



A CLINICAL COMPARATIVE STUDY TO ASCERTAIN EFFICACY OF ESMOLOL AND FENTANYL IN ATTENUATION OF HEMODYNAMIC RESPONSE DURING LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION

Anaesthesiology

Dr Jayanta Padun Assistant Professor, Department of Anaesthesiology & Critical Care, Jorhat Medical College & Hospital, Jorhat, Assam, India- 785001

Dr. Joyanta Kr. Choudhury* Associate Professor, Department of Anaesthesiology & Critical Care, Jorhat Medical College & Hospital, Jorhat, Assam, India- 785001 *Corresponding Author

ABSTRACT

Aim of the Study: To compare efficacy of Esmolol and Fentanyl in attenuation of hemodynamic response during laryngoscopy and endotracheal intubation.

Materials and Methods: 50 adult patients were randomly allocated into two Groups, Group E received 0.2mg/kg body weight of iv Esmolol and Group F received 2µg/kg iv Fentanyl, 5 minutes before intubation.

Results and Observations: Bolus dose of Esmolol 0.2 mg/kg and Fentanyl 2µg/kg administered 5 minutes before laryngoscopy and endotracheal intubation can effectively reduce the hemodynamic response associated with it. Esmolol and Fentanyl both can provide effective and reliable protection against such cardiovascular responses but cannot abolish it. Observed variance in heart rate, systolic pressure, diastolic pressure and mean arterial pressure during induction, intubation and 1,5,10 min post intubation are comparable across both the groups.

Conclusion: Esmolol and Fentanyl both can provide effective and definitive protection against hemodynamic response associated with laryngoscopy and endotracheal intubation when administered 5 minutes before laryngoscopy.

KEYWORDS

Hemodynamic response, laryngoscopy, Esmolol, Fentanyl.

INTRODUCTION

Laryngoscopy and intubation invariably cause an adrenergic stress response manifested by tachycardia & hypertension which is transient and inoffensive in patients with normal cardiovascular status, but can be dangerous in patients with pre-existing hypertension, valvular heart disease, coronary artery disease, cerebrovascular disease etc. Such events can be avoided with the use of various pharmacological agents available in our arsenal.

Various pharmacological agents have been tried before induction to attenuate this haemodynamic stress response but no single drug could be established as most appropriate due to drug specific limitations. Esmolol, an ultra short acting cardioselective β -blocker has the potential to attenuate and obtund these transient stress responses. Fentanyl a short acting opioid analgesic is very effective in attenuating the cardiovascular responses by inhibiting the catecholamine release during laryngoscopy and intubation.

AIM

The objective of this study is to compare IV Esmolol (0.2mg/kg) and IV Fentanyl (2µg/kg) administered in a bolus 5 minutes before laryngoscopy and intubation for attenuation of the haemodynamic responses associated with it.

Period of study: between November 2016 to October 2017.

Materials and Methods:

Fifty adult ASA I and II patients of either sex, undergoing non cardiac elective surgery under general anaesthesia were randomly divided into two groups E and group F.

Group - E received Esmolol 0.2 mg/kg IV 5 min before intubation.

Group - F patients were given Fentanyl- 2µg/kg IV 5min before intubation.

The procedure was explained to all the patients and informed consent was obtained

Inclusion criteria:

Age group of 18 and 50 years
All the patients were normotensive with normal heart rate,
Normal ECG, hemoglobin and electrolytes.

Exclusion criteria:

- Heart rate of less than 60 beats per minute
- Systolic blood pressure of less than 100 mm Hg
- Patients having cardiac disease.

- History of asthma
- Hepatic or renal disease
- Ingestion of any beta blocking drug in the past 24 hours

INDUCTION OF ANAESTHESIA

In the operating room baseline parameters like heart rate, systolic, diastolic and mean arterial pressure, SPO₂, were recorded and used for comparative data analysis Study drug was administered intravenously 5 min before laryngoscopy and intubation as per group assigned. In Group E: Injection Esmolol 0.2 mg/kg i.v. and in Group F: Injection Fentanyl 2 µg/kg i.v. was administered 5 min before laryngoscopy. All the patients were premedicated with injection Glycopyrrolate 0.2mg, preoxygenated with 100% oxygen for three minutes and the study drug was administered intravenously five minutes before induction of anaesthesia with inj. Propofol 2.5-3mg/kg. After loss of verbal response and adequacy of mask ventilation, Succinylcholine 1.5 mg/kg was administered to facilitate intubation. Same anaesthetic techniques and medications were used for maintenance of anaesthesia and reversal of residual blockade in both of the study groups.

