

Efficacy of Esmolol to Blunt the Cardiovascular Response During Laryngoscopy And Intubation: A Randomized Control Trial.

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Abstract

Objectives:- To observe the cardiovascular changes, to study the magnitude of changes in normotensive patients and to observe the effects in attenuating the cardiovascular responses to laryngoscopy and intubation comparing two drugs.

Methods: The study was carried out on 60 adult patients of either sex, in the age group 20-60 years. Patients were divided into 2 groups of 30 patients each. Depending upon the drugs employed to attenuate the cardiovascular responses during laryngoscopy and intubation, Patients were randomly allocated to either group.

Group NS : The patients of this group received i/v normal saline 2 minute before intubation.

Group ES : The patients of this group received i/v Esmolol 1.5mg/kg body weight 2 minute before intubation. The observations were made at 1min., 3min, 5min., and at 10 minutes interval.

Results: The result obtained from our study with this drug found that i/v esmolol is effective in controlling both SBP and DBP.

Conclusions: Esmolol was more effective in attenuating the both SBP and DBP. While in PR Esmolol was found highly significant. Esmolol, at an intravenous bolus dose of 1.5mg/kg, provided consistent and reliable protection against increases in both HR and BP accompanying laryngoscopy and intubation.

Keywords:- Esmolol, laryngoscopy, intubation.

I. Introduction

The pressure response to laryngoscopy and endotracheal intubation has been recognized since long. Induction of general anaesthesia is known to induce clinically relevant changes in hemodynamic variables due to direct laryngoscopy and intubation.

During intubation reflex increase in sympathetic activity that may result in hypertension, tachycardia and arrhythmia.

Reid and brace first described hemodynamic response to laryngoscopy and intubation in 1940¹.

These changes in hemodynamic are not significant and well tolerated by healthy individuals. But in patients with hypertension, coronary artery disease and other comorbid conditions can lead to increase in the cardiac workload.

Inducing agents like thiopentone, propofol, esmolol, lignocaine etc has been tried to prevent hemodynamic response to laryngoscopy.

Esmolol, a water-soluble, cardio selective, and ultra-short-acting β -adrenergic antagonist, has also been shown to be effective in controlling both the HR and BP responses to intubation, but only in patients undergoing elective surgery studied by Helfman SM²; Kindler CH et al³; Kampine JP et al⁴; Parnass SM et al⁵; . Ebert JP et al found in patients undergoing general anesthesia for elective surgery, that esmolol (loading dose of 500 μ g/kg/min for 4 minutes, followed by a maintenance infusion of 300 μ g/kg/min for 11 minutes) significantly attenuated the maximum increases in HR and BP when compared with placebo. Another study found that a single bolus dose of 100 or 200 mg was able to attenuate the hypertensive and tachycardia responses to laryngoscopy and intubation Parnass et al⁵.

II. Material And Methods

The present study was conducted in N.S.C.B. Medical College and Hospital, Jabalpur. The study was carried out on 60 adult patients of either sex, in the age group 20-60 years. All the patients were normotensive and devoid of any cardiovascular disturbances, belonging to ASA grade I and II. The patients were picked up from the routine operative list scheduled to undergo various types of operating procedures like general surgical, gynaecological and orthopaedic under general anaesthesia.

Systolic blood pressure, diastolic blood pressure, and heart rate were recorded . Patients were divided into two groups of 30 patients each. Depending upon the drugs employed to attenuate the cardiovascular responses during laryngoscopy and intubation, Patients were randomly allocated to either group. The groups were designated as NS and ES.

Group NS– The patients of this group received normal saline 2 minute before intubation.

Group ES– The patients of this group received i/v Esmolol 1.5mg/kg body weight 2 minute before intubation. Blinding technique employed in the study was that the person recording the parameters like SBP, DBP, and PR was not aware as to which drug and dosage was administered .

All the patients were preoxygenated with 100% oxygen for three minutes. Technique of anaesthesia was standardized for all the patients in the study. This consisted of induction with I.V. thiopentone sodium (2.5%) 5 mg/kg BW followed by I.V. succinylcholine 1.5 mg/kg BW to facilitate endotracheal intubation. The parameter like SBP, DBP, and PR were recorded every minute after ET till up to 10 min. All the observations made in this study were recorded in the specially prepared proforma for this study. Observations at different time periods were compared for each parameter within the group and intergroup comparison was done. All the data obtained were analyzed and subjected to statistical analysis for significance.

III. Statistics

It was ensured that all cases are between the age group of 20-60 years. The mean age of all the groups were comparable with no statistically significant difference ($p>0.05$) All the patients were between the 30-70 Kg ranges. The mean weight of all the groups was comparable and no statistically significant difference was observed ($p>0.05$).

