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ORIGINAL ARTICLE

TO FIND THE EFFECTIVE DOSE OF ESMOLOL TO BLUNT THE REFLEX HAEMODYNAMIC CHANGES TO LARYNGOSCOPY AND TRACHEAL INTUBATION

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ABSTRACT: AIMS AND OBJECTIVE: The study is designed to determine the effective bolous dose of esmolol which would attenuate the reflex haemodynamic response to laryngoscopy and tracheal intubation. **STUDY DESIGN:** This study was conducted in the department of anaesthesia in association with department of orthopaedics, surgery and gynecology from September 2013 to December 2014. This study was done to determine the effective bolous doses of esmolol which would blunt the reflex haemodynamic response to laryngoscopy and tracheal intubation in the study population consisted of 100 patients who were randomly divided into four groups of 25 patients each. **RESULTS:** In our study all the groups in which esmolol were used showed a decrease in mean value of systolic blood pressure and diastolic blood pressure after administration of drug. The reduction is marked in esmolol 150 mg group and less in esmolol 50 mg group. **CONCLUSION:** All the groups in which esmolol was used showed a decrease in heart rate and blood pressure. The reduction is marked in esmolol 150 mg group, less in esmolol 50 mg group, optimal in 100 mg group. So it is concluded that esmolol 100 mg is near an ideal drug for attenuation of reflex haemodynamic response to laryngoscopy and tracheal intubation.

KEYWORDS: Esmolol, Haemodynamic response, Intubation, Laryngoscopy.

INTRODUCTION: Laryngoscopy and intubation are mandatory for most patients undergoing surgery under general anaesthesia, which are invariably associated with certain cardiovascular changes such as tachycardia, rise in blood pressure and wide variety of cardiac arrhythmias.[1] These effects are deleterious in susceptible individuals as in perioperative myocardial ischemia, acute heart failure and cerebrovascular accidents.[2,3]

Esmolol is a cardioselective β-1 adrenergic blocking agent. It has rapid onset and short duration of action with a elimination half-life of 9 minutes. It is an ester and is rapidly metabolized by esterase in the blood to a free acid metabolite that has beta adrenergic potency of 1/1600 of esmolol. Its kinetics are therefore suited to a relatively short application without causing prolonged bradycardia or hypotension and it has been shown to be effective in attenuates the pressor response to laryngoscopy and endotracheal intubation.[4,5,6,7]

The present study is designed to determine the effective bolus dose of esmolol which would attenuate the pressor response to laryngoscopy and endotracheal intubation.

MATERIALS AND METHODS: This randomized prospective study to find the effective dose of esmolol to blunt the reflex haemodynamic response to laryngoscopy and endotracheal intubation was conducted in the department of anaesthesia in association with department of orthopaedics, gynaecology and general surgery at Shridevi Institute of Medical Sciences and Research Hospital, NH-4, Sira Road, Tumkur from September 2013 to December 2014.

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The study population consisted of 100 patients who were randomly divided into 4 groups of 25 patients each:

Group-A received normal saline.

Group-B received esmolol 50 mg.

Group-C received esmolol 100 mg.

Group-D received esmolol 150 mg.

Inclusion criteria:

- All patients above 18 years.
- Patients belonging to American Society of Anaesthesiologists physical status I and II.

Exclusion criteria:

- Patients with conduction block, cardiac arrhythmias.
- Patients with congestive cardiac failure.
- Patients with history of bronchial asthma.
- Patients on beta blocker treatment.
- Patients with anticipated difficult airway.

METHODOLOGY: Patients selected for the study undergone adequate general physical examination and systemic examination was done to confirm the previously mentioned inclusion and exclusion criteria.

All patients received alprozoam 0.5mg and ranitidine 150 mg orally on the night before surgery.

They were randomly allocated into 4 groups. All patients were premedicated with Inj glycopyrrolate 0.2mg and Inj fentanyl 1 μgm kg^{-1} intravenously 10 minutes before surgery.

