cardiovascular, cerebrovascular, or respiratory conditions, leading to complications like myocardial ischemia, arrhythmias, and stroke.[3]

Attenuating these hemodynamic responses is critical, especially in high-risk populations. Various pharmacological agents have been employed to blunt these responses, including opioids, beta-blockers, calcium channel blockers, and vasodilators, with varying degrees of success. Dexmedetomidine, a highly selective alpha-2 adrenergic agonist, has emerged as a promising agent for controlling these responses due to its

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sympatholytic, sedative, and analgesic properties.[4-5]

Previous studies have demonstrated the efficacy of dexmedetomidine in reducing the hemodynamic stress response to laryngoscopy and intubation. However, there is limited consensus on the optimal dosing strategy.[6] While some studies suggest that lower doses (0.6 µg/kg) are effective with minimal side effects, others advocate for higher doses (1 µg/kg) for more profound attenuation of hemodynamic responses, albeit with a higher incidence of adverse effects such as bradycardia and hypotension.[7-8]

This study aims to compare the efficacy and safety of two doses of intravenous dexmedetomidine (0.6 µg/kg and 1 µg/kg) in attenuating the hemodynamic response to laryngoscopy and intubation in patients undergoing elective surgery under general anesthesia.

MATERIALS AND METHODS

Study Design

Over the course of six months, Gandhi Medical College and Hospital in Secunderabad, Telangana, hosted this prospective, randomized controlled trial. The Institutional Ethics Committee authorized the study procedure, and each participant provided signed informed consent.

Participants

One hundred patients, ASA I and II, between the ages of eighteen and sixty-five, who were having elective operations that required general anesthesia were enrolled. Patients with a history of cardiovascular disease, diabetes mellitus, chronic hypertension, or those on beta-blockers or other antihypertensive drugs were among the exclusion criteria.

Randomization and Intervention

Patients were randomly allocated into two groups of 50 each:

- **Group D-0.6**: Received intravenous dexmedetomidine 0.6 µg/kg over 10 minutes before induction of anesthesia.
- **Group D-1**: Received intravenous dexmedetomidine 1 µg/kg over 10 minutes before induction of anesthesia.

Standard monitoring was applied, including ECG, non-invasive blood pressure, and pulse oximetry. Anesthesia was induced with intravenous propofol (2 mg/kg) and vecuronium (0.1 mg/kg) to facilitate laryngoscopy and intubation. Maintenance of anesthesia was achieved with isoflurane in a 50% nitrous oxide-oxygen mixture.

Hemodynamic Monitoring

At the following intervals, measurements of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were made:

- Baseline (before administration of dexmedetomidine)
- Immediately before laryngoscopy and intubation
- Immediately after intubation
- 1, 3, 5, and 10 minutes post-intubation

Statistical Analysis

Data were analyzed using SPSS version 20. Continuous variables were expressed as mean ± standard deviation (SD), and comparisons between groups were made using the unpaired t-test. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Characteristics of the Study Population

Variable	Group D-0.6 (n=50)	Group D-1 (n=50)	p-value
Age (years)	35.2 ± 8.1	34.8 ± 7.9	0.78
Weight (kg)	65.5 ± 12.3	64.8 ± 11.9	0.65
Gender (M/F)	28/22	27/23	0.88

Table 2: Haemodynamic Changes - Heart Rate (HR)

Time Point	Group D-0.6 (bpm)	Group D-1 (bpm)	p-value
Baseline	76.3 ± 8.2	75.9 ± 7.8	0.80
Pre-intubation	68.2 ± 6.4	60.4 ± 5.9	<0.001
Post-intubation	84.1 ± 9.7	75.8 ± 7.5	<0.001
1 minute	82.5 ± 8.9	74.2 ± 7.1	<0.001
3 minutes	78.3 ± 8.1	70.1 ± 6.3	<0.001
5 minutes	74.9 ± 7.8	68.2 ± 6.7	<0.001
10 minutes	72.5 ± 6.9	67.1 ± 6.3	0.003

Table 3: Haemodynamic Changes - Systolic Blood Pressure (SBP)

