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Original Article

Comparision of Efficacy of Esmolol and Lignocaine for Attenuation of Hemodynamic Stress Response to Laryngoscopy and Tracheal Intubation in Patients Undergoing Laparoscopic Cholecystectomy Under General Anaesthesia

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Abstract

Background

Laryngoscopy and tracheal intubation results in intense sympathoadrenal response characterized by hypertension, tachycardia and arrhythmia. There are many pharmacological and non-pharmacological method are being employed to attenuate the response. The aim of our study is to compare the efficacy of intravenous bolus dose of esmolol with lignocaine in attenuating the hemodyanamic response to laryngoscopy and tracheal intubation.

Materials and Methods

The study is prospective comparative study. One hundred six patients of both sex, aged 18-65 years, belonging to the American Society of Anesthesiologists physical Status I and II randomly allocated into two groups (n = 53). The study drugs diluted in 10−ml normal saline. Group I received esmolol 1.5 mg/kg and Group II received lignocaine 1.5 mg/kg 2 min before laryngoscopy and intubation. The heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure were noted at basal, during intubation, and 1, 2, 3, and 5 min after intubation. Data were represented by mean standard deviation and graphs. Students T-test was used to compare mean between groups.

Results

The mean pulse rate, mean of mean arterial pressure at intubation and at 1, 2, 3, and 5 min after intubation in lignocaine group showed a significant rise in these values but in esmolol group it remained nearer to or less than baseline values.

Conclusion

Esmolol 1.5 mg/kg is effective in attenuating the pressor response in comparison with lignocaine 1.5 mg/kg during laryngoscopy and intubation.

Keywords: *Hemodynamics, Intubation, Laryngoscopy, Lignocaine*

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Introduction

Direct laryngoscopy and endotracheal intubation frequently induces a cardiovascular stress response characterized by hypertension, tachycardia andarrhythmia due to reflex sympathetic simulation and catecholamine release [1,2]. Though the response is transient occurring 30 sec after intubation and lasting for less than 10 min the resulting hemodynamic consequences can cause severe arrhythmias, myocardial is chemia, and cerebrovascular events [3].

Various non-pharmacological and pharmacological techniques have used to attenuates these responses [4,5,6,7]. Among these intravenous lignocaine is used most often as it prevents rise in BP and HR and ECG changes in response to laryngoscopy and tracheal intubation [8]. Varying doses of esmolol 0.5–2 mg/kg have been used in the past [9,10]. Esmolol is a relatively cardiac-selective beta blocker with an extremely short onset and half-life [11]. Several studies have assessed the dose of esmolol required to minimize hemodynamic changes, in case of intubation through direct laryngoscope [12]. So far no study was conducted to compare the effect of esmolol and lignocaine on suppression of hemodynamic stress response to laryngoscopy and endotracheal intubation in patients of eastern Nepal.

Therefore, this study is being conducted with aim of comparing the efficacy of iv esmolol and iv lignocaine for attenuation of stress response to laryngoscopy and endotracheal intubation in population of eastern Nepal.

Material and Methods

This is prospective quantitative comparative study conducted in the department of anaesthesiology, critical care and pain management at Nobel medical college teaching hospital Biratnagar, Nepal from June 2023 to July 2024. After obtaining the ethical clearance from institutional review committee of Nobel Medical College (ref: IRC-NMCTH 812/2023), patients of ASA PS I and II and aged between 18-65 years undergoing laparoscopic cholecystectomy under general anaesthesia were included in our study. Patients with severe obesity (BMI>35), predicted difficult airway, any cardiovascular diseases, hypertension, diabetes, pregnancy and contraindication and allergy to study drugs were excluded from the study.

With anticipated mean ± standard deviation (SD) of mean aetrial pressure (MAP) after endotracheal intubation in the lignocaine group of 75.5 ± 19.8 mmHg and that in the esmolol group of 65.8 ±15.4 mmHg in the reference study, the minimum sample size calculated was 106(53 in each group) with 80% power and 5% level of significance using the following formula [2].

$$N = 2\left(\frac{[Z_{1-\propto/2} + z_{1-b}] \times S}{d}\right)^2$$

General objective of our study is to compare the efficacy of esmolol versus lignocaine to blunt hemodynamic stress response to laryngoscopy and tracheal intubation.Specific objectives are to compare mean HR, SBP, DBP and MAP 1 min, 2 min, 3min and 5 min after intubation.

