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Original Article

A Comparative Study Between Efficacy Of Esmolol And Lignocaine For Attenuating Haemodynamics Response Due To Laryngoscopy And Endotracheal Intubation

M Begum[1], P Akter[1], MM Hossain[1], SMA Alim[2], UHS Khatun[3], SMK Islam[4], L Sanjowal[5]

Abstract

Haemodynamic stability is an integral and essential goal of any anaesthetic management plan. Laryngoscopy and intubation can cause striking changes in haemodynamics. Increase in blood pressure and heart rate occurs most commonly from reflex sympathetic and vagal discharge in response to laryngotracheal stimulation, which in turn leads to increased plasma norepinephrine concentration. This study was designed to compare efficacy of esmolol and lignocaine for attenuating haemodynamics response due to laryngoscopy and endotracheal intubation. The aim of this study was to compare the effects of Esmolol with that of Lignocaine to attenuate the detrimental rise in heart rate and blood pressure during laryngoscopy and tracheal intubation. One hundred and twenty adult patients randomized into group-L and group-E, were received lignocaine 1.5 mg/kg and Esmolol 1.5 mg/kg I.V. respectively. Heart rate and blood pressure in each minutes for the 10 minutes after intubation was recorded. Time span around intubation up to 4 minutes has been looked specifically to isolate the effect of the study drugs at the time of intubation. For statistical analysis Student's 't' test was used for comparing means of quantitative data and chi-square test was used for qualitative data. Difference was considered statistically significant if $p<0.05$. The mean heart rate, systolic, diastolic, and mean blood pressure, and rate-pressure product before starting anesthesia were similar in group-L (Lignocaine group) and in group-E (Esmolol group) ($p>0.05$). The mean values of heart rate, systolic, diastolic, and mean blood pressure, and rate-pressure product at 2, 3 and 4 minutes after intubation were significantly lower in group-E than group-L ($p<0.05$). In conclusion, esmolol 1.5 mg/kg is superior to lignocaine (1.5 mg/kg) for attenuation of haemodynamic response to laryngoscopy and endotracheal intubation.

Key words: Haemodynamics, heart rate, intubation, esmolol, lignocaine

Introduction

Safe airway management is an essential skill for an anaesthesiologist. Laryngoscopy and endotracheal intubation are required to control and maintain a safe airway. Laryngoscopy and intubation violate the patients' airway reflexes and predictably lead to hypertension and tachycardia. It has detrimental effects on the other organ systems. Haemodynamic stability is an integral and essential goal of any anaesthetic management plan. Hypertension and tachycardia have been reported since 1950 during intubation under light anaesthesia complicated by hypoxia, hypercapnia or cough[1-2]. Laryngoscopy and intubation can cause striking changes in haemodynamics[3-4]. Increase in blood pressure and heart rate occurs most commonly from reflex sympathetic and vagal discharge in response to laryngotracheal stimulation, which in turn leads to increased plasma norepinephrine concentration[5]. These reflexes are of little significance in healthy patients but these changes may be fatal in patients with heart diseases and high blood pressure. Sudden death has also been reported[6].

Many attempts have been made in modifying these haemodynamic responses e.g. premedication, deep anaesthesia, topical anaesthesia, use of ganglion blockers, beta blockers[7], antihypertensive agents like phentolamine[8], vasodilators magnesium etc. Sodium nitropruside and nitroglycerine[9] are effective but require continuous

1. Dr. Muslema Begum, MD (Anaesthesiology), Dr. Parveen Akter, FCPS (Anaesthesiology), Dr. Md. Mozaffer Hossain, FCPS (Anaesthesiology), Junior Consultant, Dept. of Anaesthesiology and ICU, DMCH, Dhaka.
2. Dr. SMA Alim, MD (Anaesthesiology), Assistant Registrar, Central Police Hospital, Dhaka.
3. Dr. UH Shahera Khatun, FCPS (Anaesthesiology), Professor & Head, Dept. of Anaesthesiology and ICU, DMC, Dhaka.
4. Dr. SM Khabirul Islam, MCPS (Forensic Medicine), Assistant Professor, Dept. of Forensic Medicine, FMC, Faridpur.
5. Dr. Lipika Sanjowal, MBBS, DA student, Dept. of Anaesthesiology and ICU, DMCH, Dhaka.

Address of Correspondence
Dr. Muslema Begum, MD (Anaesthesiology),
Junior Consultant, Dept. of Anaesthesiology and ICU, DMCH, Dhaka.
Phone: +88-01716107080. E-mail: muslemabeg@yahoo.com.

