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EFFECTS OF DIFFERENT DOSES OF ESMOLOL ON HEMODYNAMICS DURING LARYNGOSCOPY AND INTUBATION

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ABSTRACT

Expert airway management is an essential skill in anaesthetic practice because direct laryngoscopy and endotracheal intubation is associated with reflex cardiovascular responses mediated by the sympathetic nervous system. The harmful effects of laryngoscopy and intubation are well tolerated by healthy people, but hemodynamic stability is important in patients with cardiovascular or neurosurgical diseases undergoing anesthesia. Various groups of drugs can be used for attenuation of intubation stress response. Esmolol is an ultra short acting β blocker with rapid onset of action. Hence, in this study we compared the efficacy of two bolus dose of Esmolol in attenuating hemodynamic stress response during direct laryngoscopy and endotracheal intubation. A prospective comparitive study was done with 2 groups of 32 patients each presenting for elective surgery requiring general anaesthesia. Group A received intravenous Esmolol 0.5 mg/kg and Group B received intravenous Esmolol 1mg/kg, 2 minutes before intubation. Hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded before induction (baseline), 2 minutes, 4 minutes, and 6 minutes intervals after intubation. It was found that there was a significant reduction in hemodynamic response to laryngoscopy and intubation in both groups who received Esmolol. Furthermore, in Group B who received Esmolol 1mg/kg, had a better attenuation of hemodynamic stress response when compared to Group A, who received Esmolol 0.5mg/kg. Therefore it can be stated that Esmolol is an efficient drug to attenuate hemodynamic stress response following laryngoscopy and intubation, especially when its given at a dose of 1mg/kg, 2 minutes prior to intubation.

KEYWORDS: Esmolol; Hemodynamic; Stress response; Laryngoscopy; Intubation.

I. INTRODUCTION

Of all general anaesthetic techniques of present day, the most popular one is endotracheal intubation after giving inducing agents and muscle relaxants. This technique was first introduced by Sir William Macewan, a Scottish surgeon in 1880. Kirstein used laryngoscope for this purpose in 1895. In 1940, Reid and Brace[1] first described hemodynamic response to laryngoscopy and intubation. The induction of anaesthesia, laryngoscopy and intubation and surgical stimulation often evoke cardiovascular response characterized by alterations in systemic arterial pressure, pulse rate and cardiac rhythm and a transient rise in central venous pressure.

Prof. King et al (1951)[2] documented myocardial ischemic changes due to reflex sympathoadrenal response immediately following laryngoscopy and intubation with a mean rise in systemic pressure of 40 mm Hg even in normotensive individuals. The response following laryngoscopy and intubation peaks at 1.2 minute and returns to normal within 5 – 10 minutes. These reflex responses are mediated by increased sympathetic nervous system activity. Later this was confirmed by catecholamine level assays.

Furthermore, it has been thought that sympathetic stimulation due to laryngoscopy and intubation may causes increment of the plasma parathyroid hormone (PTH) and decrement of plasma calcium[3] Even though these transient haemodynamic responses were of little significance to normal healthy patients, this could be life threatening to certain patients; especially hypertensive patients with impending cardiac failure, patients with ischemic heart disease, aortic or cerebral aneurysm or raised intra cranial pressures.

Various attempts were made to attenuate these haemodynamic responses to intubation. The agents used include lignocaine, opioids, calcium channel blockers, inhalational agents, nitroglycerine, captopril, adenosine,

magnesium sulphate, gabapentin, labetalol and β blockers. β adrenergic blockers are among the most desirable agents to attenuate cardiac responses to laryngeal stimulation. Of the various β adrenergic blockers, esmolol is an attractive option due to its β1 (cardioselective) blocking properties. All of these strategies target various levels in the pathway of sympathetic reflex- a) blocking of afferent pathway by topicalisation or local anaesthetic infiltration, b) central mechanism blocked by opioids and alpha 2 agonists and c) efferent pathway and effector site blockage by beta blockers, calcium channel blockers and intravenous lignocaine.

An ideal agent must not only blunt cardiovascular responses but also fulfill the following goals. It should be time efficient, appropriate for all patient groups, prevent patient awareness and should not interfere with the duration and type of anaesthesia as well as recovery of the patient. But, the search for such an ideal agent has been an unending process.

Esmolol is an ultra short-acting β1- adrenoceptor antagonist to attenuate sympathetic response related to laryngoscopy and intubation related adrenergic responses depending on the dose. It is rapidly cleared by red blood cell esterases when administered parenterally. Thus it has a rapid onset and short duration of action. It also has negative chronotropic, inotropic and dromotropic effects. By blocking the beta adrenergic receptors of the sympathetic nervous system, it counteracts the effects of released catecholamines. It suppresses the central nervous system activity and cardiovascular changes during laryngoscopy and tracheal intubation. It also helps in decreasing the dose of anaesthetics used to maintain sufficient depth of anaesthesia and also prevents arousal reactions.[41,42] Several studies have been done on different doses of Esmolol and the pressor response was found to be suppressed effectively without detrimental effects.[22,23,43,44] It has been used for attenuating the pressor response to laryngoscopy and intubation using different bolus and infusion dosage schedules.

This study was devised to assess the efficacy of single bolus dose of esmolol in attenuating the pressor response and to compare the efficacy of two different bolus doses of esmolol for the same.

