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Original Article

Comparative Evaluation of Intravenous Dexmedetomidine and Sublingual Nitroglycerin Spray to Attenuate Hemodynamic Response to Laryngoscopy and Intubation

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Abstract

Introduction: Laryngoscopy and intubation produce hemodynamic response due to increase in sympathetic and sympathoadrenal activity which manifest as increase in blood pressure and heart rate (HR).

Objective: This study was conducted to compare the effectiveness of intravenous (i.v) dexmedetomidine and sublingual nitroglycerin spray in attenuating the pressor response associated with laryngoscopy and intubation.

Materials and Methods: The study was carried out on 90 patients belonging to American Society of Anesthesiologists Grade I and II, aged 18–60 years, including either gender, scheduled for elective surgical procedure under general anesthesia.

Results: Systolic blood pressure, diastolic blood pressure, mean arterial pressure, and HR rise in all three groups. However, this rise was significantly less in dexmedetomidine group as compared to control and nitroglycerin group.

Conclusion: Dexmedetomidine (0.5 mcg/kg body weight i.v) is more effective for attenuation of hemodynamic response to laryngoscopy and intubation without undesired side effects and complications as compared to nitroglycerin spray.

Key words: Dexmedetomidine, Sublingual Nitroglycerin, Hemodynamic

INTRODUCTION

Laryngoscopy and intubation produce transient but marked sympathetic and sympathoadrenal response which manifest as increase in blood pressure and heart rate (HR).[1-5] These can be tolerable in healthy patients, but in patients with cardiovascular compromise such as hypertension, ischemic heart disease, and cerebrovascular disease and in patients with intracranial aneurysms, even these transient changes in hemodynamic can result in potentially harmful effects such as left ventricular failure, pulmonary edema, myocardial ischemia, ventricular dysrhythmias, and cerebral hemorrhage. Therefore, various drugs such as lidocaine spray, intravenous (i.v.) fentanyl, i.v. magnesium sulfate, sublingual nifedipine, i.v. esmolol, and i.v. clonidine[6-8] and procedures such as airway blocks (bilateral superior laryngeal nerve block and transtracheal recurrent laryngeal nerve block) have been tried to blunt this response, but none was found effective in completely attenuating this pressor response.

Dexmedetomidine is a potent and highly selective α-2 adrenoceptor agonist with sympatholytic, sedative, amnestic, and analgesic properties. It produces hyperpolarization of noradrenergic neurons and suppression of neuronal firing in the locus coeruleus leads to decreased systemic noradrenaline release results in attenuation of sympathoadrenal responses and hemodynamic stability during laryngoscopy and tracheal intubation.

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Nitroglycerin is a nitrate and exerts its effect by being converted to nitric oxide in the body by mitochondrial aldehyde dehydrogenase. Nitric oxide is a potent vasodilator. Nitroglycerin produces dose-dependent relaxation of vascular smooth muscle. Therapeutic doses reduce systolic, diastolic, and mean arterial blood pressure (MAP), and in response to these effects, reflex tachycardia occurs.

Therefore, in search of a better agent, we compared dexmedetomidine, a newer alpha-2 agonist, 0.5 mcg/kg body weight with sublingual nitroglycerin spray 800 mcg for the attenuation hemodynamic response during laryngoscopy and intubation.

MATERIALS AND METHODS

The present study was carried out in the Department of Anaesthesiology, S.S. Medical College and associated S.G.M. and G.M. Hospitals, Rewa (M.P.) during July 2015–June 2016. After approval from the Institutional Ethical Committee, the study was conducted on 90 patients aged 18–60 years with American Society of Anesthesiologists Class I and II posted for elective surgery under general anesthesia. Patients with Mallampatti Grade III-IV, known hypersensitivity to dexmedetomidine or nitroglycerin, patients on antihypertensive drugs and cardiac disease, and patients having raised intracranial pressure were excluded from the study. The written and informed consent was obtained from the patients.

The patients fulfilling the selection criteria were randomly divided into three groups of 30 patients each depending on the drug given. Ninety patients were randomly divided into three groups of thirty patients each depending on the study drug given.

Group D: Received i.v. dexmedetomidine 0.5 mcg/kg diluted in 100 ml normal saline infused slowly over 10 min and 5 min before induction.

Group N: Received nitroglycerin 800 mcg sublingual spray 2 min before induction.

Group C: Received 100 ml normal saline i.v. 5 min before induction.

All patients were kept nil orally for at least 6 h before surgery. After shifting the patients to operation table, non-invasive blood pressure, electrocardiogram, and pulse oximeter were attached, and the parameters were recorded.

All the patients were uniformly premedicated with i.v. ondansetron 0.08 mg/kg and injection glycopyrrolate 0.04 mg/kg, 15 min before administration of the study drug.

The study drug was given as i.v. dexmedetomidine 0.5 mcg/kg diluted in 100 ml normal saline infused slowly over 10 min and 5 min before induction or nitroglycerin spray 800 mcg sublingually 2 min before induction.

