

Type of Manuscript:- Original Research Article.

An Observational Study to Compare the Effects of Esmolol and Diltiazem in Attenuating the Haemodynamic Response to Laryngoscopy and Endotracheal Intubation

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Abstract

Background - Laryngoscopy and endotracheal intubation are two most essential part of anaesthetic management. They help in control of airway during general anaesthesia and produce transient marked sympathetic response which manifest as an increase in heart rate, blood pressure, intraocular and intracranial pressure. Esmolol is a selective beta adrenergic receptor antagonist and diltiazem is a calcium channel blocker. The drugs were compared towards reducing the haemodynamic stress response.

Methods –This study included 50 patients of both gender, with ASA grade I to IV, aged between 18 to 60 years, scheduled for surgery under general anaesthesia. Among these 25 patients were given inj. esmolol with dose of 1mg/kg i.v.bolus and 25 patients were given inj. diltiazem with dose of 0.2mg/kg i.v.bolus . The haemodynamic parameters were recorded at baseline , just after premedication , after injecting the drug under study, after intubation at 1 , 3 , 5 and 10 minutes.

Conclusion –Patients who received inj. esmolol in dose 1mg/kg i.v. showed marked attenuation in both heart rate as well as systolic and diastolic blood pressure whereas inj. diltiazem with dose of 0.2mg/kg only showed attenuation in systolic and diastolic blood pressure but failed to achieve any control over heart rate.

Keywords- Diltiazem, Esmolol, Intubation , Laryngoscopy

Introduction

Laryngoscopy and endotracheal intubation are two most important parts of anaesthetic management. They provide control of airway during general anaesthesia.

They can cause transient but marked sympathetic response which manifest as an increase in heart rate, both systolic and diastolic blood pressure, intraocular and intracranial pressure. These changes are seen maximum immediately after intubation.¹

These changes are mainly due to increase in release of catecholamine² and mechanical stimulus causing reflex responses in cardio-respiratory systems³. Although these effects are short lived they may have detrimental effect on high risk patients such as patients with coronary artery disease, uncontrolled hypertension, poor cardiac reserve, interstitial heart disease, intracranial aneurysms.⁴

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Various non pharmacological and pharmacological methods are in vogue to control this hemodynamic response. Esmolol is a cardioselective beta adrenergic receptor antagonist which is water soluble, has rapid onset and is ultra short acting with proven efficacy to provide hemodynamic stability during laryngoscopy and tracheal intubation⁵. Diltiazem, a calcium channel blocker with rapid onset of action has been used extensively to maintain perioperative hemodynamic stability which acts by causing peripheral vasodilatation and by blocking the release of catecholamines .

Material and Methodology

Study population:- After obtaining. Permission and clearance from the ethical committee, the study was conducted at Dhiraj hospital in Department of anaesthesiology All the subjects were involved in our study only after obtaining a written informed consent.

Duration of study:- The above study was conducted over a period of 18 months (2018- 2020) .

Inclusion Criteria:

1. All.patients.posted.under.general.anaesthesia.
2. Age: 18 years- 60 years of either sex
3. Patients.who.gave.written.informed.consent.
4. Patients with Malampati.grade.I and II.

Exclusion Criteria:

- 1.Patient's refusal.
- 2.Patients with history of any cardiovascular , pulmonary , hepatic and renal diseases and with bleeding disorders.
- 3.Patient taking medications for cardiovascular disease or anti hypertensive medications
4. Coexisting systemic illness like diabetes mellitus.
- 5.Pregnant woman .
6. Any patient with malampati grade III and IV or difficult intubation.

All patients were premedicated with Inj. ondansetron 0.1mg/kg i.v. ,Inj glycopyrolate 0.004 mg/kg with inj. midazolam 0.02 mg/kg i.v. and inj.fentanyl 1 microgram/kg, just before induction . Patient were preoxygenated with 100% oxygen for 3-5 minutes. According to clinical indication 25 patients were given drug esmolol at 1mg/kg and were named as group E and 25 patients were given drug diltiazem at 0.2mg/kg and were named group D. After 1 minute, anaesthesia was induced with thiopentone sodium 5mg/kg followed by succinylcholine 2mg/kg IV.

After disappearance of fasciculations, direct laryngoscopy was performed and trachea was intubated with proper sized endotracheal tube. The parameters like heart rate , systolic and diastolic blood pressure as well as mean arterial pressure were recorded at baseline, just after premedication, just after injecting the drug under study, just after intubation, 1min, 3min, 5min and 10 min after intubation.

