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COMPARISON OF INTRAVENOUS ESMOLOL AND DEXMEDETOMIDINE FOR ATTENUATION OF HAEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION

Anaesthesiology

KEYWORDS: haemodynamic parameters, dexmedetomidine, esmolol

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ABSTRACT

Rigid laryngoscopy and endotracheal intubation is the gold standard for airway management. It acts as a noxious stimuli and the haemodynamic changes are a result of sympathoadrenal discharge from epipharyngeal and parapharyngeal stimulations which becomes fatal in patients with cardiovascular diseases. Dexmedetomidine, a selective α2 adrenoceptor agonist and esmolol, a ß1 adrenergic receptor blocker have been used for attenuating this response. This study compares the pressor responses with dexmedetomidine, esmolol and placebo. 90 patients (n=30) were allocated into three groups D (Dexmedetomidine) , E (esmolol) and C (control or normal saline) and administered the study drugs and haemodynamic parameters were recorded at baseline, during and after laryngoscopy. Both dexmedetomidine and esmolol group showed less rise in HR and BP during laryngoscopy and intubation than control group. All haemodynamic parameters were also significantly less in Group-D and Group-E.

BACKGROUND:

Laryngoscopy and endotracheal intubation cause increased heart rate, increased blood pressure and occasional disturbance in cardiac rhythm because of sympathoadrenal reflex due to release of norepinephrine and epinephrine.[1,2,3,4] Effective attenuation of the sympathoadrenal stress response is essential. Esmolol hydrochloride is a $ß_1$ selective adrenergic receptor blocker. Dexmedetomidine is an imidazoline derivative and highly selective 2 adrenoreceptor agonist which cause centrally mediated reduction of sympathetic nervous system activity and decrease haemodynamic response to stress.[5,6,7,8]

MATERIALS AND METHODS:

In this randomized, single-blind, placebo-controlled, prospective study comparison of esmolol and dexmedetomidine infusions in attenuating the haemodynamic response following laryngoscopy and intubation was done. Ninety patients in the age group between 18-50 years, of either sex, of ASA physical status I and II, undergoing various elective abdominal surgeries under general anaesthesia were randomly allocated into three equal groups (n=30). Group-D and Group-E received infusion of 1.0g / kg body weight of intravenous bolus dexmedetomidine in 20ml normal saline over 10 minutes with infusion pump prior to induction followed by 0.5g / kg/hour infusion till the end of study and 1mg/kg body weight of intravenous bolus esmolol in 20ml normal saline over 1min with infusion pump prior to induction followed by 250g / kg/min infusion till the end of study respectively. Group-N (control) received only normal saline infusion. Standard institutional protocol of general anesthesia was administered. Tracheal intubation was done with an appropriate size endotracheal tube using a Macintosh laryngoscope in less than 15 seconds. Maintenance of anaesthesia was done by using N2O:O2 at the ratio of 60:40. Haemodynamic parameters (HR, SBP, DBP and MAP) were recorded in following specific time intervals-Before the study drug infusion (Baseline value),1 minute after the study drug infusion,just before intubation and 1,3,5,10 minutes after intubation. No surgical stimulus was allowed during the study period . At the end of surgery the patients were adequately reversed and any complication was detected, recorded and appropriately managed.

RESULTS:

The results of the observations in each group of patients were tabulated, compiled and statistically analyzed using Statistica version 6 [Tulsa, Oklahoma: Stat Soft Inc., 2001], SPSS Statistics version 17 [Illinois, Chicago: SPSS Inc., 2008]. Qualitative data were compared between groups with Chi-Square ($\chi 2$) test. Quantitative data were compared between groups with ANOVA.

DEMOGRAPHIC VARIABLES

Table 1. Comparison of demographic variables between three study groups

DEMOGRAPHIC VARIABLES	GROUP-D n=30 (Mean±SD)	GROUP-E n=30 (Mean±SD)	GROUP-N N=30 (Mean±SD)	p value
SEX (M:F)	11:19	12:18	10:20	.866
AGE (YEARS)	39.07 ± 8.461	38.03 ± 7.902	39.20 ± 8.290	.835
BODY WEIGHT(KG)	56.90 ± 9.935	56.07 ± 9.684	55.37 ± 9.197	.826
HEIGHT (CM)	160.03±10.361	161.63± 9.419	159.6 ± 9.568	.705
ASA GRADE (I:II)	24:6	24:6	23:7	.936

SD : standard deviation

All the three groups were statistically comparable with respect to sex, age, body weight, height and ASA grading. No significant differences were observed between the groups (p value > 0.05) [Table 1].

Both dexmedetomidine and esmolol group showed less rise in HR and BP during laryngoscopy and intubation than control group. All haemodynamic parameters were also significantly less in Group-D and Group-E at 1, 2, 3, 5 and 10 minutes after intubation. At 10 minutes after intubation, only DBP values were similar in Group-E and Group-N. Altered pressor responses were normalized after 5 minutes in Group E and 10 minutes in Group N. Haemodynamic parameters in Group D remained around the baseline value in first 1 to 3 minutes after intubation followed by a gradual fall in the next few minutes.