II. MATERIALS AND METHODS

- **Study setting:** Department of Anaesthesiology, Government Medical College, Thrissur, Kerala, India.
- **Study design:** Prospective comparitive study.
- **Study population:** Patients undergoing various surgeries in the operation theatre of Government Medical college, Thrissur.

- **Inclusion criteria**

1) ASA I and II patients
2) Age 25-60 years
3) Elective cases requiring general anaesthesia

- **Exclusion criteria**

1) Patients anticipated with difficult airways
2) Patients contraindicated to Esmolol
3) Patients already on beta-blockers
4) Emergency surgeries
5) Patients with cardiovascular diseases

- **Sample size calculation**

Sample size (n) is calculated by the formula

$$n = (Z_{1-\alpha/2} + Z_{1-\beta})^2 (\sigma_1^2 + \sigma_2^2/r) / (\mu_1 - \mu_2)^2$$

Where, Alpha (α): 0.05

Beta (β): 0.2

Mean of group1 (μ_1): 79.9

Standard deviation of group1 (σ_1): 3.5

Mean of group 2(μ_2): 77.7

Standard deviation of group 2(σ_2): 2.7

Ratio(group A/group B): 1

Sample size for group A: 32

Sample size for group B: 32

***** Group A (Esmolol 0.5 mg/kg) = 32 patients received Esmolol 0.5 mg/kg IV 2 minutes before intubation.

***** Group B (Esmolol 1 mg/kg) = 32 patients received Esmolol 1mg/kg IV 2 minutes before intubation.

- **Study procedure:** A patient will be included in the study only once the inclusion & exclusion criteria are met. All patients underwent routine pre anaesthetic evaluation and were optimized prior to anaesthesia. Routine and specific investigations were done. All patients had nil per oral for at least 8 hours prior to surgery and received Tab. Metoclopromide 10 mg HS, Tab. Ranitidine 150 mg HS and on the morning of surgery and Tab. Alprazolam 0.5 mg HS. The details about the study were explained to all patients and informed written consent taken. Social and demographic details were recorded. Morning investigations were confirmed to be normal. Peripheral intravenous lines were secured in the preoperative holding area and patient was shifted to the operation theatre. Pulseoximeter, Electrocardiogram, End tidal CO2 and Non-invasive blood pressure monitoring were done inside the operating room.

Baseline systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and heart rate were recorded before anaesthetic induction. Premedication was given with Inj. Midazolam 0.04mg/kg IV, Inj. Ondansetron 0.1mg/kg slow IV, Inj. Glycopyrrolate 0.005mg/kg and Inj. Fentanyl 2mcg/kg. As specified in the protocol, a senior Anaesthesiologist who is not involved in the study was observed while giving an intravenous bolus dose of Injection Esmolol 0.5mg/kg body weight to group A(n=32) and 1mg/kg body weight to group B(n=32) diluted to 10ml with

normal saline at least 2 minutes before intubation. After pre oxygenation with 100% oxygen for 3 minutes, induction of anaesthesia was done with Inj. Thiopentone sodium 5 mg/kg. After securing the mask ventilation, Inj. Vecuronium Bromide 0.1mg/kg body weight was administered intravenously. Mask ventilation with 100% oxygen was continued for 3 or more minutes in order to time the endotracheal intubation. Vitals were recorded before and after the administration of drugs. Direct laryngoscopy was done with Macintosh laryngoscope blade and trachea was intubated with appropriate sized oral cuffed endotracheal tube.

Anaesthesia was maintained intra-operatively with Oxygen, Nitrous Oxide and Isoflurane at 33%, 66% and 0.2-1% respectively. Neuromuscular blockade was maintained with incremental doses of Inj. Vecuronium 0.02 mg/kg IV. After intubation, till conclusion of surgery and reversal of anaesthesia, both continual and continuous monitoring of ECG, NIBP, SpO2, EtCO2, RR was done. At the end of surgery, the residual effects of muscle relaxant were reversed with Glycopyrrolate (0.01mg/kg) and Neostigmine (0.05mg/kg) combination. Any peri-operative and intra-operative complications were recorded. Heart rate, systolic blood pressure and mean arterial blood pressure (non-invasive) were recorded specifically for my study.

- **Statistical analysis**

All the statistical analysis were done using IBM SPSS Statistics Version 26. All the categorical variables were presented as in frequency or in percentage. All the measurable variables will be presented as mean ± SD or Median (Q1-Q3). Independent sample t test was applied to compare mean of continuous parameters like age, weight, HR, SBP, DBP and MAP at different time points between two groups.

Mann Whitney U test was applied to compare median of percentage reduction of HR, SBP, DBP and MAP from baseline to different time points in between two groups. Paired sample-t test was applied to find the significant difference in the mean parameters from baseline to different time points within group. Pearson chi square test was applied to compare sex and ASA between groups. All the statistical test were two tailed. A p-value <0.05 was considered as statistically significant.

Expected outcome of the study

1. It is expected that the rise in hemodynamic parameters such as heart rate and rhythm, systolic and diastolic blood pressure, could be attenuated by the administration of bolus dose of esmolol before laryngoscopy and intubation.
2. Also, of the two doses, esmolol 1 mg/kg has a better potential in attenuation of hemodynamic responses following laryngoscopy and intubation.