Sample size: For calculating the sample size , based on previous study in literature the incidence of attenuating the haemodynamic response on injecting esmolol and diltiazem was taken to be 80% and 50% reduction in haemodynamic response considered clinically significant. The minimum size for each group, assuming a value of 0.05 and a power value 90% was calculated to be twenty five .

Statistical Analysis

Data was collected and tabulated. Numerical variables were presented as mean & standard deviation (SD) while categorical variables were presented as frequency and percentage. As regard numerical variables; unpaired student –t test were used whenever appropriate, for between-groups comparisons, while for categorical variables; chi-square test were used. A difference with significant level <0.05 was considered statistically significant.

Results

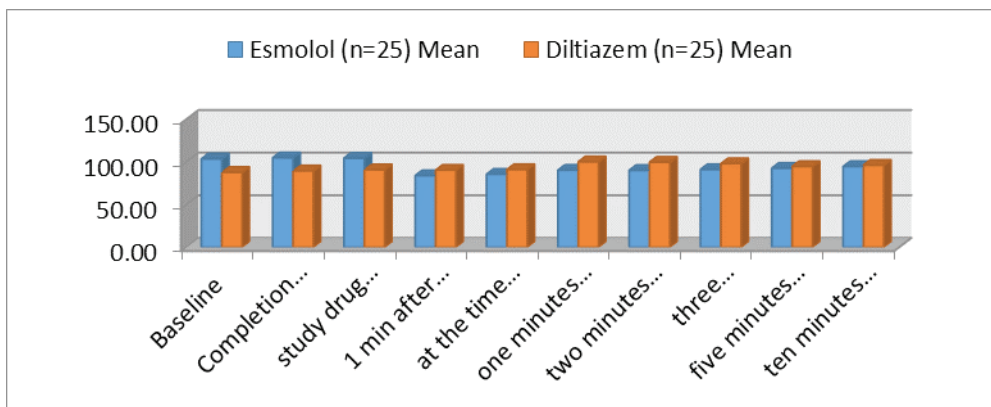
Demographic Data:-

Table 1: Age distribution and gender distribution.

PARAMETER	ESMOLOL GROUP	DILTIAZAM GROUP	P VALUE
AGE	42.92 ± 12.26	37.04±13.96	0.1201
MALE	13 (52%)	10(40%)	0.5704
FEMALE	12 (48%)	15(60%)	0.5704

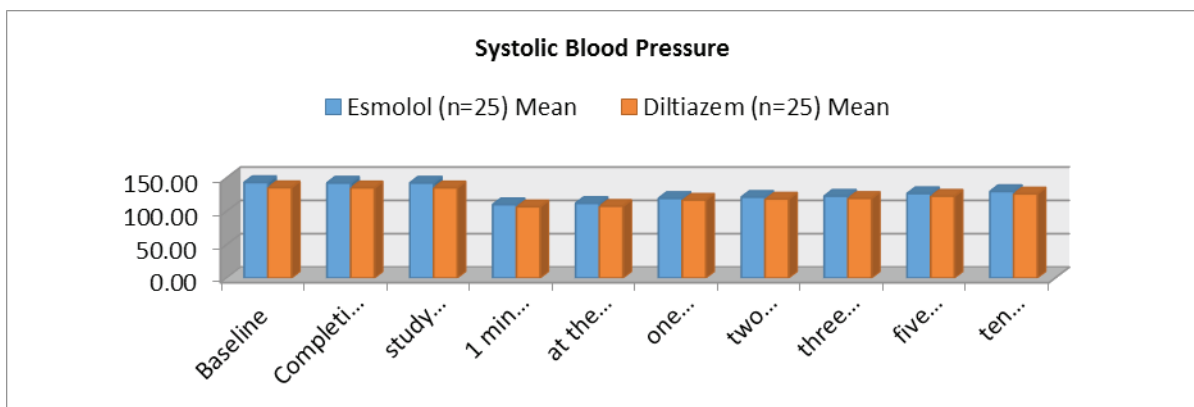
P<0.05 – not significant statistically

From table 1 , it can be stated that there was no significant difference in age or gender distribution within the study subject.