Convenience purposive sampling method was used to select the participants. Informed written consent was obtained from all the patients. They were randomly divided into two groupsusing computer generated random numbers.

Group E: received iv esmolol 1.5 mg/kg 2 min prior to intubation

Group L: received iv lignocaine 1.5 mg/kg 2 min prior to intubation

Thorough pre-anaesthetic evaluation was performed on the day prior to surgery. patients were advised nil per oral for 8 hours prior to surgery. Study objective andprocedure were explained to the participants anda written informed consent was obtained from eachparticipant. Patients were shifted to operating room and Standard ASA monitoring were attached. Intravenous access was secured and infusion of Ringer's lactate solution started. The patients werepre−medicated with 0.01 mg/kgglycopyrrolate and 0.05 mg/kg midazolam5min prior to induction. Then pre-oxygenation with 100% oxygen was done for 3 min. The patientswere induced with 1.5 mcg/kg fentanyl and incremental doses of propofol.After checking adequate bag mask ventilation, rocuronium 0.8 mg/kg was administered for muscle relaxation followed by injection of study drug 2 min prior to laryngoscopy and intubation. Laryngoscopy was performed 3 min after administration of rocuronium and trachea was intubated with appropriated size endotracheal tube. After confirming tube placement, patient was kept on ventilation VC-IPPV mode and anaesthesia was maintained with oxygen and isoflurane. HR, SBP, DBP and MAP were recorded before induction (baseline), during induction and after tracheal intubation at 1, 2, 3, and 5 min for the purpose of this study. Patients were monitored for conduction abnormalities, ST−segment changes with electrocardiography monitoring, hypotension, bradycardia, bronchospasm, and pain on injection. At the end of the surgery, the patients reversed with injection neostigmine0.05 mg/kg and injection glycopyrolate 0.01 mg/kg. Patients were followed up postoperatively for complications.

Data collected were entered and analysed using SPSS version 25. Student t-test was used to analyse data. Categorical data were presented in number(percentage) and continuous data in mean ± SD. P-value ≤0.05 was considered significant.

Results

A total of 106 patients included in the study were randomly allocated to either esmolol or lignocaine group. The demographic profiles of participants were comparable among the groups (Table 1).

Table 1: Demographic Profile of two study groups

Variables	Group A(n= 53)	Group B(n=53)
Age (Years)	36.06±7.04	30.12± 9.18
Sex (Male/Female)	18/35	16/37
Weight (Kg)	56.12±10.06	62.10±6.16
ASA (I/II)	33/20	55/18

The baseline heart rate was comparable in both groups. The result showed that the increase in heart rate in esmolol group was less than that in lignocaine group after (Table 2 and Figure 1).

Table 2: Changes in Heart rate values (HR)

Group	Base line	Intubation	1 minute	2 minute	3 minutes	5 minutes
Group E	78.4 ±6.23	74.3 ±4.82	72.4 ±4.12	71.8 ±4.64	72.8 ±4.14	75.4 ±5.64
Group L	80.4 ±4.82	90.8 ±4.64	95.8 ±2.67	100.8 ±2.74	94.6 ±6.97	93.8 ±7.25

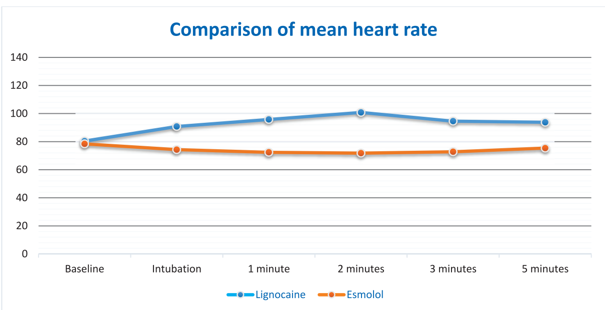

Figure 1: Comparison HR in esmolol and lignocaine group

There was similar baseline mean arterial pressure among both groups. The more increase in MAP was observed in lignocaine group compared to esmolol group after laryngoscopy and intubation Table 3 and Figure 2). The increase in MAP 1 minute and 3 minute after intubation was statistically significant. But the map value at 2 minute and 5 minute was not significant.

