

EFFECT OF 0.75mg/Kg ESMOLOL ON PRESSOR RESPONSE DURING LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION: A COMPARATIVE STUDYRoopa Hatti¹, Vinay Patil²**HOW TO CITE THIS ARTICLE:**

Roopa Hatti, Vinay Patil. "Effect of 0.75mg/Kg Esmolol on Pressor Response during Laryngoscopy and Endotracheal Intubation: A Comparative Study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 72, September 07; Page: 12516-12522, DOI: 10.14260/jemds/2015/1802

ABSTRACT: Laryngoscopy and intubation contravene the patient's protective airway reflexes and lead to physiological changes involving various systems of the body. Reflex changes in the cardiovascular system are more marked after laryngoscopy and intubation. Esmolol is an ultra-short acting beta-1 adrenergic blocking drug, with cardio selectivity, rapid onset of action and extremely short elimination half-life. **AIM OF STUDY:** To study the efficacy and safety of attenuation of pressor response during laryngoscopy and tracheal intubation using esmolol, administered in dose of 0.75mg/kg single IV bolus prior to induction of anesthesia. **MATERIALS AND METHODS:** The study was conducted in 50 patients, who were randomly assigned into 2 groups of 25 each. Group A (25) not received any drug and Group B (25) received Inj. Esmolol 0.75mg/kg I.V before induction. **RESULTS:** There was an increase in heart rate and blood pressure in the Group A whereas there was a decrease in blood pressure heart rate in the Group B immediately after intubation and at the end of 4th min. **CONCLUSION:** In this study, the esmolol group showed a decrease in mean values of Heart Rate, Blood Pressure immediately after administration.

KEYWORDS: Esmolol, Intubation, Laryngoscopy, Pressor Response.

INTRODUCTION: Laryngoscopy and intubation contravene the patient's protective airway reflexes and lead to physiological changes involving various systems of the body. Reflex changes in the cardiovascular system are more marked after laryngoscopy and intubation which lead to an average increase in blood pressure by 40 to 50% and 20% increase in heart rate.¹

The quest for effective blockade of these responses has included I.V or topical lidocaine vasodilators, adrenergic blockers, narcotics² and inhalational anesthetics. Narcotics like fentanyl control both heart rate and blood pressure responses, however, complex respiratory depression and truncal rigidity is frequent complications. On the other hand vasodilators and lidocaine provide an incomplete solution controlling hypertension but not affecting heart rate.

Esmolol is an ultra-short acting beta-1 adrenergic blocking drug. Its cardio selectivity, rapid onset of action and extremely short elimination half-life of 9.2±2 minutes makes it a preferred drug. Esmolol achieves peak effect on heart rate within one minute and on blood pressure within two minutes of intravenous injection, which correlates to the time we wait for neuromuscular drugs to produce complete relaxation.

These pharmacokinetic and pharmacodynamic properties make esmolol suitable for administration by either continuous infusion or bolus injection. Initial studies have shown that infusion of esmolol is efficacious in preventing tachycardia and hypertension and in reducing the incidence of myocardial ischemia during the pre-bypass period in patients undergoing coronary artery bypass graft.³

ORIGINAL ARTICLE

It was recognized that Esmolol bolus injection might be a simple and effective alternative to infusion of other drug in situations involving transient hyperdynamic cardiovascular events. Therefore trials are undertaken to determine the efficacy and safety of bolus administration of esmolol for attenuating the hyperdynamic cardiovascular response to tracheal intubation.

Laryngoscopy and tracheal intubation are frequently associated with sympathetic response. Diagnostic laryngoscopy under anaesthesia and endotracheal suctioning are also associated with adverse circulatory changes. Severe hypertension, tachycardia, increase in intracranial pressure can also be seen.

Traction during laryngoscopy or superficial stimulation of airway or passage of tracheal tube into trachea may be associated with reflex sympathetic changes.⁴

Other contributory factors to hypertension and tachycardia like anxiety, baroreceptor-mediated reflex after induction are less important than laryngotracheal stimulation.⁵ Increase in sympathetic and hypothalamo-pituitary adrenal activity is responsible for cardiovascular changes seen with laryngoscopy and tracheal intubation.

These drugs do not produce any marked effect on the normal heart in the subject at rest. In the presence of increased sympathetic tone, however, the β blockade in the heart prevents a rise in heart rate, cardiac output and stroke volume. There is a reduction in myocardial contractility. The automaticity is suppressed and the atrioventricular (AV) conduction is slowed. The cardiac response to exercise and to other situation, in which sympathetic tone is increased, is attenuated. These drugs usually reduce myocardial oxygen requirement and improve exercise tolerance in patients with angina.⁶

AIM OF STUDY: To study the efficacy and safety of attenuation of pressor response during laryngoscopy and tracheal intubation using esmolol, administered in dose of 0.75mg/kg single IV bolus prior to induction of anesthesia.

