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RESEARCH ARTICLE

Attenuation of hemodynamic response to laryngoscopy and tracheal intubation in adult patients with a single intravenous bolus dose of dexmedetomidine – A prospective, randomized, double-blind, controlled clinical study

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ABSTRACT

Background: Performing laryngoscopy and endotracheal intubation evokes a reflex circulatory response, which results in an increase in the blood pressure and heart rate (HR) and causes arrhythmia due to increased outflow from the sympathoadrenal axis. **Aim and Objective:** The aim of this study was to evaluate the efficacy of a single bolus dose of 0.6 mg/kg body weight dexmedetomidine, a centrally acting α-2 agonist, through intravenous route, in attenuating the hemodynamic responses to laryngoscopy and endotracheal intubation. **Materials and Methods:** It was a randomized, prospective, two fold-blinded, and placebo-controlled clinical study. After obtaining Ethical Committee clearance, 100 adult patients in the age group of 18–50 years were enrolled. Blood pressure of the patients enrolled was within the normal range and they were posted for various elective surgeries. Categorization was performed with the American Society of Anaesthesiologists and Mallampatti as Class I and II Grade I and II, respectively. The patients were randomly distributed into two groups, Group A and Group B. Group A included 50 patients ($n = 50$) and was treated with 1 ml/kg of normal saline intravenously for about 10 min and 10 min before the induction. Group B included 50 patients ($n = 50$) and was treated with dexmedetomidine 1 ml/kg (0.6 μg/kg body weight), which was further diluted in 100 ml ordinary saline and given intravenously, for about 10 min and 10 min before the induction. After premedication, anesthesia was induced with injection thiopentone 5 mg/kg body weight and was given until the loss of eyelash reflex. Dose of thiopentone required was noted. It was followed by injection succinylcholine 1.5 mg/kg body weight. HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were the various parameters for analysis and recorded at regular time intervals. **Results:** Initiation of laryngoscopy and intubation resulted in significant rise in the HR (36.14 bpm), SBP (29.22 mmHg), DBP (20.30 mmHg), and MAP (14.46 mmHg) in patients who were grouped under Group A. In Group B (dexmedetomidine), mean of HR, SBP, DBP, and MAP decreased by 2.86 bpm, 17.66 mmHg, 1.54 mmHg, and 4.98 mmHg, respectively, when compared to basal values which is statistically highly significant ($P < 0.0001$). **Conclusion:** Dexmedetomidine, at the dose of 0.6 μg/kg body weight when given intravenously 10 min before induction was noted to efficiently reduce the hemodynamic response to laryngoscopy and tracheal intubation.

KEY WORDS: Laryngoscopy and Tracheal Intubation; Hemodynamic Response; Intravenous Dexmedetomidine

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INTRODUCTION

Laryngoscopy and tracheal intubation is a noxious stimulus which evokes a reflex circulatory response. Increased outflow from the sympathoadrenal axis will result in catecholamine hyperactivity leading to high blood pressure and tachycardia and might result in arrhythmia. The springing up in heart rate (HR) and blood pressure is usually momentary, uncertain and will last for <5–10 min. These short-lived episodes will not produce any consequences in healthy individuals, but it is harmful for patients with cardiovascular and cerebrovascular diseases.[1-4]

Sympathetic hyperactivity to intubation gets overelaborated in hypertensive patients, even when they are rendered normotensives by antihypertensive medication.[5-7] Anesthetic agents used for induction do not effectively suppress the pressor responses by laryngoscopy and endotracheal intubation.[8-10]

To prevent the pressor response to laryngoscopy, many drugs such as inhalational anesthetics,[11] topical and intravenous (IV) lignocaine,[12-14] and opioid analgesics;[15-19] calcium channel blockers such as nifedipine, verapamil,[20-22] beta-blockers,[16] and arterial; and vasodilators such as sodium nitroprusside and nitroglycerine[14,15] have been evaluated by various investigators. However, none could prove themselves as an effective agent to curtail the adverse sympathetic response to laryngoscopy and intubation.