RESULTS AND OBSERVATIONS:

Heart rate and blood pressure (Systolic, Diastolic and Mean Arterial Pressure) were recorded before administration of study drug, during induction, immediately after intubation, at 1min, 5min & 10 min after intubation. Acquired data was subjected to students't' test as per requirement for statistical analysis and $P < 0.05$ is considered statistically significant.

Table 1 Demographic data of the patients

Characteristics	Group-E Esmolol	Group-F Fentanyl
No of patients	25	25
Mean age (yrs.)	35.12 ± 13.76	35.96 ± 11.47
Mean body wt. (Kg.)	61.08±5.06	62.24±5.41
Sex (M : F)	19 : 6	18 : 7
ASA (I : II)	22 : 3	23 : 2

Demographic data obtained with reference to age, sex, body weight, ASA status and distribution of patients in both the groups are homogeneous.

CHANGES IN HEART RATE

Table 2 CHANGES IN HEART RATE

Parameters	Group	Pre operative	Intubation	1 min	5 min	10 min
Changes in Heart rate	Gr E	89.84 ± 20.60	91.76 ± 15.78	88.56 ± 15.50	83.28 ± 16.23	83.64 ± 16.048
	Gr F	92.84 ± 18.38	93.56 ± 17.16	90.68 ± 15.56	89.6 ± 12.64	87 ± 15.01

In the operation theatre heart rate was recorded just before administration of study drug. Mean \pm SD of heart rates recorded in Group- E, 89.84 \pm 20.60 compared with Group- F 92.84 \pm 18.38, no significant statistical difference was observed across the groups. During Intubation the mean \pm SD of heart rate was Group E 91.76 \pm 15.78 & in Group F 93.56 \pm 17.16. Increase in heart rate from baseline was observed but the difference between the groups is statistically

insignificant. 1min after intubation the mean \pm SD of heart rate was 88.56 \pm 15.50 in Group E & 90.68 \pm 15.56 in Group F. Fall in heart rate was also recorded during induction, intubation, 1, 5 & 10 min post intubation in both the groups, but no significant difference could be demonstrated between the groups, on analysis obtained P-0.1075 suggests insignificant variations at P < 0.05.

CHANGES IN SYSTOLIC BLOOD PRESSURE

Table 3 CHANGES IN SYSTOLIC BLOOD PRESSURE

Systolic BP mmHg Mean SD	Group	Pre operative	induction	Intubation	1min	5 min	10 min
	Gr. E	126.12 \pm 9.71	114.3 \pm 7.36	116.18 \pm 12.77	100.28 \pm 11.54	99.41 \pm 11.62	98.44 \pm 13.07
	Gr. F	124.32 \pm 11.49	116.5 \pm 11.82	117.64 \pm 16.19	106.04 \pm 12.79	105.36 \pm 15.62	98.04 \pm 17.87

In the operation theatre systolic blood pressure was recorded just before administration of study drug. Group E systolic blood pressures with a mean \pm SD of 126.12 \pm 9.71 is compared with Group - F 124.32 \pm 11.49. During induction after injection of the study drug, the mean \pm SD of systolic blood pressures was 114.3 \pm 7.36 in the Group E & 116.5 \pm 11.82 in Group F. At the time of intubation mean \pm SD of systolic blood pressures were 116.18 \pm 12.77 & 117.64 \pm 16.19 in the group E & F respectively.

Systolic pressure variations during induction, intubation 1,5,10 min post intubation were comparable across the groups. Rise in systolic blood pressure during intubation was observed in both the groups but it was limited below the baseline level. Although at 1,5,10 min post intubation a falling trend was observed more with Esmolol than Fentanyl the difference between the groups is not significant (P-0.605) at P < 0.05.