Ethical concerns

Institutional ethics committee clearance will be obtained before the commencement of the study. Confidentiality will be ensured and maintained throughout the study. Written informed consent will be obtained from patients participating in the study.

III. RESULTS AND OBSERVATIONS

A total of 64 patients were recruited with 32 in each group.

Comparison of age

Table 2: Comparison of mean age among groups.

Group	Number	Age	p-value
		Mean ± SD	
A	32	45.69 ± 11.91	0.272
B	32	42.78 ± 8.86	

The mean age of Group A was 45.69 ± 11.91 years and in group B was 42.78 ± 8.86 years. There is no significant difference in the mean age between two groups. Groups are comparable with respect to age (p-value - 0.272).

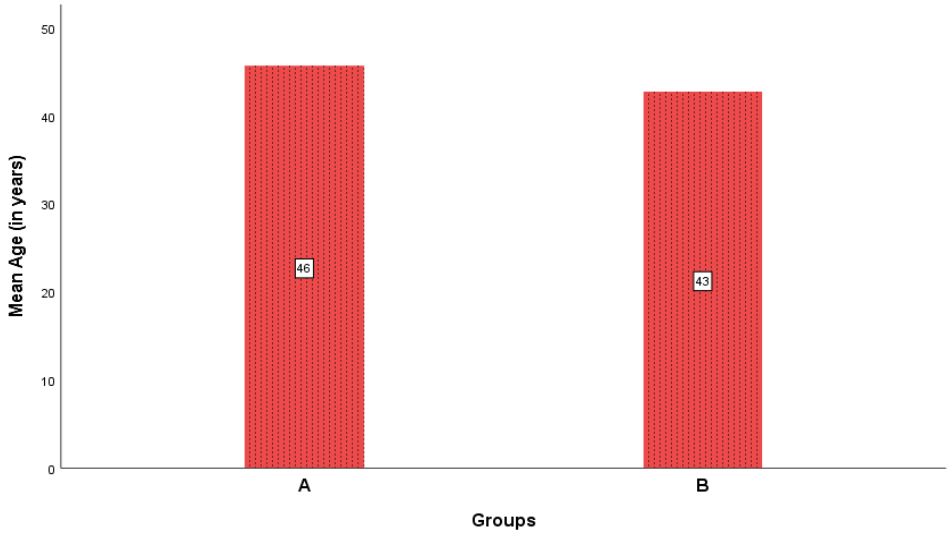

Figure 5: Bar diagram of mean age among two groups.

Table 3: Comparison of Sex among groups.

Sex	Group				p-value
	A		B		
	No	%	No	%	
Female	20	62.5	13	40.6	0.08
Male	12	37.5	19	59.4	
Total	32	100	32	100	

In our study, 32 patients in Group A 20 (62.5%) were female and 12 (37.5%) were male. In Group B 13 (40.6%) were female and 19 (59.4%) were male. However, there is no significant difference in the proportion of sex between two groups. Groups are comparable with respect to sex (p-value – 0.080)

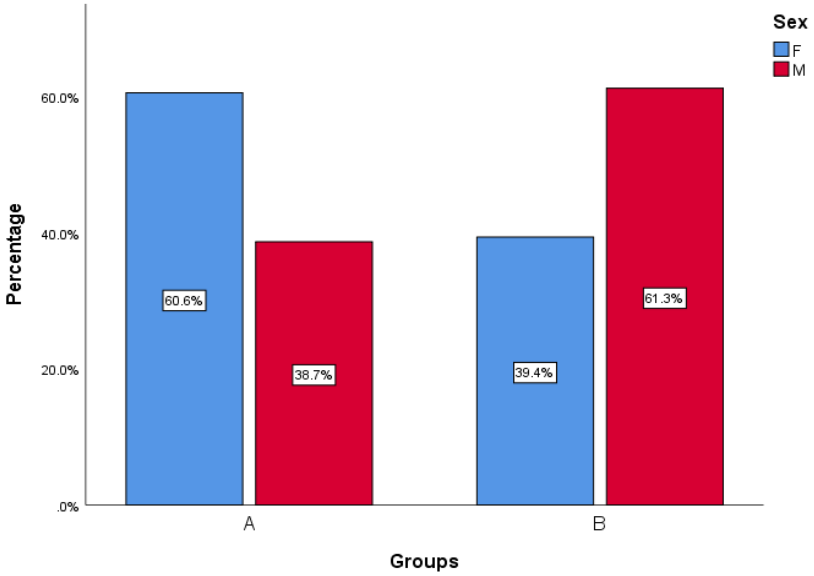

Figure 6: Multiple Bar diagram of Sex among groups.

Table 4: Comparison of classification of ASA between Groups.

ASA	Groups				p-value
	A		B		
	No	%	No	%	
I	14	43.8	17	53.1	0.453
II	18	53.1	15	46.9	
Total	32	100	32	100	

In Group A, 14 (43.8%) were ASA classification I and 18 (53.1%) were ASA classification II. In Group B, 17(53.1%) were ASA classification I and 15 (46.9%) were ASA classification II. ASA classification among the two groups is comparable (p-value – 0.453).