Alpha-2 adrenergic agonists are evaluated for curtailing sympathetic response.[17,18] Clonidine and dexmedetomidine act on both α-1 and α-2 adrenergic receptors. Dexmedetomidine has a more pronounced effect on α-2 adrenoceptor.[19,20] Hence, in this study, dexmedetomidine as a single IV bolus dose of 0.6 μg/kg body weight was evaluated as a pre-anesthetic medication for attenuating sympathetic response to laryngoscopy and endotracheal intubation.

MATERIALS AND METHODS

After obtaining approval from the Institutional Ethical Committee, the present study enrolled 100 patients who were posted for various elective surgeries under general anesthesia. They were categorized with the American Society of Anaesthetiologists and Mallampati as Class I-II and Grade I-II, respectively. The study was conducted in Vikram Hospital Private Limited, Mysore, during the period of June 2011–April 2012. Adult patients, both male and female in the age group of 18 and 60 years, were enrolled in the study. Those patients with other systemic diseases such as cardiac, renal, hepatic, cerebral, endocrinal, and peripheral vascular diseases were excluded from the study. Those with hypertension, bradycardia (HR <60 bpm), and systolic blood pressure (SBP) <100 mmHg were not included in the study. The presence of heart block, difficult airway, and obesity was considered as exclusion criteria.

The patients were divided into two treatment categories. In each treatment category, 50 patients were allocated. Allocation was done using the sealed envelopes which had the name of the groups. The patient was requested to pick a sealed envelope and it was opened by a senior anesthesiologist who also prepared solutions necessary for the study but was not directly involved in the study.

Group A – Control group (n = 50) – was treated with 1 ml/kg of normal saline intravenously 10 min before induction for about 10 min.

Group B – Dexmedetomidine treatment group (n = 50) – was treated with infusion of dexmedetomidine 1 ml/kg body weight (0.6 mcg/kg) (Dexem, Themis Medicare Limited, 200 μg in 2 ml ampoule) (which was prepared by including 60 mcg – 0.6 ml of dexmedetomidine to 99.4 ml common saline – 0.6 mcg/ml) intravenously. It was further diluted in 100 ml ordinary saline and was given intravenously for about 10 min and 10 min before the induction.

Pre-anesthetic Evaluation

Patients were given premedication and connected to a multiparameter monitor for noninvasive recording of HR, SBP, diastolic blood pressure (DBP), mean arterial pressure (MAP), end trial CO_2, continuous electrocardiography, and oxygen saturation. Baseline parameters were recorded. The 60 μg of dexmedetomidine (0.6 ml) was added to 99.4 ml of normal saline and brought up to 100 ml with every ml containing 0.6 μg of dexmedetomidine. According to the patient's body weight, 1 ml/kg of drug preparation (dexmedetomidine group) or 1 ml/kg of normal saline (control group) were given intravenously for about 10 min. Hemodynamic parameters were recorded before and after the infusion for 10 min. Induction was done with thiopentone 5 mg/kg body weight, which was given as 2.5% solution until the loss of eyelash reflex. Endotracheal intubation was performed with 1.5 mg/kg succinylcholine intravenously given a minute before laryngoscopy and intubation. Maintenance of anesthesia was done with inhalational anesthetics – 66% nitrous oxide and 33% of oxygen with 0.5% isoflurane. Vecuronium 0.05 mg/kg body weight was given to maintain neuromuscular blockade. During the 10 min recording time, it was ensured that no surgical or other stimulus was applied. Vecuronium was the only drug given during the 10 min recording period. Neostigmine 0.05 mg/kg body weight and atropine 0.02 mg/kg body weight were given at the end of the surgery for the reversal.

The cardiovascular parameters recorded were as follows:

- SBP (mm Hg)
- DBP (mm Hg)

- HR (bpm)
- MAP (mm Hg).

Statistical Analysis

The results were computed using GRAPHPAD PRISM InStat software package-version 5. Student's *t*-test, ANOVA, and Chi-square test were used for analysis. $P < 0.01$ was considered as statistically significant.

RESULTS

The mean basal HR in the two groups was comparable ($P = 0.837$). After 2 min of administration of the drug, between the group analyses showed that there was a significant decrease in the HR of patients in Group B and the values were statistically significant. Decrease in the HR was observed in the following recording and was statistically highly significant [Table 1].