Baseline reading of heart rate, systolic blood pressure, diastolic blood pressure were recorded.

All patients were preoxygenated with 100% oxygen for 3 minutes.

The study group received either 10 ml normal saline, 50 mg esmolol, 100 mg esmolol, and 150 mg esmolol made to 10 ml with normal saline intravenous bolus over 10 seconds.

The heart rate, systolic blood pressure and diastolic blood pressure were recorded and anesthesia was induced with Inj thiopentone sodium 5 mg kg^{-1} and tracheal intubation facilitated with Inj succinyl choline 1.5mg kg^{-1}.

Laryngoscopy and intubation performed by single investigator after 2 minutes of study drug administration.

Laryngoscopy was done using rigid laryngoscope with standard Macintosh blade. Intubation was done with appropriate sized, disposable, high volume low pressure cuffed endotracheal tube. Oral intubation was done for all surgical procedures. Laryngoscopy and intubation was done within 20 seconds.

The heart rate, systolic blood pressure and diastolic blood pressure were recorded after induction, after intubation and thereafter every minute for 5 minutes.

Anesthesia was maintained with O_2 (33%), N_2O (67%), and intermittent atracumium 0.5mg kg^{-1} and intermittent positive pressure ventilation.

The data was analysed and the results were considered significant when p value <0.05.

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RESULTS:

Time of Assesment	Group A		Group B		Group C		Group D		P value
	Mean ± SD	% Diff	Mean ± SD	% Diff	Mean ± SD	% Diff	Mean ± SD	% Diff	
Base	85±9.26		81.76±9.19		80.28±9.12.		78.92±12.84		0.188
Ind	92.36± 13.15	8.6	87.04±12.21	6.4	82.84±8.97	3.1	79.44±10.01	0.6	0.001
2 min	119.08±10.35	40	108.04±11.93	32.1	91.40±8.84	13.8	83.28±9.07	5.5	0.000
3 min	123.28± 9.70	45	110.88± 13.6	35.6	91.40±7.58	13.8	84.04±"9.84	6.4	0.000
4 min	122.72± 9.16	44.3	108.56±14.16	32.7	89.84±8.69	11.9	82.48±10.20	4.5	0.000
5 min	117.52± 8.93	38.2	103.12±13.44	26.1	85.76±9.61	6.8	81.12±9.68	2.7	0.000

Comparison of Heart Rate

Time of assessment	Group A		Group B		Group C		Group D		P value
	Mean± SD	% Diff	Mean± SD	% Diff	Mean± SD	% Diff	Mean± SD	% Diff	
Base	129.44±8.90		128±9.01		129.68±8.60		131.44±11.53		0.655
Ind	128.72±10.19	-0.5	128.28±12.12	0.2	127.88± 9.70	-1.3	124.20±13.45	-5.5	0.487
2 min	155.96±8.41	20.4	151.32± 8.23	18.2	137.80±9.30	6.2	129.20±15.45	-1.7	0.000
3 min	160.04±6.15	23.6	153.56± 8.30	19.9	137.64±11.34	6.1	129.20±15.41	-1.8	0.000
4 min	155±5.59	19.7	148.72±8.52	16.1	134.64±10.19	3.8	127.72±15.61	-2.8	0.000
5 min	149.48 ±6.39	15.4	143.76± 8.39	12.3	132.40± 9.23	2	i'126.16±16.14	-4	0.000

Comparison of Systolic Blood Pressure

Time of assessment	Group A		Group B		Group C		Group D		P value
	Mean± SD	% Diff	Mean±SD	% Diff	Mean±SD	% Diff	Mean± SD	% Diff	
Base	76.68±5.66	-	75.24±4.59	-	79.08±6.18	-	79.76± 8.32	-	0.057
Ind	76.08±6.89	-0.8	74.92±.07	-0.4	77.76±6.28	-1.66	76.6± 7.39	-4	0.539
2 min	89.92±5.35	17.2	88.12±5.37	17.1	81.72±7.28	3.3	80.04± 8.96	0.3	0.000
3 min	91.32±4.76	19.1	88.84±5.36	18	82.16±6.88	3.8	77.84±10.45	-2.5	0.000
4 min	89.76±4.50	17	87.56±5.97	16.3	80.96±5.61	2.3	75.92±11.48	-4.8	0.000
5 min	86.68±4.70	13	84.62±5.44	12.4	79.44±6.27	0.5	76.84± 9.66	-4	0.000