Pre-oxygenation was done with 100% oxygen for 3 min. All patients were induced with injection propofol 2.5 mg/kg body weight, and muscle relaxation was facilitated with injection succinylcholine 1.5 mg/kg body weight. Laryngoscopy and intubation were performed 60 s after the administration of succinylcholine. The patients in which intubation cannot be performed within 20 s were excluded from the study. Anesthesia was maintained with 40% oxygen, 60% nitrous oxide, 1% sevoflurane, and intermittent doses of injection atracurium.

HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), and MAP were recorded just before induction, before intubation, and after intubation at 1, 3, 5, 7, 15, and 30 min.

More than 20% fall in MAP below baseline was considered as hypotension and was treated by decreasing sevoflurane and injection mephentermine 6 mg intravenously. More than 30% rise in MAP above baseline was considered hypertension. HR <60 bpm was considered bradycardia and HR <50 bpm was treated with injection atropine 0.6 mg intravenously. HR >100 bpm was considered tachycardia.

After completion of surgery, patients were reversed with injection glycopyrrolate 0.01 mg/kg and injection neostigmine 0.05 mg/kg and were extubated.

At the end of the study, the observations were tabulated and statistically analyzed using mean, standard deviation, *P* value, and student *t*-test. For comparison, $P \leq 0.05$ was taken to be statistically significant and <0.0001 was taken to be highly significant.

RESULTS

A total of 108 patients were assessed for eligibility, of which 15 refused and 3 did not meet the inclusion criteria. All the patients in three groups were comparable to each other with respect to age, weight, and sex [Table 1].

Baseline HR was comparable in all three groups. After giving study drug, there was a significant increase in HR in Group N from baseline, while significant decrease in HR was observed in Group D. At 1, 3, and 5 min after intubation, there was a rise in HR in all three groups from baseline. However, the rise in HR was significantly higher in Group N as compared to Group D and Group C.

Among Group C and D, this rise was significantly higher in Group C as compared to Group D. In Group D, rise in HR was slight after intubation and returned to baseline at 3 min after intubation. At 7 min after intubation, mean HR reached near baseline value in Groups C and N [Figure 1].

There was an increase in MAP, SBP, and DBP after laryngoscopy and intubation in all groups, but it was significantly higher in Group C as compared to Groups D and N and it was also significantly higher in Group N as compared to Group D at 1, 3, and 5 min after intubation. In Group D, this rise at 1 min was non-significant and returned to baseline at 3 min after intubation. At 7 min after intubation, these values reached near baseline value in Groups C and N also [Figures 2-4].

Hypotension was observed in 5 patients of Group N. Hypertension was found in 20 patients in Group C, not in any patient in Group D, and 2 patients in Group N. Tachycardia was seen in 13 patients in Group C, 1 patient in Group D, and 25 patients in Group N. Bradycardia was not observed in any patients [Table 2].

DISCUSSION

In our study, we found that injection dexmedetomidine given preoperatively was associated with significantly lesser increase in HR after laryngoscopy and intubation compared to control and nitroglycerine spray.

Similarly, there was an increase in MAP, SBP, and DBP after laryngoscopy and intubation in all groups, but this increase was significantly less in Group D as compared to Group C and Group N and it was also significantly less in Group N as compared to Group C at different time intervals [Figures 2-4].

Similar results were found by Scheinin *et al.*[9] in their study "dexmedetomidine attenuates sympathoadrenal responses to tracheal intubation" in which they found that the maximal average increase (vs. baseline) was 1% and 21% in systolic, 23% and 46% in diastolic arterial pressure, and 6% and 29% in HR in the dexmedetomidine and saline groups, respectively, just after intubation.

Reddy *et al.*[7] found that the mean HR, SBP, DBP, and MAP levels in dexmedetomidine group were significantly lower than esmolol group and control group immediately after intubation. In our study, we also found lower mean HR, SBP, DBP, and MAP level in dexmedetomidine

Table 1: Patient characteristics

Characteristics	Group D	Group N	Group C	*P* valve
Age	35.4±12.6	39.36±11.93	39.93±10.86	0.27
Weight	55.7±5.50	54.5±5.64	55.1±6.01	0.72
Sex - male	20	11	11	0.17
Female	10	19	19	0.27

Table 2: Incidence of complications

Complications	Group C	Group D	Group N
HypotensioN	0	0	5
Hypertension	20	0	2
Bradycardia	0	0	0
Tachycardia	13	1	25