CHANGES IN DIASTOLIC PRESSURE

Table 4 CHANGES IN DIASTOLIC PRESSURE

Diastolic BP mmHg Mean SD	Group	Pre operative	induction	Intubation	1min	5 min	10 min
	Gr. E	80.19 \pm 8.16	74.65 \pm 7.60	78.05 \pm 8.04	84.77 \pm 8.99	89.41 \pm 8.62	88.44 \pm 8.07
	Gr. F	79.77 \pm 9.04	75.9 \pm 6.39	77.08 \pm 7.89	86.88 \pm 8.07	88.36 \pm 7.82	90.04 \pm 8.87

In the operation theatre diastolic blood pressures was recorded just before administration of study drug. Mean \pm SD diastolic blood pressures in Group-E, 80.19 \pm 8.16 and in Group-F, 79.77 \pm 9.04. During induction after injection of the study drug the mean \pm SD of systolic blood pressures was 74.65 \pm 7.60 in the group E & 75.9 \pm 6.39 in Group F. During intubation the mean \pm SD of diastolic blood pressures was 78.05 \pm 8.04 & 77.08 \pm 7.89 in group E & F respectively.

At 1min after Intubation, the mean \pm SD of diastolic blood pressures was 84.77 \pm 8.99 in Group-E, and 86.88 \pm 8.07 in Group-F. At 5 min after intubation mean \pm SD of diastolic blood pressures in Group E was 89.41 \pm 8.62 and in Group F 88.36 \pm 7.82. Diastolic pressure variations during induction, intubation 1,5,10 min post intubation were comparable across the groups, the difference between the groups is not significant (P-0.9170) at P < 0.05.

CHANGES IN MEAN ARTERIAL PRESSURE

Table 5 CHANGES IN MEAN ARTERIAL PRESSURE

MAP Mean SD	Group	Pre operative	Induction	Intubation	1min	5 min	10 min
	Gr. E	94.74 \pm 9.39	87.87 \pm 7.23	93.7 \pm 6.24	92.74 \pm 6.62	91.1 \pm 6.07	90.45 \pm 6.11
	Gr. F	96.3 \pm 7.59	89.43 \pm 6.56	92.87 \pm 6.23	91.7 \pm 6.78	92.7 \pm 6.87	90.81 \pm 6.63

In the operation theatre mean arterial pressures were recorded before administration of study drug. Mean \pm SD of MAP recorded in Group-E, 94.74 \pm 9.39 was compared with Group-F, 96.3 \pm 7.59. During Induction the mean \pm SD of MAP was 87.87 \pm 7.23 & 89.43 \pm 6.56 in Group E & F respectively. During Intubation the recorded mean \pm SD of MAP was 93.7 \pm 6.24 & 92.87 \pm 6.23 in the Group E & F respectively. At 1 min post intubation the mean \pm SD of MAP was 92.74 \pm 6.62 in Group E and 91.7 \pm 6.78 in Group F. The mean arterial pressure variations during induction, intubation 1,5,10 min post intubation were comparable across the groups. On analysis of acquired result (P-0.789) is not significant at P < 0.05.

Yushi et al. concluded that 2 μ g/kg Fentanyl suppresses the hemodynamic response to endotracheal intubation more than the response to laryngoscopy⁸. Fentanyl in bolus dose of 2 μ g/kg before inductions of anaesthesia is effective in attenuating the hemodynamic responses to laryngoscopy and endotracheal intubation⁹. In our study Fentanyl 2 μ g / kg was used 5 minutes before intubation and the efficacy was compared with Esmolol 0.2mg / kg.

DISCUSSION

Laryngoscopy and Intubation stimulates a sympathomimetic response manifested by hypertension, tachycardia and vulnerability to cardiac dysarrhythmias due to increased myocardial oxygen demand and increase in circulating serum catecholamine level. Such effects are short lived yet such hemodynamic stress responses can induce life-threatening situations like left ventricular failure, myocardial ischemia, cerebral hemorrhage and ruptured cerebral aneurysm etc².