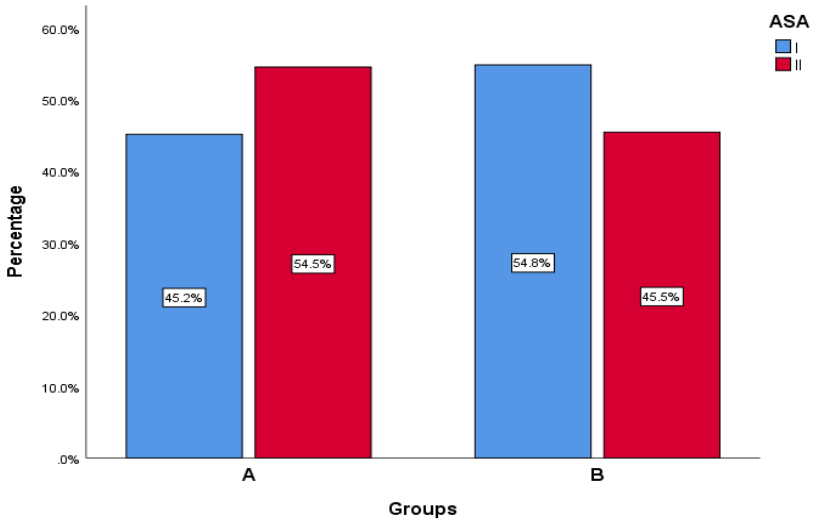

Figure 7: Bar diagram of comparison of ASA among Groups.

Table 5: Comparison of mean weight among Groups.

Group	N	Weight in Kg	p-value
		Mean ± SD	
A	32	57.78 ± 8.06	0.076
B	32	61.06 ± 6.37	

The mean weight of Group A was 57.78 ± 8.06 Kg and in Group B was 61.06 ± 6.37 Kg. There is no significant difference in the mean weight between two groups. Groups are comparable with respect to weight (p- value – 0.076).

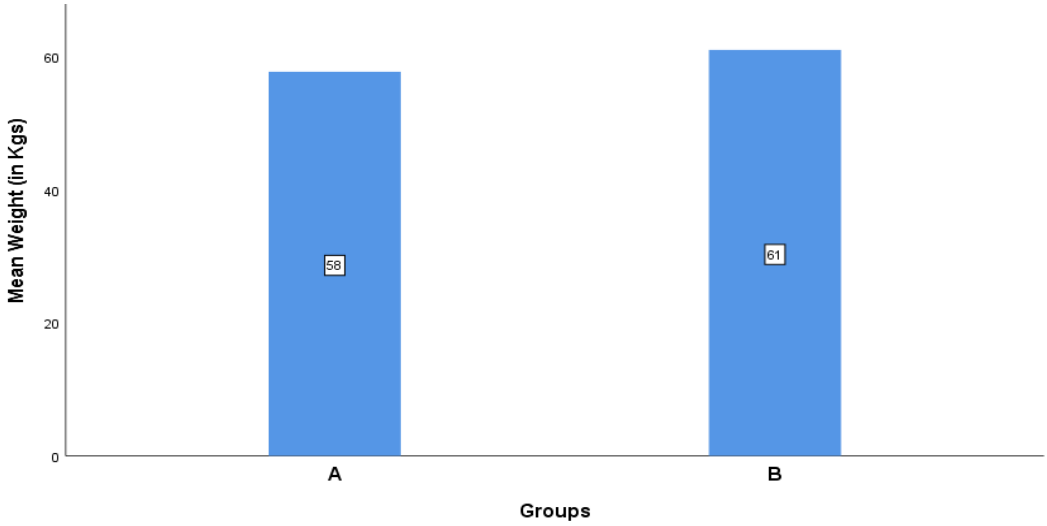

Figure 8: Bar diagram of mean weight among groups.

Heart rate

Table 6: Comparison of mean Heart Rate (HR) among groups.

Heart rate	Groups		p-value
	A	B	
	Mean ± SD	Mean ± SD	
Baseline	94.09 ± 14.49	81.00 ± 6.77	<0.001
After Premed	91.5 ± 12.96	77.25 ± 6.58	<0.001

Esmolol	88.44 ± 13.74	72.66 ± 6.25	<0.001
Induction	85.53 ± 12.65	70.25 ± 6.22	<0.001
Intubation (2 Mins)	83.75 ± 11.42	67.78 ± 6.76	<0.001
4 Mins	82.75 ± 9.95	64.56 ± 6.13	<0.001
6 Mins	81.81± 10.55	61.97 ± 6.72	<0.001

There was statistically significant difference in mean Heart Rate between group A and Group B at the time points baseline, after premed, Esmolol, induction, intubation at 2 minutes, 4 minutes and 6 minutes.

At all-time points, mean heart rate were significantly higher in Group A than Group B (all p-value is <0.001) (Table:6 and Figure 9).