Ca-channel blockers are also preferred because myocardial depression produced by it is minimized by reduction in afterload so that cardiac output remains unchanged, but they have no effect on increase in heart rate[10-11].

Various studies have been shown that intravenous Lignocaine administration prior to induction of anaesthesia is effective in preventing or attenuating the arterial hypertension and tachycardia in response to endotracheal intubation[12-13]. A few publications have shown the lack of effect of intravenous lignocaine on haemodynamic response[14-16].

Esmolol is effective in attenuating sympathetic responses to laryngoscopy and intubation[17], to sternotomy and to emergence from anaesthesia and extubtion[18]. It has been claimed to be more effective than sodium nitroprusside in controlling postoperative hypertension following coronary artery surgery, causing less of a fall in diastolic pressure. There is also a reduction in heart rate (nitroprusside tending to cause a reflex tachycardia) and minimal effects on Pao_2 and oxygen saturation[19]. Esmolol is potentially safer to use than longer-acting antagonist in critically ill patient who require-adrenoceptor antagonists. Objective of present study is to compare efficacy of Esmolol and lignocaine for attenuating laryngoscopy and endotracheal intubation reflex.

Methods

After obtaining the informed consent of the patient, this single blind prospective study was carried out in Anaesthesiology Department of Dhaka Medical College Hospital. The patients were explained in details about the procedure, benefits and complications of the study on the preoperative day. The study was approved by the ethical committee of Dhaka Medical College Hospital. 120 patients of ASA class I & II was selected. The patients were divided into 2 (two) groups, 60 (sixty) in each group by card sampling. Each patient given cards to take any one blindly from two groups. Both groups were treated with Diazepum 5 mg orally at night before operation. In both the groups after arrival at the operation theater, base-line parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) was measured non-invasively by sphygmomanometer. Rate pressure product (RPP) was also calculated. The same parameters were recorded during pre-oxygenation and before induction of anaesthesia as control value.

Then premedication was given with Midazolam 0.1 mg/kg intravenously. After 5 (five) minutes of premedication the patient was induced with Thiopentone (25%) 5 mg/kg I.V. Then the group-L patient received lignocaine 1.5 mg/kg in the volume of 10 ml (with distil water) and group-E patients received Esmolol 1.5 mg/kg l.V. slowly. Both of these drugs were given slowly within 15-20 second in same volume (10 ml). Vecuronium bromide o.1mg/kg was given for intubation. Intubating condition assessed clinically by Cooper’s score. After 3 minutes of injection Vecuronium bromide endotracheal intubation was done with the aid of standard Macintosh laryngoscope blade. Patient of both groups was ventilated with 30% O_2, 70% N_2O and 0.5% Halothane. All intubation was done with in 30 sec. The same cardiovascular parameters were recorded at 1 minute intervals for a total of 10 minutes after intubation. All relevant data were collected. Heart rate and blood pressure in each minutes for the 10 minutes after intubation was recorded. Time span around intubation up to 4 minutes has been looked specifically to isolate the effect of the study drugs at the time of intubation. Data were analyzed by computer-based statistical program SPSS (Statistical Package for Social Science) for Window (version 12). For statistical analysis Student's 't' test was used for comparing means of quantitative data and chi-square test was used for qualitative data. Difference was considered statistically significant if $p<0.05$ (Cl-95%).

Results

Demographic characteristics were comparable among the groups. Baseline heart rate and mean arterial pressures were comparable between the groups. The mean intubating condition (Table I) of the groups were not statistically different (P=0.817). The mean heart rate, systolic, diastolic, and mean blood pressure, and rate-pressure product before starting anesthesia were similar in group-L (Lignocaine group) and in group-E (Esmolol group) ($p>0.05$). The mean values of heart rate (Table II), systolic, diastolic, and mean blood pressure (Table III), and rate-pressure product (Table IV) at 2, 3 and 4 minutes after intubation were significantly lower in group-E than group-L ($p<0.05$).