The Z value was calculated after calculating the mean and ‘P Value was seen for the significance and result derived

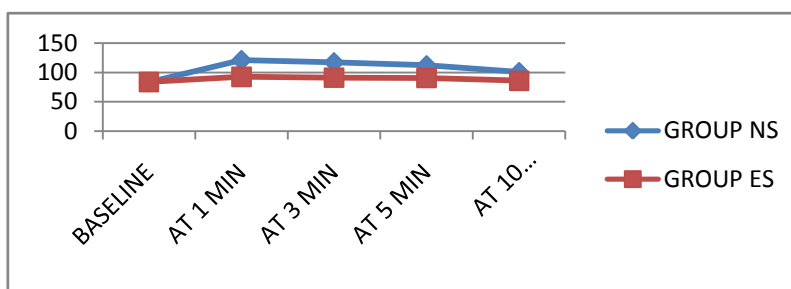
IV. Result

The result obtained from our study with this drug found that i/v esmolol is effective in controlling both SBP and DBP, while in PR esmolol was found highly significant. Esmolol, at an intravenous bolus dose of 1.5mg/kg, provided consistent and reliable protection against increases in both HR and BP accompanying laryngoscopy and intubation.

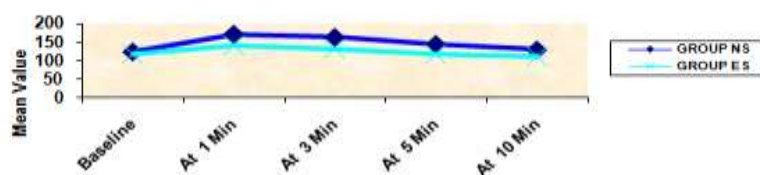
Table 1 shows the base line parameters of the studied cases in both groups. The baseline pulse rate, systolic BP and Diastolic BP were almost equal and no statistically significant difference was observed ($p>0.05$).

Time	Pulse Rate			Systolic Blood Pressure SBP			Diastolic blood Pressure DBP		
	NS	ES	p-value	NS	ES	p-value	NS	ES	p-value
Baseline	83.00± 9.44	83.57± 7.50	$p>0.05$;NS S	124.47±9 .97	117.20± 8.48	$P>0.05$;NS	79.20± 5.93	77.40± 5.80	$P>0.05$;NS
1min	120.60± 10.32	92.50± 8.08	$P<0.0001$;S	171.43± 18.23	140.80±1 6.47	$P<0.0001$;S	119.40 ± 9.34	94.00±12.7 1	$P<0.0001$;S
3min	116.80± 10.39	91.00± 9.08	$P<0.0001$;S	163.17± 19.20	131.07± 12.96	$P<0.001$;S	109.07 ± 9.68	87.67± 10.90	$P<0.0001$;S
5min	111.73±9. 46	90.40± 8.90	$P<0.0001$;S	144.20± 14.96	116.93±1 2.74	$P<0.0001$;S	95.67± 8.31	77.33± 9.50	$P<0.0001$; HS
10 min	100.20± 9.40	85.60± 7.32	$P<0.0001$;S	129.5± 12.28	115.4± 9.32	$P<0.0001$;S	85.00± 5.45	75.60 4.99	$P<0.0001$;S

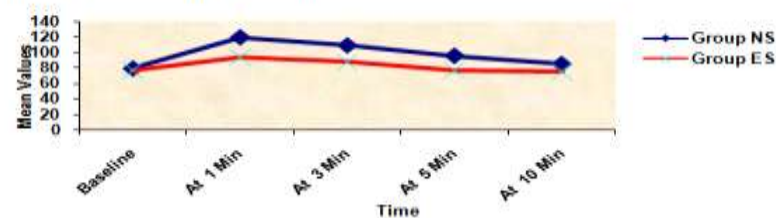
Graph -1 Comparison Of Mean Pulse Rate At Different Time Interval In Studied Groups



GRAPH 2- COMPARISON OF MEAN SYSTOLIC BLOOD PRESSURE AT DIFFERENT TIME INTERVAL IN STUDIED GROUPS



GRAPH 3- COMPARISON OF MEAN DIASTOLIC BLOOD PRESSURE AT DIFFERENT TIME INTERVAL IN STUDIED GROUPS



V. Discussion

Endotracheal intubation is a commonly performed procedure in routine anesthesia practice, critical care setup and emergency medicine. Endotracheal intubation is an invasive procedure leading to various physiological stress responses. Hemodynamic disturbances are very common while performing direct laryngoscopy, leading to tachycardia, hypertension, arrhythmia, bradycardia, etc.

Recognition of these effects can be traced back to the 1950s. In their respective findings, Reid and Brace¹, King and Harris⁶ found that tachycardia and rise in arterial pressure is the usual circulatory response. This response was attributable to an increase in the sympathetic response during laryngoscopy according to M.F. Cummings⁷.

Besides a rise in arterial pressure and tachycardia, other effects were also observed by continuous ECG monitoring, such as arrhythmias, ectopic beats, etc.