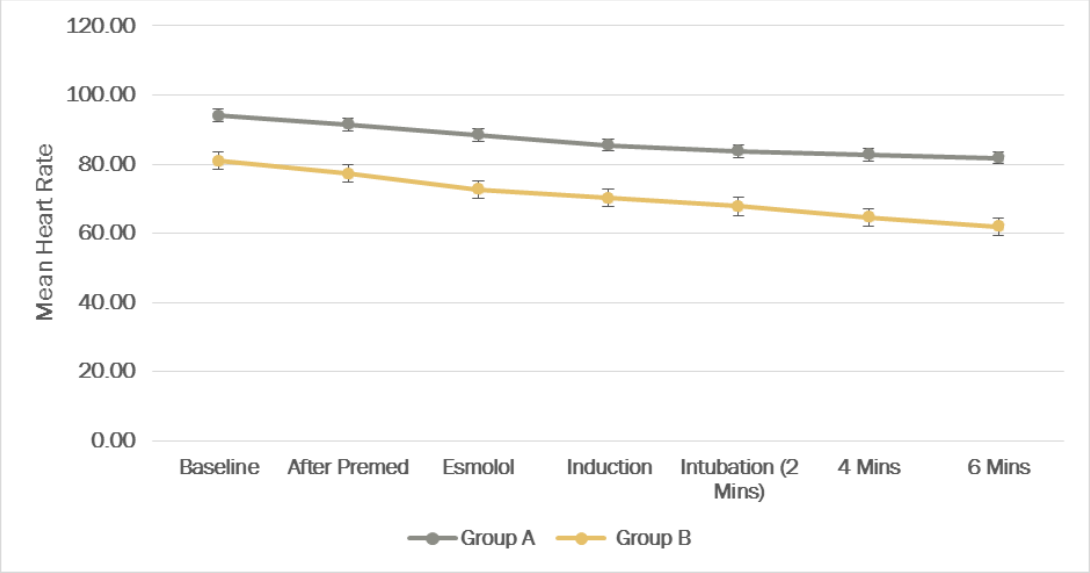

Figure 9: Line diagram of mean HR at different time points between groups.

Table 7: Comparison of mean percentage reduction of Heart Rate (HR) from baseline to different time points in between groups.

Percentage reduction of HR from Baseline to	Groups				p-value
	A		B		
	Mean ± SD	Median (Q1 - Q3)	Mean ± SD	Median (Q1 - Q3)	
After Premed	2.40 ± 5.33	3.21 (1.79 - 5.86)	4.56 ± 4.09	4.50 (2.44-6.94)	0.197
Esmolol	5.57 ± 9.11	5.72 (2.34 - 9.76)	10.06 ± 7.04	10.36 (7.63 - 12.87)	0.002
Induction	8.64 ± 8.71	9.76 (5.55 - 14.06)	13.22 ± 3.09	14.20 (10.48-16.23)	0.200
Intubation (2 Mins)	10.36 ±8.62	11.80 (5.79- 14.92)	16.28 ± 5.11	16.67 (12.67 -20.84)	0.002
4 Mins	10.99± 11.37	15.23 (5.64 - 16.67)	20.22 ± 4.76	19.87 (17.09-23.46)	<0.001
6 Mins	12.03 ±12.00	16.67 (7.85- 19.73)	23.42 ± 5.86	23.53 (19.00 - 27.60)	<0.001

There was statistically significant difference in median value of percentage reduction of heart rate between two groups during all the time points except at the time point after premed (p-value 0.197) and Induction (p-value 0.2) . As compared to group A, group B shows a high significant reduction in heart rate from baseline to all other time points (Table:7 and Figure 10).

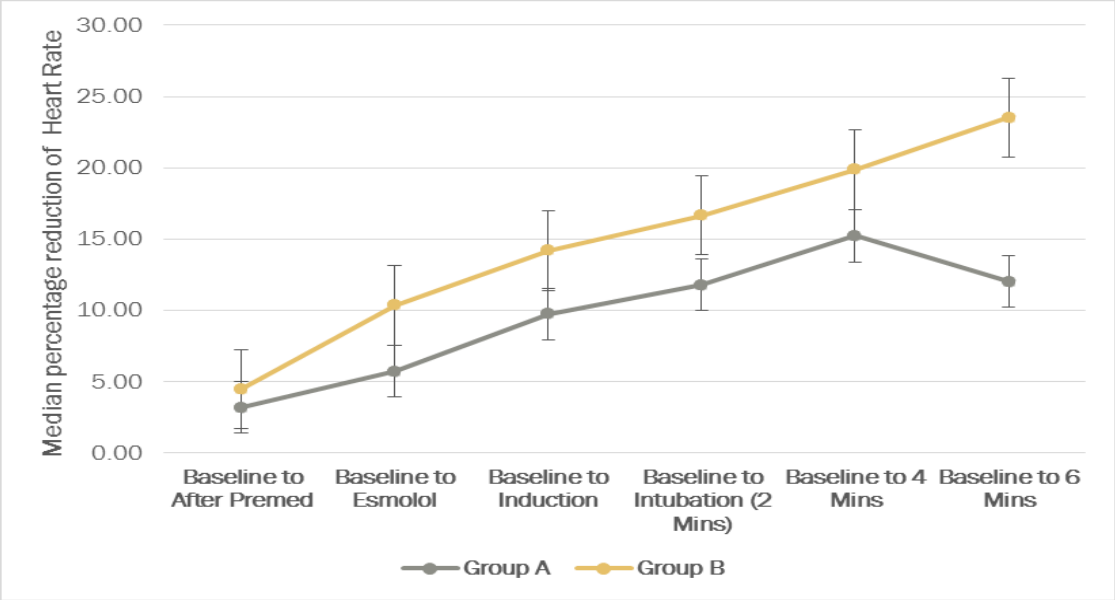

Figure 10: Line diagram of mean percentage reduction of heart rate from baseline to different time points between group.

