



COMPARISON OF ESMOLOL AND DEXMEDETOMIDINE FOR SUPPRESSION OF HEMODYNAMIC RESPONSE TO ENDOTRACHEAL INTUBATION IN ADULT PATIENTS UNDERGOING ELECTIVE GENERAL SURGERY: A PROSPECTIVE, RANDOMIZED CONTROLLED DOUBLE-BLINDED STUDY

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ABSTRACT

The present study compared the efficacy of esmolol and dexmedetomidine for attenuation of the sympathomimetic response to laryngoscopy and intubation in elective surgery under general anesthesia. 90 patients aged 20-60 years, ASA status I or II, either sex. Patients were randomly allocated to 3 groups of 30 each comprising of Control group (group C) 20 ml 0.9% saline IV, group dexmedetomidine (group D) 1 µg/kg diluted with 0.9% saline to 20 ml IV and group esmolol (group E) 1.5 mg/kg diluted with 0.9% saline to 20 ml IV. All the drugs were infused over a period of 10 min and after 2 min induction of anesthesia done. HR, SBP, DBP, & MAP after induction every 2 min for 15 min after orotracheal intubation. Hemodynamic stability remains significantly lower in Group D than that of Group C and Group E at all time intervals up to 15 min after intubation.

KEYWORDS : Dexmedetomidine, endotracheal intubation, esmolol, hemodynamic response, laryngoscopy

INTRODUCTION

Laryngoscopy and endotracheal intubation lead to strong sympathetic response which manifests as transient but marked tachycardia and hypertension. This response is maximum immediately following intubation and lasts for 5-10 min. The response may be tolerated by healthy individuals but may precipitate arrhythmias, myocardial ischemia, and cerebrovascular accidents in patients with preexisting cardiovascular disease. Different methods have been used to suppress these responses such as use of topical lignocaine spray, maintenance of deep Plane of anesthesia. Esmolol is a rapid-onset, ultrashort-acting (half-life 9 min), selective β_1 adrenergic receptor antagonist and proved to be an efficient agent to provide hemodynamic stability during laryngoscopy and intubation. Dexmedetomidine is a selective α_2 agonist which produces hyperpolarization of noradrenergic neurons and suppresses neuronal firing in the locus coeruleus, which decreases sympathoadrenal response and maintains hemodynamic stability during laryngoscopy and endotracheal intubation.

MATERIALS AND METHODS

A total of 90 patients of either sex with inclusion criteria aged between 20 and 50 years ASA physical status Classes I and II posted for elective surgery under general anesthesia were enrolled in this prospective, randomized controlled double-blinded study. All the patients were included after obtaining written informed consent and after thorough preanesthetic checkup including general, physical, and systemic examinations. Routine investigations (complete blood count, renal function tests, liver function tests, electrocardiogram (ECG), and chest X-ray) were carried out in all patients. Patients were kept fasting for 6 h prior to surgery.

In the operating room, an 18G IV cannula was secured and infusion of Ringer lactate was started at 10 mL/kg/h. Standard monitoring including pulse oximetry (SpO_2), ECG, and noninvasive blood pressure was instituted and baseline vitals such as HR, SBP, DBP, MAP were recorded. Randomization was performed by computer-generated random numbers. This was done by an anesthesiologist who was unaware of the study protocol and was not involved in administering the drugs or observing results. The patients were blinded to the

treatment group and all recordings were performed by a separate anesthesiologist blinded to the group allocation. The drugs were infused in the following manner over 10 min: Group C patients received an infusion of 20 mL 0.9% normal saline (NS), Group D patients received infusion of dexmedetomidine 1 µg/kg diluted in 20 mL 0.9% NS, and Group E patients received infusion of esmolol 1.5 mg/kg diluted in 20 mL 0.9% NS. After completion of the study drug infusion, all patients were preoxygenated with 100% oxygen for 3 min and general anesthesia was induced with IV propofol 2.5 mg/kg. After loss of response to verbal commands, IV succinylcholine 2 mg/kg was given as per standard protocol. Laryngoscopy was done by an expert anesthesiologist using McIntosh curved blade of appropriate size, and intubation was done with cuffed endotracheal tube of appropriate size and confirmed using capnography. Laryngoscopy time was considered as time from the introduction of laryngoscope blade into the oropharynx to the appearance of the capnography curve on the monitor and this time was limited to <20 s. Bilateral equal air entry was confirmed by auscultation, the tube was secured, and the patients were put on controlled ventilation using closed circuit with circle absorber system.