MATERIALS AND METHODS: This study was carried in Kamineni Hospitals, during the academic year June 2006-June 2008, after getting clearance from the hospital ethics committee.

Inclusion criteria were ASA I and II grade, 18 to 60 age group of both sexes normotensive or controlled hypertensive patients. Exclusion criteria were uncontrolled hypertension, baseline HR<70bpm, right ventricular or left ventricular failure, treatment with adrenergic augmenting or depleting drugs, myocardial infarction in the past 3 months, hyper-reactive airway disease, treatment with other experimental drugs within the last 14 days, heart blocks & arrhythmias.

The study was conducted in 50 patients, who were randomly assigned into 2 groups of 25 each. Informed consent was obtained from each patient under the study.

Group A (25) not received any drug and Group B (25) received Inj. Esmolol 0.75mg/kg I.V before induction.

Patients were pre-medicated the night before surgery with Cap. Omeprazole 40mg, Tab. Alprazolam 0.5mg. Inj. Promethazine hydrochloride 0.5mg/kg & Inj. Tramadol 1mg/kg was given IM 60mins before surgery. On arrival in the operation theatre, a good I.V line was secured.

With the monitors (PULSE OXIMETERY, ECG and NIBP-PHILIPS, Tntelli Vue, MP 40) attached, baseline reading of heart rate (HR), systolic blood pressures (SBP), diastolic blood pressure (DBP) were noted, rate pressure product (RPP) was derived. Inj. Esmolol 0.75mg/kg/, in 20ml Normal saline was administered over 15 seconds as appropriate to the group to which the patient was assigned.

ORIGINAL ARTICLE

Patient was administered with Inj. Midazolam 0.04mg/kg & Inj. Fentanyl 1-2microgms/kg prior to induction. Patient was induced with Inj. Thiopentone 3-5mg/kg. Laryngoscopy and tracheal intubation was done 45-60 seconds after administering inj. Succinylcholine. Anaesthesia was maintained with 50% N₂O, 50% O₂, 0.2% to 0.4% Isoflurane & Inj. Pancuronium 0.08mg/kg (Loading dose). Monitoring of haemodynamic changes were recorded and readings were taken immediately, after 4min and 8min after intubation.

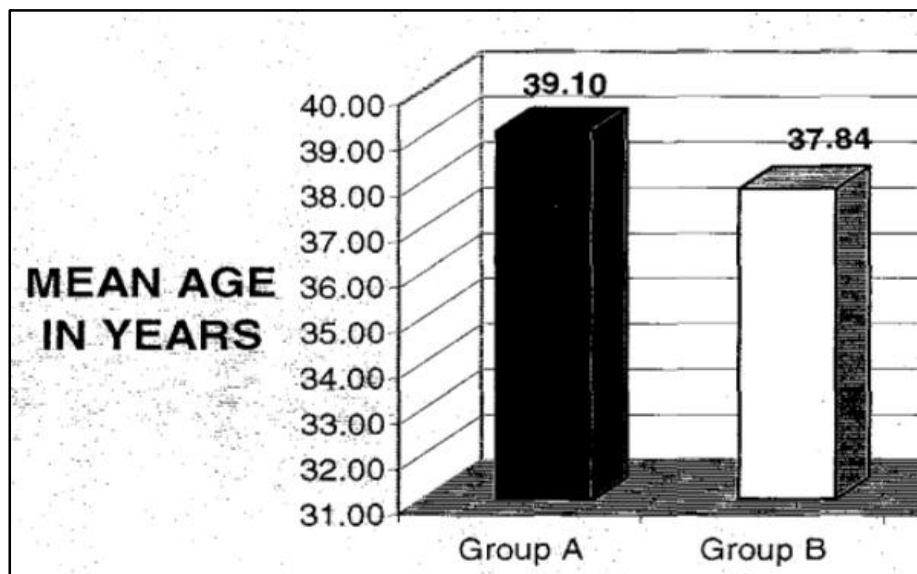
STATISTICS: Statistical analysis was done by using Medcalc statistical 8.2 Version.

RESULTS: In Group A 76% patients are males, 24% were females and Group B 68% patients are males, 32% were females. No significant difference was observed in sex wise distribution of the cases in between the two groups (p=0.50406).