Systolic blood pressure

Table 8: Comparison of mean Systolic Blood Pressure (SBP) among groups.

SBP	Groups				p-value¶
	A		B		
	Mean ± SD	p-value*	Mean ± SD	p-value*	
Baseline	140.22 ± 9.47	-	130.03 ± 11.71	-	0.462
After Premed	137.28 ± 13.22	0.025	125.13 ± 8.92	<0.001	<0.001
Esmolol	124.38 ± 12.65	<0.001	119.19 ± 7.07	<0.001	0.048
Induction	121.09 ± 11.93	<0.001	115.06± 6.21	<0.001	0.015
Intubation (2 Mins)	119.53 ± 9.94	<0.001	113.5 ± 6.78	<0.001	0.006
4 Mins	118.86 ± 7.91	<0.001	112.03± 6.78	<0.001	0.001
6 Mins	118.22 ± 6.07	<0.001	108.75 ± 8.44	<0.001	<0.001

**- within group comparison, ¶ - between group comparison*

There is no statistical significant difference in baseline Systolic Blood Pressure between two groups (p-value 0.462). There is a statistically significant difference in mean Systolic Blood Pressure between group A and Group B at the time points after premed (p-value <0.001), esmolol (p-value- 0.048), induction (p-value 0.015), intubation at 2 minutes (p-value – 0.006), 4 minutes (p-value-0.001) and 6 minutes (p-value - <0.001). At all-time points, mean systolic blood pressure were significantly higher in Group A than Group B except at baseline. Within Group A and Group B there is significant reduction in mean SBP from baseline to different time points. Group B shows a significant reduction of SBP than Group A. (Table 8 and Figure 11).

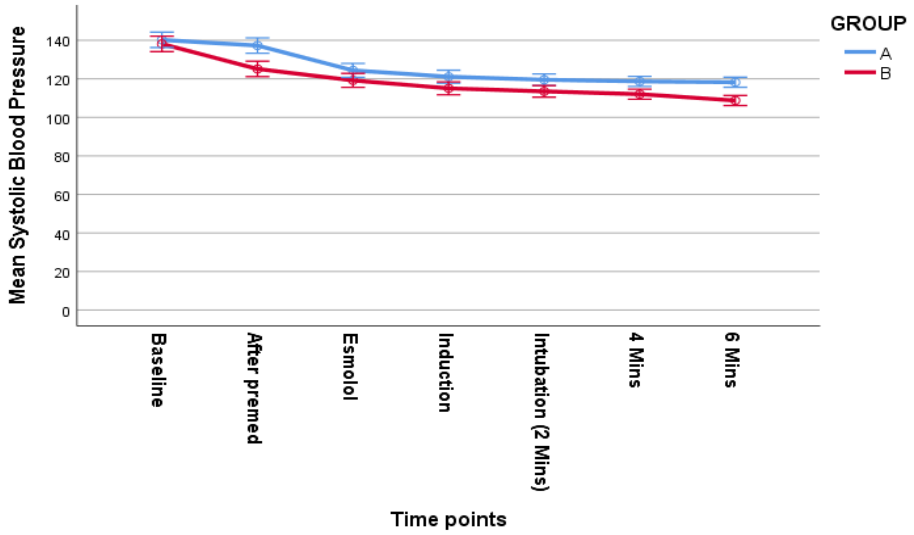

Figure 11: Line diagram of mean SBP between groups.

Diastolic blood pressure

Table 9: Comparison of mean diastolic Blood Pressure (DBP) among groups.

DBP	Groups				p-value ¶
	A		B		
	Mean ± SD	p-value*	Mean ± SD	p-value*	
Baseline	82.88 ± 8.45	-	74.56 ± 9.59	-	0.204
After Premed	81.81 ± 9.96	0.486	72.59 ± 7.02	<0.001	<0.001
Esmolol	75.88 ± 10.24	<0.001	70.13 ± 6.21	<0.001	0.009
Induction	72.19 ± 10.43	<0.001	68.53 ± 7.73	<0.001	0.116
Intubation (2 Mins)	71.09 ± 9.97	<0.001	66.72 ± 6.57	<0.001	0.043
4 Mins	70.56 ± 8.96	<0.001	65.61 ± 8.04	<0.001	0.032
6 Mins	70.03± 7.13	<0.001	63.81 ± 8.61	<0.001	0.003

**- within group comparison, ¶ - between group comparison*

There is no statistical significant difference in mean Diastolic Blood Pressure between two groups at the time point of baseline (p-value 0.204) and induction(0.116). There was a statistically significant difference in mean Diastolic Blood Pressure between group A and Group B at the time points after premed (p-value <0.001), Esmolol(p-value- 0.009), intubation at 2 minutes(p-value – 0.043),4 minutes(p-value-0.032) and 6 minutes (p-value - <0.003). At all-time points, mean diastolic blood pressure were significantly higher in Group A than Group B except at baseline. Within Group A and Group B there is significant reduction in mean DBP from baseline to different time points except after premed in Group A (p-value 0.486). Group B shows a significant reduction of DBP than Group A. (Table 9 and Figure 12).