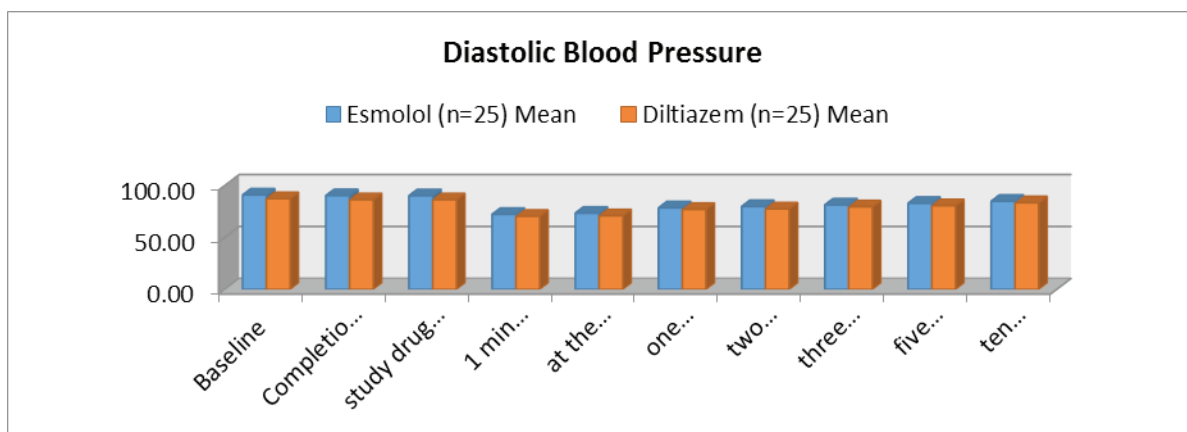


Graph 1 : Heart rate comparison between esmolol and diltiazem

The heart rate was found to be significantly lower in group E than those in group D during intubation and 1,3,5 and 10 minutes after intubation. Statistical evaluation when both the groups were compared showed that decrease in heart rate in Group E was statistically highly significant ($p < .001$) when compared to the heart rate in Group D.

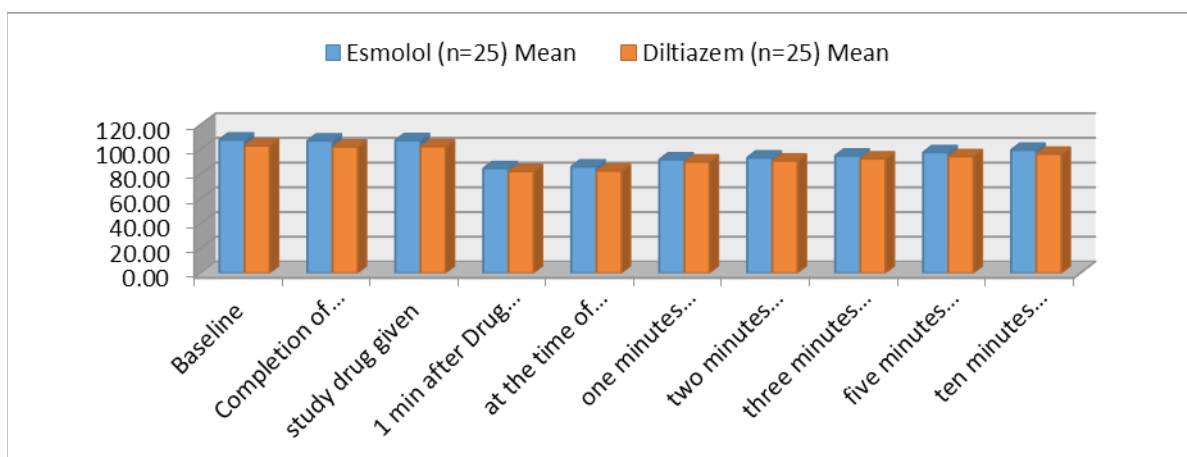


Graph 2- Systolic blood pressure comparison between esmolol and diltiazem



Statistical evaluation between the two groups showed that decrease in SBP and DBP observed in Group E was statistically highly significant ($p < .0001$) when compared to the SBP and DBP in Group D.

Graph 3: Diastolic blood pressure comparison between esmolol and diltiazem



Graph 4 :Mean arterial pressure comparison between esmolol and diltiazem

Statistical evaluation between the two groups showed that decrease in MAP observed in Group E was statistically highly significant ($p < .0001$) when compared to the MAP in Group D.

Discussion

Endotracheal intubation and laryngoscopy often provokes hypertension and tachycardia and cardiac dysarrhythmias.^{6,7} This is due to reflex sympathetic discharge which occurs as a result of pharyngeal and laryngeal stimulation. These circulatory stimulus can occasionally lead to heart failure, myocardial ischemia, laryngospasm, arrhythmias due to difference between myocardial oxygen demand and supply and bronchospasm. Above mentioned events are more significant in patients with coronary artery disease,

hypertension and cerebrovascular disease.