HAEMODYNAMIC PARAMETERS

HEART RATE

Table-2 Comparison of heart rates between the study groups at different points of time

TIME INTERVAL	Group D (n =30) (Mean ± SD)	Group E (n =30) (Mean ± SD)	Group N (n =30) (Mean ± SD)	p value
Before study drug infusion(baseline)(T1)	84.00±9.124	83.47±9.035	83.27±9.490	.951
1 minute after the loading dose infusion of study drug (T2)	79.17±8.659	79.00±8.489	84.70±9.018	.019
Just before intubation(T3)	74.13±7.763	75.77±8.089	81.80±8.572	<0.01

1 minute after intubation (T4)	86.03±7.320	93.53±7.167	107.67±6.381	<0.01
3 minutes after intubation (T5)	81.90±6.661	91.43±7.094	103.13±6.756	<0.01
5 minutes after intubation (T6)	78.00±6.953	84.50±7.286	94.70±8.412	<0.01
10 minutes after intubation (T7)	73.93±6.933	80.10±6.588	84.37±8.286	<0.01

COMPARISON BETWEEN GROUPS

When the preoperative baseline HR was compared between three groups, no statistically significant difference was found (p value 0.951).1minute after loading dose of study drug infusion, significant reduction in HR is noted in Group-D and Group-E compared to Group-N(p value 0.019). HR was also significantly lower in Group-D and Group-E compared to Group-N (p value < 0.01) just before intubation .The increases in HR at 1, 2, 3, 5 and10 minutes after intubation were highly significant in Group N compared to Group-D and Group-E (p value < 0.01) [Table 2].HR remained significantly lower in Group-D and Group-E compared to Group-N throughout the maintenance dose of study drug infusion.

MEAN ARTERIAL PRESSURE

Table 3. Comparison of mean arterial pressures between three study groups at different points of time

TIME INTERVAL	Group D (n =30) (Mean ± SD)	Group E (n =30) (Mean ± SD)	Group N (n =30) (Mean ± SD)	p value
Before study drug infusion(baseline)(T1)	93.90±10.330	94.33±10.186	93.07±10.570	.891
1 minute after the loading dose infusion	84.70±9.470	89.07±9.588	91.43±9.659	.025
Just before intubation(T3)	78.90±8.676	82.30±9.143	86.67±10.094	.007
1 minute after intubation (T4)	91.83±7.488	101.13±8.513	113.20±7.184	<0.01
3 minutes after intubation (T5)	88.57±7.610	99.23±8.625	109.07±6.807	<0.01
5 minutes after intubation (T6)	85.50±7.510	91.73±9.255	99.00±7.334	<0.01
10 minutes after intubation (T7)	81.93±7.451	87.43±9.054	92.50±6.801	<0.01

COMPARISON BETWEEN GROUPS

When the preoperative baseline MAP was compared between three groups, no statistically significant difference was found(p value 0.891). 1minute after loading dose of study drug infusion, significant reduction in MAP is noted in Group-D and Group-E compared to Group-N(p value 0.025).MAP was also significantly lower in Group-D and Group-E compared to Group-N(p value 0.007) just before intubation. The increases in MAP at 1, 2, 3, 5 and10minutes after intubation were highly significant in Group N compared to Group-D and Group-E(p value < 0.01) [Table 3]. MAP remained significantly lower in Group-D and Group-E compared to Group-N throughout the maintenance dose of study drug infusion.

A few patients in all groups had postoperative complications (e.g. bradycardia, hypotension, hypoxaemia, shivering and PONV), which were mild in nature and not statistically significant.

Discussion

Attenuation of hemodynamic response to laryngoscopy and tracheal intubation is of great importance in prevention of perioperative morbidity and mortality especially in patients with coronary artery disease, hypertension and aneurysmal vascular disease.[1,2,4]

This study compares the usefulness of Esmolol,and Dexmedetomidine, in the attenuation of the hemodynamic response following laryngoscopy and endotracheal intubation. Fluctuations in hemodynamic response have been reported in all age groups. Therefore, patients with an optimal age range of 18 to 50 years were selected.

1 minute after loading dose of study drug infusion, significant reduction in HR was noted in Group-D and Group-E compared to Group-N(p value 0.019) but there was no significant difference between Group-D and Group-E (p value > 0.05). Dexmedetomidine had a better effect than esmolol in controlling HR(p value < 0.01).

Highly significant fall in NIBP (SBP, DBP and MAP)(p value < 0.05) were noted in Group D compared to Group-N after loading dose of study drug infusion. SBP and MAP values are significantly low(p value < 0.01) in Group-E compared to Group-N at 1,3,5 and 10 minutes. NIBP (SBP, DBP and MAP) were better maintained in Group-D than Group-E throughout the study period and values are significant (p value < 0.05). These findings corroborate with the result of the study by Reddy SV [9] et al who concluded that both dexmedetomidine and esmolol attenuated the pressure response and of the two drugs , dexmedetomidine 1.0 μg/kg provides a consistent, and effective attenuation of pressure responses when compared to esmolol 2.0 mg/kg.

In all groups peak haemodynamic surges were observed at 1 minute after intubation. HR increased from the baseline value by 2.4% and 12 % in Group D and Group E respectively. This corroborates with Derbyshire DR et al 10 and Shribman AJ et al [11].

A few patients in all groups showed certain dysrhythmias like sinus tachycardia and ventricular premature contractions at 1 min after laryngoscopy. It has been shown by various authors like Bedford RF 12 and Shribman AJ et al [11] that reflex autonomic responses provoked by laryngoscopy could cause various types of dysrhythmias.

Serum catecholamines are an important marker to assess the sympathoadrenal stress respons. But, in this study we could not measure its level in every patient due to scarcity of the resources. This is the major limitation of our study.

CONCLUSION:

Both dexmedetomidine and esmolol administered intravenously attenuate the haemodynamic respons. Dexmedetomidine is a better agent than Esmolol in attenuating the haemodynamic responses to laryngoscopy and intubation. Both the study drugs are devoid of any serious adverse effect and found safe in this study.

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