All patients received IV vecuronium 0.08 mg/kg for muscle relaxation and maintained on intermittent bolus doses of vecuronium 0.02 mg/kg as per requirement along with oxygen and isoflurane 1%-1.5%. During the study period of 10 min following intubation, no stimulus such as any surgical intervention, nasogastric tube insertion, surgical incision, or any drug administration was given. Vital parameters including HR, SBP, DBP, MAP, and RPP were recorded at 1, 3, 5, 7, and 10 min after intubation. Patients were observed for any episode of bradycardia (HR <50 beats/min), hypotension (SBP <20% baseline), and any other adverse events during the surgery.

After completion of surgery, residual neuromuscular blockade was reversed with IV neostigmine 0.05 mg/kg and IV glycopyrrolate 0.01 mg/kg. Patients were extubated after complete clinical recovery and were shifted to postanesthesia care unit.

Statistical Analysis

Standard deviation (SD) was considered 20% of average

difference between the groups. The α value was 0.05 and the power of the study ($1 - \alpha$) was 0.90. One-way ANOVA was used for comparison among the groups while unpaired t -test was used for comparison within the groups along with Tukey's test for post test analysis.

RESULTS

All the patients who were enrolled completed the study. There was no significant difference with regard to demographic profile (age, sex, height, weight, and ASA physical status) among the groups Table 1.

Distribution of study population by patients' characteristics

Parameters	Group C	Group D	Group E	P
Age (years)	31.46 $\pm$ 9.0	33.1 $\pm$ 9.52	30.86 $\pm$ 8.65	>0.05
Height (cm)	152.32 $\pm$ 6.8	152.80 $\pm$ 4.4	152.83 $\pm$ 6.43	>0.05
ASA status (I:II)	10:20	9:21	11:19	-
Weight (kg)	66.6 $\pm$ 5.43	64.26 $\pm$ 5.43	65.43 $\pm$ 5.83	>0.05
Sex (male:female)	21:9	16:14	18:12	-
MPG Class (I:II)	21:9	11:19	12:18	-

ASA=American Society of Anesthesiologists, MPG=Mallampati Grading

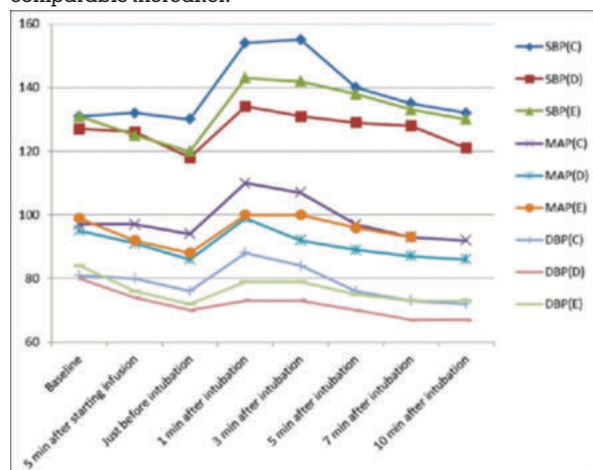
Mean HR at baseline was comparable in all the three groups ($P = 0.8250$). After completion of study drug infusion and just before intubation, there was a fall in mean HR in both Group D (16.72%) and Group E (7.31%), but there was a rise in Group C (2.53%). After intubation, mean HR remained significantly lower ($P < 0.001$) in Group D compared to Group C and Group E at all time intervals up to 10 min Table 2.