Time Point	Group D-0.6 (mmHg)	Group D-1 (mmHg)	p-value
Baseline	126.5 ± 12.3	125.2 ± 11.9	0.65
Pre-intubation	114.2 ± 10.4	102.8 ± 9.1	<0.001
Post-intubation	139.1 ± 11.7	124.8 ± 10.2	<0.001
1 minute	136.5 ± 10.9	121.2 ± 9.3	<0.001
3 minutes	132.3 ± 11.2	118.1 ± 8.8	<0.001
5 minutes	128.9 ± 10.7	115.5 ± 8.9	<0.001
10 minutes	126.5 ± 9.8	113.1 ± 8.3	<0.001

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Table 4: Haemodynamic Changes - Diastolic Blood Pressure (DBP)

Time Point	Group D-0.6 (mmHg)	Group D-1 (mmHg)	p-value
Baseline	76.5 ± 8.3	75.9 ± 7.6	0.78
Pre-intubation	68.4 ± 6.9	62.8 ± 5.9	<0.001
Post-intubation	84.5 ± 8.5	74.8 ± 7.3	<0.001
1 minute	82.9 ± 7.9	71.2 ± 6.8	<0.001
3 minutes	78.7 ± 7.6	69.8 ± 6.5	<0.001
5 minutes	74.9 ± 7.5	67.5 ± 6.2	<0.001
10 minutes	72.5 ± 7.2	66.2 ± 5.9	<0.001

Table 5: Haemodynamic Changes - Mean Arterial Pressure (MAP)

Time Point	Group D-0.6 (mmHg)	Group D-1 (mmHg)	p-value
Baseline	92.3 ± 9.2	91.8 ± 8.7	0.65
Pre-intubation	82.4 ± 7.4	75.2 ± 6.3	<0.001
Post-intubation	96.7 ± 9.1	85.4 ± 7.8	<0.001
1 minute	94.3 ± 8.7	82.8 ± 7.2	<0.001
3 minutes	90.7 ± 8.5	79.8 ± 6.9	<0.001
5 minutes	87.5 ± 8.1	77.5 ± 6.7	<0.001
10 minutes	85.3 ± 7.9	75.1 ± 6.5	<0.001

Table 6: Incidence of Bradycardia and Hypotension

Adverse Event	Group D-0.6 (%)	Group D-1 (%)	p-value
Bradycardia	5 (10%)	15 (30%)	0.02
Hypotension	4 (8%)	12 (24%)	0.01

Table 7: Sedation Scores Between Two Groups

Sedation Score	Group D-0.6	Group D-1	p-value
1 (Awake)	10 (20%)	5 (10%)	0.03
2 (Sedated)	30 (60%)	20 (40%)	0.04
3 (Deep Sedation)	10 (20%)	25 (50%)	<0.001

Table 8: Recovery Times Between Two Groups

Recovery Time (min)	Group D-0.6	Group D-1	p-value
Time to Eye-Opening	12.5 ± 2.3	15.2 ± 2.8	0.01
Time to Extubation	15.1 ± 2.5	18.4 ± 2.9	0.03

DISCUSSION

The results of this study demonstrate that dexmedetomidine effectively attenuates the hemodynamic response to laryngoscopy and intubation at both 0.6 µg/kg and 1 µg/kg doses.[9-10] The reduction in heart rate and blood pressure was more pronounced in the 1 µg/kg group, indicating that a higher dose provides superior control of hemodynamic variables during these procedures.[11-12] However, the increased incidence of bradycardia and hypotension in the 1 µg/kg group suggests that caution should be exercised when administering higher doses, particularly in patients with pre-existing cardiovascular conditions.[13]

Sedation levels were significantly higher in the 1 µg/kg group, with more patients experiencing deep sedation, which could be advantageous in some clinical settings but may prolong recovery time. Clinicians must balance the need for hemodynamic stability with the potential for delayed recovery and adverse events when selecting the appropriate dexmedetomidine dose.[14-15]

CONCLUSION

Intravenous dexmedetomidine at both 0.6 µg/kg and 1 µg/kg effectively attenuates the hemodynamic response to laryngoscopy and intubation. The 1 µg/kg dose provides greater suppression of heart rate and blood pressure but is associated with a higher incidence of bradycardia, hypotension, and delayed recovery. The choice of dose should be individualized based on patient characteristics and surgical requirements.

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