The mean basal SBP was comparable ($P = 0.837$). Between the group analyses showed that mean SBP values recorded after 2 min of the drug administration were significantly low in the Group B when compared to Group A [Table 2].

Table 1: Intergroup mean heart rate (bpm) changes between the control group and test group

Variables	Group A	Group B	*P* value
Basal	87.36±9.96	87.36±13.58	1.000 (NS)
AD–2nd min	88.18±9.77	81.28±14.25	0.006 (HS)
AD–5th min	86.62±9.08	78.64±13.47	0.001 (HS)
AD–8th min	84.82±9.92	75.26±12.62	0.000 (HS)
Before induction (BI)	85.30±9.81	74.08±11.09	0.000 (HS)
After induction	96.24±9.76	81.26±12.08	0.000 (HS)
AI–1st min	123.6±10.46	84.50±11.41	0.000 (HS)
AI–3rd min	116.4±9.16	82.38±11.28	0.000 (HS)
AI–5th min	109.62±9.17	79.88±11.93	0.000 (HS)
AI–10th min	98.30±9.82	76.90±10.77	0.000 (HS)

AD: After the administration of drug, AI: Post-intubation. NS: Nothing significant, HS: Highly significant. Values are expressed as mean±standard deviation comparison between control v/s the test group. Statistical analysis was done by one-way ANOVA followed by ANOVA and Chi-square test. $P<0.01$ was considered highly significant, $P<0.05$ significant, and $P>0.05$ as non-significant

Table 2: Changes in the mean systolic blood pressure (mmHg) during laryngoscopy and tracheal intubation

Variables	Group A	Group B	*P* value
Basal	128.80±6.24	129.18±11.39	0.837 (NS)
AD–2nd min	128.76±6.60	129.26±12.95	0.808 (NS)
AD–5th min	127.76±5.62	116.92±11.99	0.000 (HS)
AD–8th min	127.18±5.84	111.32±11.80	0.000 (HS)
Before induction (BI)	127.90±6.86	110.02±10.03	0.000 (HS)
After induction	121.30±5.11	103.68±11.15	0.000 (HS)
AI–1st min	158.02±4.41	111.52±9.95	0.000 (HS)
AI–3rd min	149.02±8.14	105.04±11.13	0.000 (HS)
AI–5th min	138.70±8.26	103.04±12.38	0.000 (HS)
AI–10th min	128.78±6.35	101.30±11.12	0.000 (HS)

AD: After the administration of drug, AI: Post-intubation. NS: Nothing significant, HS: Highly significant. Values are expressed as mean±standard deviation comparison between control v/s the test group. Statistical analysis was done by one-way ANOVA followed by ANOVA and Chi-square test. $P<0.01$ was considered highly significant, $P<0.05$ significant, and $P>0.05$ as non-significant

DISCUSSION

The study was conducted to evaluate dexmedetomidine as a pre-anesthetic medication for attenuating the hemodynamic responses to laryngoscopy and intubation and also to know the hemodynamic response to laryngoscopy and intubation with no pre-treatment. It was conducted in Vikram Hospital Private Limited, Mysore. The study was conducted between June 2011 and April 2012. The study showed the following observations.

Changes in HR

After the administration of dexmedetomidine, HR decreased consistently at 2, 5, 8, and 10 min in Group B in contrast with Group A.

Induction of anesthesia resulted in momentous fall in HR in Group B, i.e., dexmedetomidine group which was not observed in the control group.

Dexmedetomidine group showed a statistically significant decrease in the HR until the 10th min after induction, whereas the control group showed an increase in the HR.

Changes in SBP

After the administration of dexmedetomidine, a significant change in SBP was not observed until 5th min, after which gradual decrease was noted. The attenuation of SBP following administration of dexmedetomidine was statistically significant, whereas in the control group significant decrease in the blood pressure was not observed. Same trend was observed after induction. Statistically significant fall in SBP was observed after 1, 3, 5, and 10 min of induction.

CONCLUSION

Dexmedetomidine, when administered at a dose of 0.6 µg/kg body weight before induction, significantly reduced the hemodynamic responses to laryngoscopy and tracheal intubation.

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