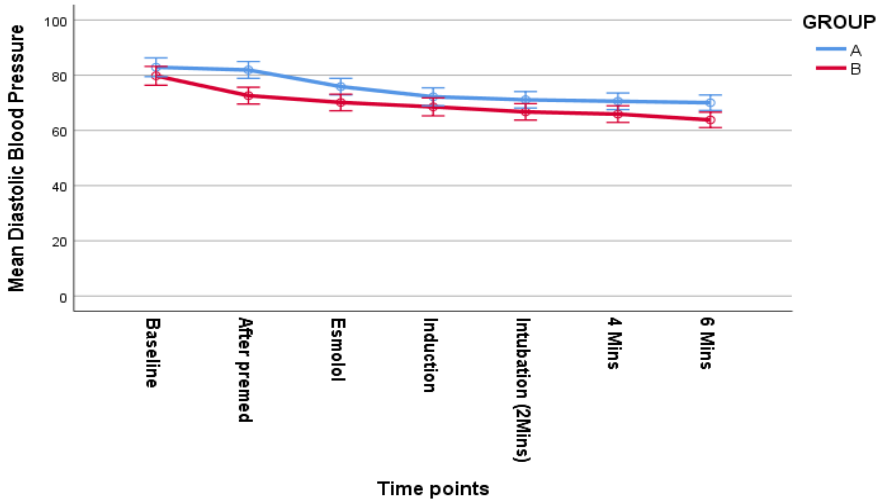

Figure 12: Line diagram of mean DBP between groups.

Mean arterial pressure

Table 10: Comparison of mean Mean Arterial Pressure (MAP) among groups.

MAP	Group				p-value¶
	A		B		
	Mean ± SD	p-value*	Mean ± SD	p-value*	
Baseline	101.65± 7.91	-	92.75 ± 9.07	-	0.158
After Premed	100.68 ± 10.42	0.413	89.56 ± 6.91	<0.001	<0.001
Esmolol	91.97 ± 10.07	<0.001	86.34 ± 6.80	<0.001	0.011
Induction	88.47 ±10.16	<0.001	83.94 ± 6.31	<0.001	0.037
Intubation (2 Mins)	87.16 ± 9.36	<0.001	82.31 ± 5.98	<0.001	0.017
4 Mins	86.68 ± 7.97	<0.001	81.22 ± 6.48	<0.001	0.004
6 Mins	86.03 ± 6.11	<0.001	78.06 ± 8.00	<0.001	<0.001

*- *within group comparison*, ¶ - *between group comparison*

There is no statistical significant difference in baseline Mean Arterial Pressure between two groups (p-value 0.158). There was a statistically significant difference in mean Mean Arterial Pressure between Group A and Group B at the time points after premed (p-value <0.001), Esmolol (p-value- 0.011), induction (p-value 0.037), intubation at 2 minutes (p-value – 0.017), 4 minutes (p-value-0.004) and 6 minutes (p-value -<0.001). At all-time points, mean Mean Arterial Pressure were significantly higher in Group A than Group B except at baseline. Within Group A and Group B there is significant reduction in mean MAP from baseline to different time points except after premed in Group A (p-value- 0.413). Group B shows a significant reduction of MAP than Group A ((Table 10 and Figure 13).

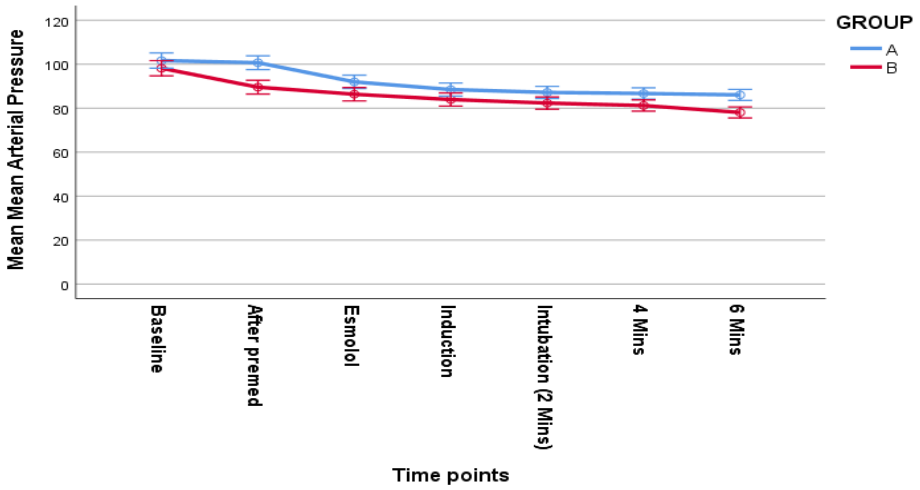

Figure 13: Line diagram of mean MAP between groups.

IV. DISCUSSION

Laryngoscopy and endotracheal intubation leads to hemodynamic stress response characterised by tachycardia and hypertension, which is due to the involvement of sympathetic discharges triggered by stimulating the epipharynx and laryngopharynx.[27] This is hazardous especially in patients with cardiac and vascular pathologies. In patients with raised intracranial pressure, this may produce transient impairment of cerebral perfusion. Direct laryngoscopy[28] not exceeding more than 15 seconds duration is helpful in minimizing the blood pressure elevation evoked by this painful stimulus. Esmolol hydrochloride is an ultrashort acting, beta-one selective blocker with a distribution half-life of two minutes.[27] Esmolol is quite useful for a short-lived stress such as tracheal intubation, organ manipulation like handling adrenal and thyroid gland and extubation. Administration of esmolol by bolus and infusion has been found to be effective in blunting the haemodynamic effects of laryngoscopy and intubation[31] as well as intra-operative[32] and postoperative[33] stresses.