Comparison of mean heart rate among three groups

Time interval	Mean HR (beats/min) $\pm$ SD			P	Difference between groups		
	Group C	Group D	Group E		C-D	C-E	D-E
Baseline	89.53 $\pm$ 10.6	88.5 $\pm$ 10.75	90.2 $\pm$ 10.7	0.8250	>0.5	>0.5	>0.5
5 min after starting infusion	91.01 $\pm$ 10.73	81.3 $\pm$ 9.92	83.3 $\pm$ 9.30	<0.05	<0.001	<0.05	<0.05
Just before intubation	91.8 $\pm$ 11.01	73.7 $\pm$ 11.08	83.6 $\pm$ 11.03	<0.001	<0.001	<0.05	<0.05
1 min after intubation	109.06 $\pm$ 13.17	78.8 $\pm$ 13.20	93.0 $\pm$ 11.8	<0.001	<0.001	<0.001	<0.001
3 min after intubation	111.5 $\pm$ 13.20	79.2 $\pm$ 12.82	93.3 $\pm$ 13.5	<0.001	<0.001	<0.001	<0.001
5 min after intubation	106.3 $\pm$ 11.82	75.4 $\pm$ 11.06	90.3 $\pm$ 11.43	<0.001	<0.001	<0.001	<0.001
7 min after intubation	102.43 $\pm$ 11.06	72.50 $\pm$ 11.0	87.8 $\pm$ 11.1	<0.001	<0.001	<0.001	<0.001
10 min after intubation	93.42 $\pm$ 10.45	70.01 $\pm$ 10.7	86.6 $\pm$ 10.38	<0.001	<0.001	<0.001	<0.001

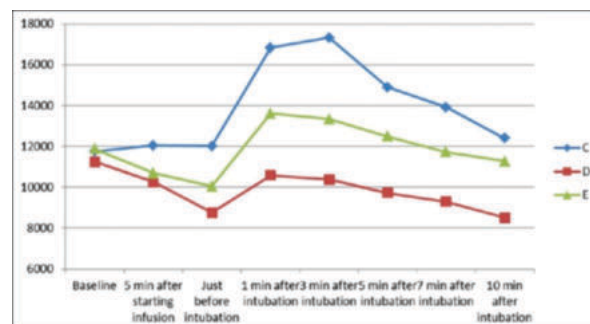
HR=Heart rate, SD=Standard deviation

Mean values of SBP, DBP, and MAP at baseline were comparable in all the three groups ($P < 0.05$) [Figure 1]. After completion of study drug infusion and just before intubation, there was a significant fall in mean SBP, DBP, and MAP in both Group D and Group E compared to Group C. Mean SBP, DBP, and MAP values increased in all the three groups at 1 min after intubation. The values in Group D were significantly lower than that of Group C and Group E ($P < 0.001$). In addition, the values in Group E were significantly lower than that of Group C ($P < 0.05$) at this time. Whereas the mean SBP, DBP, and MAP values remained significantly lower in Group D than Group C and Group E at all time intervals up to 10 min after intubation; the difference between the esmolol and control groups was not significant after 3 min and these two groups remained comparable thereafter.



One-way ANOVA showed no significant difference in RPP

among the three groups at baseline ($P > 0.05$) [Figure 2]. RPP increased from baseline 1 min after intubation in all the groups. The values in Group D were significantly lower compared to Group C and Group E and this trend was observed up to 10 min after intubation. Similarly, RPP values in Group E were significantly lower than that of Group C up to 7 min after intubation.



Monitoring of HR, BP, and ECG has shown no evidence of myocardial insult, bradycardia, or hypotension in any of the patients in any group in our study.

CONCLUSIONS

We concluded that both dexmedetomidine and esmolol are effective in blunting the hemodynamic response to laryngoscopy and intubation when compared to control. Dexmedetomidine shows better hemodynamic stability when compared to esmolol.

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