Table 3. Changes in Mean Arterial Pressure values (MAP)

Group	Base line	Intuba-tion	1 minute	2 minutes	3 minutes	5 minutes
Group E	90.42 ±10.63	89.26 ±4.64	87.72 ±5.62	86.67 ±1.36 NS	86.23 ±5.63	85.12 ±3.89 NS
Group L	94.12 ±2.63	99.32 ±6.45	105.44 ±4.52	108.08 ±5.43 NS	107.45 ±7.03	100.22 ±2.73 NS

NS= not significant

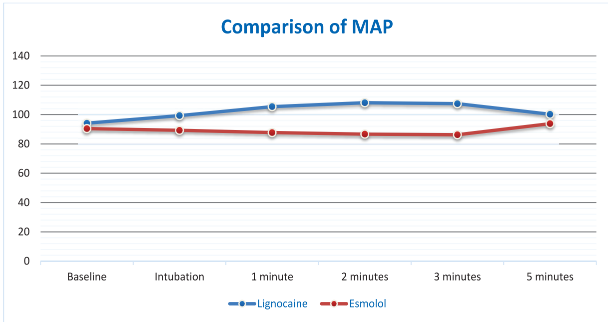

Figure 2: Comparison of MAP in esmolol and lignocaine group

Discussion

The reflex rise in heart rate and blood pressure occurs in response to laryngoscopy and tracheal intubation due to rise in catecholamines following sympathoadrenal activation [13]. Pharmacological techniques are known to be better than non-pharmacological technique to reuduce these hemodynamic changes.It is easier to titrate to the effect of esmolol due to its rapid onset and short acting property. Hence esmolol isthe β-blocker of choice for use in perioperative period. Though different doses of esmolol have been studied previously, the selection of effective dose is essential to balance between desired effect and side effects. Many studies done previously used 1.5mg/kg of esmolol and found significant results without any major adverse events [14, 15, 16]. Thus we preferred esmolol 1.5 mg/kg in ourstudy and found significant results compared to lignocaine1.5 mg/kg.

Regarding the incidence of tachycardia the result of our study was consistent with the previous study reporting the better efficacy of esmolol compared to lignocaine in minimizing the rise in heart rate after laryngoscopy and endotracheal intubation [17,18,19,20]. In our study we found the significant fall in heart rate and mean arterial pressure at 2 and 3 minute after intubation in esmolol group. This finding was similar to studies conducted by Singh et.al. and Mulimani et.al. [3,14] In our study we did not observed any serious adverse events like episodes of intraoperative hypotension and bradycardia after esmolol administration. These findings were consistent with the results of various studies [17,19,20,21].

There are some studies which disagree to the efficacy of esmolol in attenuating the tachycardia and hypertensive response to laryngoscopy and intubation. Oxorn *et al*. in their study concluded that esmolol in bolus doses of 100 mg and 200 mg significantly reduced the HR only not MAP [22]. Similar findings were observed in study by Kindler *et al* [23]. In our study, esmolol 1.5 mg/kg was found to be quite effective in attenuating the hypertensive response characterized by rise in mean arterial pressure as well as increase in heart rate during laryngoscopy and tracheal intubation till 5 min.

Lignocaine has been a popularly used for attenuation of hemodynamic response to laryngoscopy during intubation. The beneficial effect of lidocaine is due to its direct cardiac depression and peripheral vasodilation, ability to suppress airway reflexes due to irritation of tracheal mucosa as well as antiarrhythmic properties.Lev and Rosen in their review stated that the use of 1.5 mg/kg lignocaine intravenously 3 min before intubation was found to be optimal for attenuation of the sympatho-adrenal response to laryngoscopy and intubation without any harmful effects [24]. This finding was similar to the study conducted by Wilson *et al* [25]. Bruder et al. in their review article mentioned that lignocaine is particularly effective in preventing the rise in blood pressure in response to tracheal intubation, whatever its route of administration (intravenous or intratracheal), but not the increase in HR [26].

There are some limitations of our study. This study is not the randomized control trial and we have included normotensive patients having no comorbid conditions. We did not measure the catecholamine level which would better reflect hemodynamic response to laryngoscopy and tracheal intubation. Another limitation is the use of non-invasive blood pressure monitoring in our study. It was observed that there was variability in optimal dose and time of drug administra-tion. Hence further studies are required to validate the results and to know the exact dose of drug and timing of drug administration.

Conclusion

Although intravenous bolus dose of both lignocaine (1.5mg/kg) and esmolol (1.5mg/kg) are effective in attenuating the hemodynamic stress response to laryngoscopy and tracheal intubation during induction of anaesthesia esmolol appears to be more efficacious than lignocaine.

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Conflict of interest

There is no conflict of interest to declare.

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