There were two groups of 32 patients each in the study. Group A received intravenous Esmolol 0.5mg/kg body weight and group B received Esmolol 1mg/kg body weight, 2 minutes before intubation for attenuation of stress response to intubation. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and rate pressure product were recorded before induction, 2 minutes, 4 minutes, 6 minutes intervals after induction.

In this study, there were no statistically significant differences in the age and gender among the participants of the three groups indicating comparability between the groups. Similarly, no significant difference was observed in the weight of the participants of the three group. On considering the hemodynamic parameters, our study demonstrated significant reduction in the heart rate, systolic BP, diastolic BP and mean arterial pressure in both groups compared to the baseline values but the percentage reduction was more shown in the group that received Esmolol 1 mg/kg. Feng et al.[34] used esmolol at a dose of 2 mg/kg in their study and proved that it was better at reducing the heart rate and blood pressure during laryngoscopy and intubation in comparison to the other drugs used in the study. Sheppard et al[4] (1990) compared different bolus dose of Esmolol and concluded that attenuation of intubation response is adequate following 100 mg of Esmolol.

Heart rate

There was statistically significant difference in mean Heart Rate between group A and Group B. At all-time points, mean heart rate were significantly higher in Group A than Group B (all p-value is <0.001). This proves the efficacy of esmolol in attenuating the pressor response to laryngoscopy and intubation. This is consistant with the results obtained by the Canadian multicentric trial in 1991 carried out by Miller RD et al.[5] and a randomized double blind placebo controlled study by Sharma S et al. conducted at PGI Chandigarh, India(1996 August).[38]

Systolic and Diastolic blood pressure

There is a statistically significant difference in mean Systolic Blood Pressure between group A and Group B at the time points after premed (p-value <0.001), Esmolol (p-value- 0.048), induction (p-value 0.015), intubation at 2 minutes (p-value – 0.006), 4 minutes (p-value-0.001) and 6 minutes (p-value - <0.001). At all-time points, mean systolic blood pressure were significantly higher in Group A than Group B except at baseline. Within Group A and Group B there is significant reduction in mean SBP from baseline to different time points. Group B shows a significant reduction of SBP than Group A.

This is consistant with the study by Reves JG et al.[35] The study by Liu PL et al. also showed significant

(p<0.05) attenuation of the systolic blood pressure response to laryngoscopy and intubation.[36] Statistically significant decrease in systolic blood pressure response to laryngoscopy and intubation was also demonstrated in the study by Zargar JA et al.[37] There was a statistically significant difference in mean Diastolic Blood Pressure between group A and Group B at the time points after premed (p-value <0.001), Esmolol (p-value- 0.009), intubation at 2 minutes (p-value – 0.043), 4 minutes (p-value-0.032) and 6 minutes (p-value - <0.003). At all-time points, mean diastolic blood pressure were significantly higher in Group A than Group B except at baseline. Group B shows a significant reduction of DBP than Group A.

This is consistant with the studies by Ghaus MS et al,[38] Sharma S et al. and the meta-analysis by Figueredo E et al.[39] which showed effective blunting of the pressor response following laryngoscopy and intubation. In a study by Susan T. Cheeran, Elizabeth Joseph[40] where they compared attenuation of stress response by two doses of Esmolol(1mg/kg and 2 mg/kg) found that difference in diastolic blood pressure response between the two esmolol groups (1mg/kg group and 2 mg/kg group) was not statistically significant.

Mean arterial pressure

Group A and B did not show any increase in MAP, which shows the efficacy of Esmolol in attenuating the mean arterial pressure response to laryngoscopy and intubation. At all-time points, mean arterial pressure were significantly higher in Group A than Group B except at baseline. Group B shows a significant reduction of MAP than Group A showing that a higher dose was necessary for attenuating the mean arterial pressure response to laryngoscopy and intubation. This is supported by the study by Kovac AL et al.[41]

Yuan L, Chia YY (1994)[12] studied the efficiency of bolus dose Esmolol in blunting the stress response comparing 100 mg Esmolol versus 200 mg Esmolol and concluded that both bolus dose of Esmolol could effectively attenuate the increase the heart rate, hypertension produced by laryngoscopy and intubation, furthermore, Esmolol 200 mg presented a better hemodynamic stability than100 mg Esmolol. In our study Esmolol 1mg/kg provided better hemodynamic control than Esmolol 0.5 mg/kg bolus.

Limitations of the study include study design as a randomised controlled trial would be an appropriate study design to see the effectiveness of a drug and its long term outcomes. Plasma level of catecholamines would be more appropriate marker for assessing effectiveness of drug.

V. CONCLUSION

This study was carried out to determine the efficacy of bolus doses of esmolol in attenuation of hemodynamic stress response during laryngoscopy and intubation when administered prior to the procedure. This study also aimed at determining which dose of Esmolol would better decrease the pressor response to laryngoscopy and intubation. The results clearly confirm that both the doses offset the pressor response to laryngoscopy and intubation. But the attenuation of the pressor response is far greater with Esmolol 1 mg/kg when compared to Esmolol 0.5mg/kg.

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