In our study the mean heart rate at the time of drug administration in esmolol group was 104.6 ± 9.70 and in diltiazem group was 91.0 ± 15.95 . After 1 minute of intubation it was 90.32 ± 8.73 in esmolol group and 100.20 ± 14.45 in diltiazem group. Thus decrease in heart rate was noticed more in Esmolol at the time of intubation.

For next ten minutes heart rate was found to be significantly lower in Esmolol group as compared to the heart rate which was raised after induction of anaesthesia in diltiazem group. This rise in heart rate in diltiazem group can be due to diltiazem induced peripheral vasodilatation which can lead to reflex tachycardia. Thus diltiazem group was found to be inefficient in controlling

tachycardia post induction due to. symphathatic stimulation .Individual study on diltiazem was done by **santosh kumar et al (2003)**⁸.It was found that diltiazem was not effective in controlling heart rate. These finding were also found to be consistent with that of **Mikawa et al (1990)**⁹.

While in esmolol group the heart rate showed a very insignificant rise immediately after intubation but at 1 min the heart rate remained closer to the basal value at all the time interval. So the heart rate was most effectively controlled by esmolol group. **Dr Hansraj Charan et al**¹⁰ in 2018 studied the effect of intravenous esmolol and diltiazem in attenuation of the response to laryngoscopy and intubation, where esmolol was given in a dose of 1 mg/kg The mean heart rate in esmolol group at the time of drug administration was 84.5±15.5 and in diltiazem group was 90.8±14.3. one minute after intubation mean heart rate in esmolol group was 89.8±16 and in diltiazem group was 101.2±15.5. Thus in diltiazem group there was insignificant increase in heart rate after intubation. These findings were similar to our study as shown in Table No - 3. Thus esmolol was the more significant in controlling the heart rate than diltiazem.

.CH Kindler et al, in 1996¹¹ studied the comparison of intravenous lidocaine and esmolol in attenuating hemodynamic response to laryngoscopy and intubation . They concluded from the study that esmolol 1 to 2 mg/kg is more effective in attenuating HR response to tracheal intubation.

In our study mean SBP in esmolol group at the time of drug administration was 142.48±11.01 and in diltiazem group it was 135.20±11.75. After 5 minute post intubation mean SBP in esmolol group was 126.56±6.37 and in diltiazem group it was 122.68±6.24 . Thus esmolol was statistically better in reducing the mean SBP. **Vandana talwar et al, in 2018**¹² concluded that esmolol in dose of 1.5 mg/kg intravenously prevented the rise in systolic blood pressure in comparison to diltiazem. Similarly , **Rashmee chavan,sandeep kadam et al**,¹³ in 2017 also studied the effect of iv esmolol and diltiazem in attenuating the stress response to laryngoscopy and intubation .They concluded that diltiazem group demonstrates significant increase in SBP than esmolol group.

In our study we found that mean DBP in esmolol group at the time of drug administration was 90.08±5.81 and in diltiazem group it was 86.3±5.07 After 5 minutes post intubation mean DBP was 82.84±4.96 in esmolol group and 80.60±3.83 in diltiazem group. These results are comparable to results of **S. Umamaheshwararaju et al ,in 2013**¹⁴,who studied the effect of intravenous esmolol and diltiazem in attenuating the hemodynamic stress response to laryngoscopy and intubation. They concluded that diltiazem in a dose of 0.2mg/kg was less effective in controlling the diastolic blood pressure as compared to esmolol.

In our study MAP in esmolol group at the time of drug administration was 107.28±7.25 and in diltiazem group was 102.36±6.84. 5 minutes after intubation it was 97.56±5.11 in esmolol group and 94.36±4.26 in diltiazem group . These results were similar to the study carried by **H Singh et al in 1995**¹⁵, to compare the effects of lidocaine, esmolol, and nitroglycerin in modifying the hemodynamic response to laryngoscopy and intubation and they concluded that esmolol was significantly more effective than lidocaine in minimizing the increase in MAP (25% vs. 55%). Similarly ,**Chitranagana Gupta, Bhawana Rastogi et al**, in 2017¹⁶ compared the effect of intravenous esmolol and diltiazem in attenuating the haemodynamic stress response to laryngoscopy and intubation.They concluded that diltiazem in a dose of 0.2mg/kg was less effective than esmolol given in a dose of 1.5mg/kg.These findings were similar to our study.

Conclusion

It can be concluded from the above study that inj.esmolol and inj.diltiazem both were efficient in controlling systolic , diastolic blood pressure and mean arterial pressure after endotracheal intubation but only inj.esmolol was effective in controlling the heart rate.

Source of Funding- Self

Conflict of Interest - None

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