Comparison of Diastolic Blood Pressure

	GROUP A	GROUP B	GROUP C	GROUP D
Maximum change in heart rate (In %)	45	35.6	13.8	6.4
Maximum change in SBP (In %)	23.6	19.9	6.2	-5.5
Maximum change in DBP (In %)	19.1	18	3.8	0.3

Results of our Study

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In our study, all the groups in which esmolol was used showed a decrease in mean value of systolic blood pressure and diastolic blood pressure after administration of drug. The reduction is marked in esmolol 150 mg group and less in esmolol 50 mg group.

The maximum change in heart rate was 45% in control group compared to 35.6% in patients receiving esmolol 50 mg, 13.8% in esmolol 100 mg and 6.4 % in esmolol 100 mg group.

The maximum change in systolic blood pressure in control group was 23.6% compared to 19.9% in those receiving esmolol 50 mg, 6.2% in esmolol 100 mg group. The systolic blood pressure value was below the baseline throughout the study period with a maximum decrease of 5.5 % in patients given esmolol 150 mg.

The rise in diastolic blood pressure in control group was 19.1%, compared to 18% in esmolol 50 mg, 3.8% in esmolol 100 mg and 0.3 % in esmolol 150 mg group.

Esmolol 50 mg group adequately attenuated the heart rate but the systolic blood pressure and diastolic blood pressure were not satisfactorily attenuated compared to esmolol 100 mg group.

In esmolol 100 mg group, heart rate, systolic blood pressure, diastolic blood pressure were adequately attenuated during laryngoscopy and tracheal intubation.

In esmolol 150 mg group, heart rate, systolic blood pressure and diastolic blood pressure were adequately attenuated during laryngoscopy and tracheal intubation. The systolic blood pressure and diastolic blood pressure were below the baseline value throughout the study period.

DISCUSSION: The induction of anaesthesia, laryngoscopy and tracheal intubation are associated with marked haemodynamic changes and autonomic reflex activity which may be a cause of concern in many high risk patients.

Laryngoscopy and intubation is associated with rise in heart rate, blood pressure and incidence of cardiac arrhythmias. There is a potential for life threatening complications due to these changes in patients with coronary artery disease, systemic arterial hypertension, leading to myocardial ischaemia, heart failure and cerebrovascular catastrophies.

Although these responses of blood pressure and heart rate are transient and short lived, they may prove to be detrimental in high risk patients especially in those with cardiovascular disease.

Many factors influence the cardiovascular changes associated with laryngoscopy and intubation age, drugs, type and duration of procedure, depth of anaesthesia, hypoxia, hypercarbia influence the pressure response.

Attenuation of sympathetic response during laryngoscopy and intubation is of prime concern to the anaesthesiologist more so in high risk patients.

CONCLUSION: In our study, all the groups in which esmolol was used showed a decrease in heart rate, systolic blood pressure and diastolic blood pressure after administration of drug. The reduction is marked in esmolol 150mg group and less in esmolol 50 mg group.

Esmolol 50 mg group adequately attenuated the heart rate, but the systolic blood pressure and diastolic blood pressure were not satisfactorily attenuated.

In esmolol 100 mg group, heart rate, systolic blood pressure and diastolic blood pressure were adequately attenuated during laryngoscopy and tracheal intubation. In esmolol 150 mg group, adequately attenuates the pressor response for laryngoscopy and tracheal intubation, but the systolic blood pressure and diastolic blood pressure were below the baseline value throughout the study period.

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So it is concluded that esmolol 100 mg is near an ideal drug for attenuation of pressor response to laryngoscopy and endotracheal intubation.

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