Increase in heart rate from baseline was observed during intubation and fall in heart rate was recorded at 1, 5, 10 min after intubation across the groups, but no significant difference could be demonstrated. Esmolol can be considered as good as Fentanyl for attenuation of the heart rate during laryngoscopy & intubation.

The hemodynamic changes that we encounter during laryngoscopy and intubation was first described by Reid and Brace³. Such stimulations are initiated within 5 seconds of direct laryngoscopy and further increases with the passage of the endotracheal tube. It peaks in 1-2 min and returns to normal by 5 min⁴.

Rise in systolic blood pressure during intubation was limited below the baseline level. At 1,5,10 min post intubation, the falling trend was more with Esmolol than Fentanyl.

Diastolic pressure variations during induction, intubation 1,5,10 min post intubation were comparable across the groups but observed rising trend of mean \pm SD of diastolic blood pressures post intubation was more in the Fentanyl group than the Esmolol group.

Esmolol is an ultra short acting β 1 cardio selective, β blocking agent with a short half-life (9 minutes) and its onset of action is very prompt.⁵ Fentanyl 2 μ g/kg significantly attenuated the sympathomimetic response to laryngoscopy at 2 μ g/kg IV given before laryngoscopy and intubation. Optimal time of administration is considered 5 minutes before laryngoscopy and intubation. Fentanyl 6 μ g/kg completely abolishes the pressure responses⁷.

The rise in mean arterial blood pressure observed after intubation in both the groups was limited below the baseline level which was insignificant. On analysis of the obtained data at 1, 5 & 10 minutes after intubation no significant statistical differences could be observed.

Conclusion:

It can be concluded that bolus dose of Esmolol (0.2mg/kg) and Fentanyl (2 μ g/kg) administered 5 minutes before laryngoscopy and endotracheal intubation can effectively reduce the hemodynamic responses associated with it. Esmolol and Fentanyl both can provide effective and reliable protection against such cardiovascular responses but cannot abolish it.

REFERENCES

- (1) Catecholamine response to laryngoscopy and intubation. The influence of three different drug combinations commonly used for induction of anaesthesia. Chraemmer-Jørgensen B, Hertel S, Strøm J, Høiland-Carlsen PF, Bjerre-Jepsen K *Anaesthesia*. 1992 Sep; 47(9):750-6.
- (2) Stress response to tracheal intubation: direct laryngoscopy compared with blind oral intubation. Pernerstorfer T, Krafft P, Fitzgerald RD, Krenn CG, Chiari A, Wagner O, Weinstabl C *Anaesthesia*. 1995 Jan; 50(1):17-22.
- (3) Reid LC, Brace DE. Irritation of respiratory tract and its reflex effect on heart surgery. *Surg Gynaecol Obstet* 1940;70:157-62.
- (4) Henderson J. Airway management in the adult. In: Miller RD, editor. *Miller's Anaesthesia*. 7th ed. Philadelphia: Churchill Livingstone; 2010. p. 1573-610.
- (5) Prys-Roberts C, Foex P, Biro GP, Roberts JG. Studies of anesthesia in relation to hypertension versus adrenergic beta blockade. *Br J Anaesth*. 1973;45:671.
- (6) Menkhaus PG, Reves JG, Kissin I. Cardiovascular effects of Esmolol in anaesthetized humans. *Anaesth Analg*. 1985;64:327.
- (7) Attenuation of the circulatory response to laryngoscopy and intubation by fentanyl. Kautto UM *Acta Anaesthesiol Scand*. 1982 Jun; 26(3):217-21.
- (8) Fentanyl attenuates the hemodynamic response to endotracheal intubation more than the response to laryngoscopy. Adachi YU, Satomoto M, Higuchi H, Watanabe K *Anesth Analg*. 2002 Jul; 95(1):233-7.
- (9) Gupta S, Tank P. A comparative study of efficacy of esmolol and fentanyl for pressure attenuation during laryngoscopy and endotracheal intubation. *Saudi J Anaesth*. 2011;5(1):2-8. Jan-Mar.