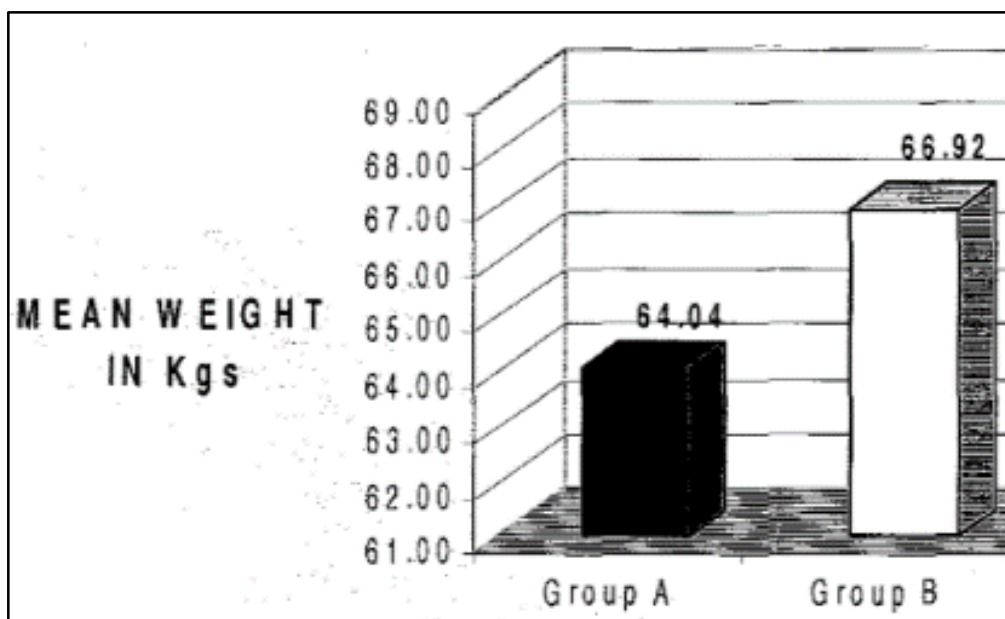
Parameters	Age (Years)		Weight (Kgs)	
	Range	Mean±SD	Range	Mean±SD
Group A	18-60	39.00±0.58	40-100	44-100
Group B	18-60	37.84±0.49	64.04±11.09	66.92±13.74

Table 1: Age and Weight Distribution

The above table shows age distribution in groups A and B. The age range was 18-60 years in both the groups. The mean values of age with standard deviation are 39.00±10.58 for group A and 37.84±10.49 for group B. There was no significant difference between them (P=0.466095). Weight range in-group A is 40-100 Kgs. Mean value of weight is 64.04 with standard deviation of ±11.09. In groups B weight ranged between 44-100 Kgs. Mean values and standard deviation of weight for groups B are 66.92±13.74.



Graph 1: Age Distribution



Graph 2: Weight Distribution

CHANGES IN HEART RATE (HR): Changes in HR assessed pre and post induction and at different intervals from the onset of laryngoscopy and intubation, in control and study groups and their comparative statistics are presented.

Time of Assessment	Group A		Group B	
	Mean±SD	% Differences	Mean±SD	% Difference
Baseline readings	84.08±4.65	-	86.52±6.87	-
0 min: study drug	77.20±6.39	-8.18	84.92±8.33	-1.85
Immediately after intubation	106.60±7.27	26.78	92.48±12.62	6.89
4 min after intubation	100.68±7.23	19.74	92.24±9.82	6.61
8 min after intubation	93.20±7.81	10.84	93.64±14.93	8.23

Table 2: Comparison of Changes in Heart Rate

GROUP A: The mean heart rate in this group before induction of anesthesia was 84.08±4.65. Following induction, it increased by 26.78% with mean±SD of 106.60±7.27. At 4 min from onset of laryngoscopy and intubation, heart rate increased by 19.74% with a mean±SD of 100.68±7.23 and decreased at the end of 8th min with a mean±SD of 93.20±7.81.

GROUP B: This study group had a baseline mean±SD of HR of 86.52±6.87 before induction of anaesthesia. Following induction of anesthesia the HR decreased by a meager 1.85% with a mean±SD value of 84.92±8.33. An increase of 6.89% in HR was observed immediately after intubation having a mean±SD of 92.48±12.62. It decreased to mean±SD of 92.24±9.82. i.e. only by 6.61% at 4th min and persisted with a mean±SD of 93.64±14.93 at the end of 8th min.