These changes can be well tolerated by healthy individuals. But they can be hazardous in patients with existing comorbid conditions like chronic hypertension, coronary artery disease, or cerebrovascular diseases.

All patients were preoxygenated with 100% oxygen for 3 minutes. In the Normal Saline (NS) group, normal saline was administered 2 minutes before laryngoscopy. In the Esmolol (ES) group, Esmolol was administered intravenously at a dose of 1.5 mg/kg 2 minutes before laryngoscopy.

Succinylcholine was used as a muscle relaxant for intubation at a dose of 1.5 mg/kg. Laryngoscopy was performed with the help of a Macintosh laryngoscope in this study. Patients were intubated with a cuffed endotracheal tube, and anesthesia was maintained on gas (N₂O: O₂) (60:40); halothane (0.5%) and a non-depolarizing muscle relaxant. The present study was conducted to observe the various hemodynamic responses during laryngoscopy and intubation. Hemodynamic parameters recorded in the operating theatre after a resting level of 10 minutes, which served as the baseline for further comparison of SBP, DBP, and pulse rate, which were recorded at different intervals, i.e., from 1 minute to 10 minutes after intubation. Monitoring of blood pressure and PR was done. Resting BP was almost the same in both groups.

At the 1-minute period after intubation, a rise in PR, SBP, and DBP was observed in the NS group.

The mean changes in PR were 37.60 ± 10.86 in the NS group and 8.93 ± 5.25 in the ES group. The ES group showed a considerably significant lower evaluation compared to the other group, and the level of significance of the ES group was very high ($P < 0.0001$).

The average variation in SBP was 47.23 ± 15.08 in the NS group and 23.60 ± 16.04 in the ES group respectively. The ES group showed a considerably significant lower variation compared to the NS group, and the level of significance of this group was very high ($p < 0.0001$). This shows that the ES group gives a more accurate result, i.e., statistically significant from the NS group. Similarly, this result was also seen in DBP with a mean average of 40.20 ± 8.01 in the NS group and 16.60 ± 12.33 in the ES group. Miller DR, et al⁸ administered a single intravenous bolus of esmolol prior to induction in a dose of 100 mg or 200 mg. It was found that a 100 mg bolus of esmolol is safe and effective for controlling the hemodynamic response to tracheal intubation. This dose of esmolol, combined with a low dose of narcotic (fentanyl 2-3 micrograms/kg-1 or equivalent), results in effective control of both heart rate and blood pressure, while avoiding important side-effects. E. Figueredo and E.M. Garcia-Fuentes⁹ compared esmolol with placebo on hemodynamic changes induced by laryngoscopy and intubation. It was concluded that esmolol is effective, in a dose-dependent manner, in the attenuation of the adrenergic response.

At the period of 3 min. after ET ,Group ES showed a considerably highly significant lower variation compared to the other group($p<0.0001$).The average valuation in PR is $33.88*9.91$ and $7.43*8.29$ in Group NS and ES respectively ($p<0.0001$).The average valuation in SBP were $38.7*14.23$ and $13.87*9.02$ in Group NS and ES respectively ($p<0.0001$).this result also seen in DBP with mean average of $29.87*8.48$ and $10.27*9.97$ in Group NS and ES respectively ($p<0.0001$).Esmolol effectively decrease DBP better than other group.

At 5 min the mean variation in PR,SBP and DBP between groups NS and ES was significant ($p<0.001$). At 10 min after ET, the rise in PR with NS is more than ES and there difference was significant. ($p<0.0001$).But rise in SBP and DBP between both groups was not significant ($p>0.05$)

In a study conducted by Yuan L et al¹⁰ , where they compared 2 different doses of Esmolol.i.e 100 mg and 200 mg , found that Esmolol 200 mg is better in achieving hemodynamic stability.In our study same response was found with 1.5mg/kg(avg. 75mg).

Roerig D et al¹¹,Sharma et al¹² and Bensky KP et al¹³ studied Esmolol and its effects on hemodynamics and concluded that Esmolol is highly effective in controlling the stress response. Lee TY¹⁴ et al Studied four groups of patients, normal saline as control and lidocaine 2 mg/kg, fentanyl 3 microgram/kg and Esmolol 2 mg/kg and concluded that only Esmolol could reliably offer protection against the increase in both HR and SBP. In our study same response was found with 1.5mg/kg.Ebert JP et al¹⁵ advocated use of Esmolol with a loading dose of 500 microgram/kg/min followed by maintenance dose of 300 microgram/kg/min for controlling the stress response to intubation. Parnass et al⁵concluded that single dose of Esmolol controls the response of intubation effectively.

In recent researches many drugs have been used to compare the effect and hemodynamic stability during intubation. Present study was conducted to establish the effect of Esmolol and efficacy of the same as attenuating agent for response to intubation. Our observation are also in agreement with the other workers who used to achieve attenuation. Hence it can be concluded that IV Esmolol is effective and superior to other drugs which have been thoroughly investigated.

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