Table I: Comparison of intubating condition of the two groups

Intubating condition	Group-E n=60	Group-L n=60	P-value
Excellent/Good	48/12	49/11	0.817^{NS}

Table II. Heart rate changes between two groups

Heart rate (Beat/minute)	Group -E (n=60)	Group -L (n=60)	P value
Before starting anesthesia	79.03±8.97	80.40±7.92	.378 NS
2minute after intubation	90.90±8.11	94.93±8.47	.012 S
3 minute after intubation	85.10±9.13	89.77±7.22	.012 S
4 minute after intubation	82.70±8.64	87.03±6.58	.002 S

The differences in the mean heart rate at 2, 3 and 4 minutes after intubation between the two groups were statistically significant (p=0.012, p=0.012, and p=0.002 respectively).

Table III. Mean arterial pressure changes between the groups

Mean arterial pressure (mmHg)	Group -E (n=60)	Group -L (n=60)	P value
Before starting anesthesia	89.25±7.04	87.86±7.15	.286 NS
2 minute after intubation	102.31±6.90	106.78±6.46	<.001 S
3 minute after intubation	97.64±7.05	102.06±6.70	<.01 S
4 minute after intubation	92.00±6.87	96.61±6.21	<.001 S

The mean arterial blood pressures at 2, 3 and 4 minutes after intubation were significantly lower in group-E than group-L (p= .000, p=.001, and p=.000 respectively).

Table IV. Rate pressure product changes between the groups

Rate pressure product (RPP)	**Group –E (n=60)**	**Group-L (n=60)**	**P value**
Before starting anesthesia	7077.50±1141.93	7070.11±952.10	.969 NS
2 minute after intubation	9317.94±1186.18	10136.50±1189.78	<.001 S
3 minute after intubation	8322.06±1163.17	9164.72±980.94	<.001 S
4 minute after intubation	7623.78±1085.42	8412.00±865.92	<.001 S

The mean rate pressure product at 2, 3 and 4 minutes after intubation were significantly lower in group-E than in group-L (p<0.001 in each).

Discussion

The results of the present study show that esmolol 1.5 mg/kg is superior to lignocaine (1.5 mg/kg) for attenuation of haemodynamic response to laryngoscopy and endotracheal intubation. There were no significant differences between two groups in age, body weight, gender and ASA grading. Before induction of anaesthesia heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), rate pressure product (RPP) and mean arterial pressure (MAP) were not statistically significant >0.05) in both groups. One minute after intubation, these parameters were significantly raised (p<0.05) in two groups. The findings of our study are comparable to those of King et al who found a rise of HR, SBP, DBP, RPP and MAP 1 min after intubation. He also found gradual return of these parameters to baseline as anaesthesia deepened. Our study demonstrated highly significant reduction in HR, DBP, RPP and MAP in both groups (p<0.0l), 2 and 4 minutes after induction. But the SBP reduction was only statistically significant (p<0.05). In group-E patients, these reductions were more than that of in group-L patients. Four minutes after intubation, HR, SBP, DBP, RPP and MAP returned to almost baseline values in esmolol group. These findings are in agreement with that of Ugur B, Ogurlu M, et al who showed attenuated haemodynamic response due to sympathetic stimulation associated with tracheal intubation. It is also comparative with that of Feng CK, Chan KH et al[12] who showed that only esmolol could reliably offer protection against the increase in both HR and SBP, low dose of fentanyl (3 micrograms/kg) prevented hypertension but not tachycardia and 2 mg/kg lidocaine had no effect to blunt adverse hemodynamic responses during laryngoscopy and tracheal intubation. Singh H, Vichitvejpaisal P, et al[9] compared the effects of the lidocaine, esmolol, and nitroglycerin and showed lidocaine 1.5 mg/kg i.v. and nitroglycerin 2 micrograms/kg i.v. were ineffective in controlling the acute hemodynamic response following laryngoscopy and intubation. Esmolol 1.4 mg/kg i.v. was significantly more effective than either lidocaine or nitroglycerin in controlling the HR response to laryngoscopy and intubation (p<0.05). Another study was done to compare the effectiveness of single bolus dose for esmolol or fentanyl in attenuating the haemodynamic responses during laryngoscopy and endotracheal intibution by Hussain AM, Sultan ST. They have shown that the rise in heart rate was minimal in esmolol group and was statistically significant. Present study strongly supports Singh H, Vichitvejpaisal P, et al[9] study.

Conclusion

Esmolol 1.5 mg/kg is superior to lignocaine (1.5 mg/kg) for attenuation of haemodynamic response to laryngoscopy and endotracheal intubation. Therefore we can conclude that patients with hypertension, ischaemic heart disease, and brain tumour will be benefited by giving intravenous esmolol preoperatively before laryngoscopy and endotracheal intubation.

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