ORIGINAL ARTICLE

Time of Assessment	Group A		Group B	
	Mean±SD	% Differences	Mean±SD	% Difference
Baseline readings	85.56±6.28	-	85.44±8.49	-
0 min: study drug	79.92±7.84	-6.59	82.52±10.11	-3.42
Immediately after intubation	108.32±9.05	26.60	91.72±11.38	7.35
4 min after intubation	98.88±6.90	15.57	90.48±11.47	5.90
8 min after intubation	87.68±7.98	2.48	89.88±12.70	5.20

Table 3: Comparison of Changes in Blood Pressure

CHANGES IN BLOOD PRESSURE (BP): The changes in BP are assessed before and after induction of anaesthesia and at various time intervals from onset of laryngoscopy and intubation in control and study groups. Statistic comparison is presented in table 3.

GROUP A: The mean±SD baseline value of BP was 130.32±6.198. It decreased to 128.40±8.04. i.e., by 1.47% with induction of anaesthesia with laryngoscopy and intubation. We noticed an increase in SBP by 27.10% with a mean±SD value of 165.4±11.2. It remained almost at the same level with a mean±SD value of 151.16±11.65 at the end of 4th min. At the end of 8th min though the SBP was lower than the values at laryngoscopy and intubation, it was 2.92% above the baseline value with a mean±SD of 134.12±13.9.

GROUP B: A decrease in SBP by 4.40% with a mean±SD from its baseline value of 135.08±14.36 occurred with induction of anaesthesia. With onset of laryngoscopy and intubation rise in SBP was 1.66% with a mean±SD of 137.32±15.00. Subsequent observations showed a value, which was almost similar to the baseline values with a mean±SD of 136.10±14.55 and 135.52±17.35 at the end of 4th and 8th min respectively.

DISCUSSION AND CONCLUSION: Our study was done on 50 subjects/patients to compare the efficacy and safety of attenuation of pressor response during laryngoscopy and tracheal intubation using esmolol, administered in dose of 0.75mg/kg single IV bolus prior to induction of anesthesia. Different studies were conducted in the past regarding the efficacy of Esmolol administration during laryngoscopy and tracheal intubation. In a study by D.R Miller, a bolus dose of 100 mg of esmolol was safe and effective in attenuating the haemodynamic response to tracheal intubation.⁷

Withington et al compared the effectiveness of esmolol with placebo in CAD patients. Changes in heart rate and systolic blood pressure were measured at baseline and each minute after intubation.

One minute after intubation heart rate increased by mean of 7 beats/minute in the placebo group while there was a decrease of 10 beats/minute in the esmolol group. There was no significant difference in the systolic blood pressure at any time between the groups. They also concluded that esmolol 100mg prevents tachycardia associated with intubation. Prevention of tachycardia may prevent ischemia in patients with coronary artery disease and 100mg esmolol appeared to be valuable and convenient adjunct to anaesthetic intubation.⁸

Vuscevic et al carried out a double blind randomized study in 30 ASA grade I and II patients to manage the cardiovascular stress response to laryngoscopy and intubation using esmolol as a

ORIGINAL ARTICLE

continuous infusion. The study showed that maximum rate pressure product recorded in association with laryngoscopy and intubation was significantly reduced in patients who received esmolol infusion.⁹ Sharma et al used 100mg bolus of Esmolol to attenuate the pressor response and concluded that Esmolol 100mg bolus is effective as well as safe in blunting the haemodynamic response to laryngoscopy and tracheal intubation in treated hypertensive patients.¹⁰

Bensky et al carried out a study using small dose of esmolol 0.4mg/kg to find out the dose related effects of bolus esmolol on heart rate and blood pressure following laryngoscopy and intubation. It was shown that esmolol group had very small increase in heart rate when compared to placebo group, and in esmolol 0.4mg/kg, the systolic blood pressure was significantly blunted.¹¹

J Agarwal et.al concluded that Esmolol, an ultra-short acting beta-blocker with rapid onset of action is a suitable drug to attenuate the haemodynamic response to laryngoscopy and intubation with an effective control of arrhythmia by its infusion and no evidence of hypersensitivity reactions.¹²

Arti Rathore et al found Esmolol to be effective in attenuating the rise in mean heart rate response to laryngoscopy and intubation at doses of 50mg or 100mg IV boluses.¹³ In the study we conducted, our control group (group A) Heart rate, Blood Pressure increased maximally immediately after intubation and gradually decreased at 8min following intubation, but never reached the baseline during the study period.

In group B, suppression of the sympathetic response when compared to the control group was not significant. The Heart rate, Blood Pressure reached near to baseline values earlier than in the control group that is at 8 min following intubation.

CONCLUSION: In this study, the group in which esmolol was used showed a decrease in mean values of HR, SBP, DBP immediately after administration of the study drug.

The limitations of our study include hemodynamic changes associated with two stages i.e. direct laryngoscopy and passage of the tracheal tube into the trachea were not studied separately.

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ORIGINAL ARTICLE

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