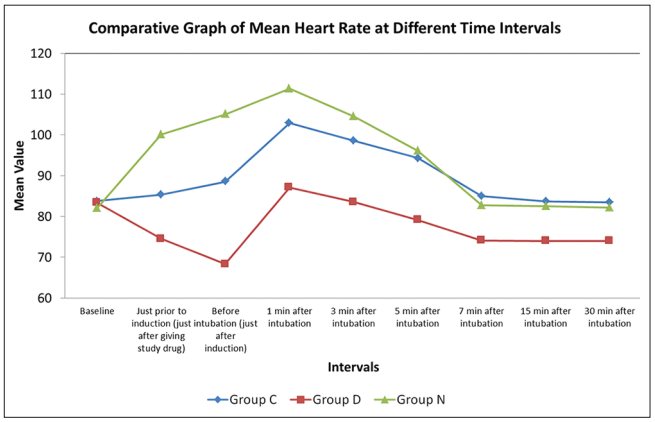

Figure 1

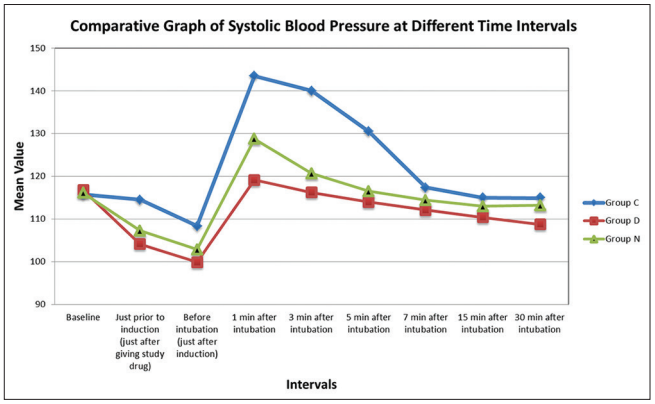

Figure 2

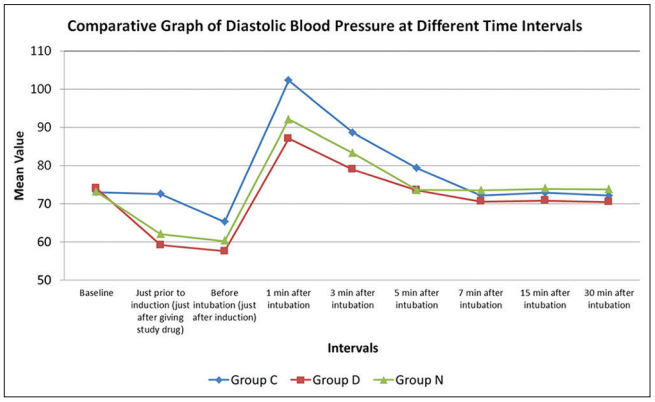

Figure 3

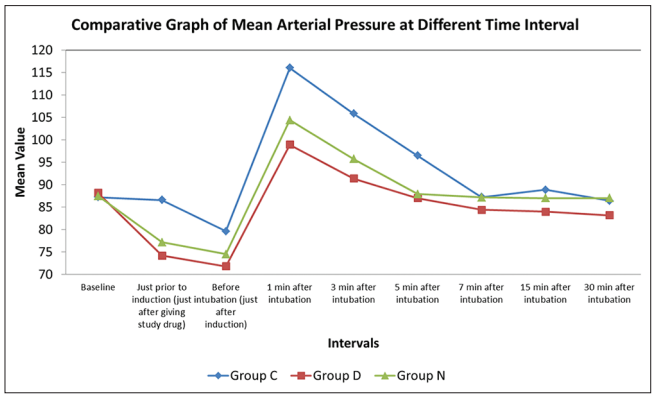

Figure 4

group in comparison with nitroglycerin and control group immediately after intubation.

Sarkar *et al.*[8-12] studied i.v clonidine 3 mcg/kg body weight and dexmedetomidine 0.5 mcg/kg body weight for blunting pressor response during laryngoscopy and intubation. They found that the mean MAP, SBP, DBP, and HR was significantly lower after intubation in both dexmedetomidine and clonidine group as compared to control group. Similarly, we also observed significantly lower mean SBP after intubation in dexmedetomidine group as compared to control group.

Hypotension was observed in 5 patients of Group N. Hypertension was found in 20 patients in Group C, not in any patient in Group D, and 2 patients in Group N. Tachycardia was seen in 13 patients in Group C, 1 patient in Group D, and 25 patients in Group N. Bradycardia was not observed in any patient.

This dexmedetomidine-induced hemodynamic profile can be attributed to the known sympatholytic effects of α2-agonists. The α2-receptors are involved in regulating the autonomic and cardiovascular systems. Alpha-2 receptors are located on blood vessels, where they mediate vasoconstriction, and on sympathetic terminals, where they inhibit norepinephrine release. The decrease in HR by dexmedetomidine is due to a centrally mediated decrease in sympathetic tone and an increase in vagal activity. It seems that postsynaptic alpha-2 adrenoceptors and imidazoline receptors in the brainstem are involved.

The hemodynamic effect of nitroglycerin can be attributed to its vasodilatory action on vascular smooth muscle. Systemic arterial pressure may fall slightly in lower doses. Higher doses cause further venous pooling and may decrease arteriolar resistance as well, thereby decreasing systolic and DBP and cardiac output and causing tachycardia by activation of compensatory sympathetic reflexes.

CONCLUSION

Dexmedetomidine (0.5 mcg/kg body weight i.v) is more effective for attenuation of hemodynamic response to laryngoscopy and intubation without undesired side effects and complications.

Nitroglycerin (800 mcg sublingual spray) also attenuates blood pressure response (less than dexmedetomidine) during laryngoscopy and intubation, but it produces reflex tachycardia which is undesirable.

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