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Research Article

ATTENUATION OF LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION-INDUCED SYMPATHOMIMETIC RESPONSES WITH INTRAVENOUS ESMOLOL AND LIGNOCAINE: A COMPARATIVE STUDY

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ABSTRACT

Objectives: Direct laryngoscopy and endotracheal intubation are a noxious stimulus and induces sympathomimetic responses. Although properly tolerated in normal and healthy subjects, it can impose serious arrhythmias, left ventricular failure, myocardial ischemia, or rupture of cerebral aneurysm in vulnerable patients. Various techniques are currently working to attenuate this response, but, so far, none of them have been proven to be superior. Esmolol and Lignocaine; attenuate those responses however are related to some untoward outcomes such as bradycardia and hypotension. In low doses, the chances of those expected untoward outcomes are relatively low.

We designed this prospective clinical education to assess and compare the efficacy of intravenous Esmolol and Lignocaine in attenuating sympathomimetic responses to laryngoscopy and endotracheal intubation.

Methods: After the Institutional Ethics Committee approval, 52 consenting patients of ASA physical repute I or II of age between 20 and 60 years, scheduled for surgeries requiring general anesthesia, remained randomly owed to two groups; Group E and Group L, given 2 mg/kg of inj. Esmolol intravenously and inj. Lignocaine 2 mg/kg, respectively, 2 min before intubation. Final outcome variables such as heart rate (HR), systolic blood pressure (BP), diastolic BP, and mean arterial pressure (MAP) had been recorded and compared between the two groups immediately after intubation (AI) and then at 1, 3, and 5 min AI.

Results: There was no statistically huge distinction regarding the demographic profiles of both the study groups. There has been a substantial rise in mean HR in the lignocaine group all through laryngoscopy and intubation, which did not settle to baseline level even after 5 min ($p<0.0001$). In the esmolol group, a significant attenuation of HR was observed immediately AI and 1, 3, and 5 min following intubation. MAP was well controlled in the esmolol group. Throughout the study period, readings of mean arterial pressure were much higher in esmolol group. In the lignocaine group, the values of study parameters were higher than the baseline at every point of time. Diastolic BP was elevated in both groups.

Conclusion: Esmolol was found to be more effective for attenuation of hemodynamic tension response to laryngoscopy and intubation when compared with Lignocaine. However, Lignocaine is also safe and effective to some extent.

Keywords: Endotracheal intubation, Esmolol, Laryngoscopy, Lignocaine, Sympathomimetic reflexes.

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INTRODUCTION

Cardiovascular stress response is frequently persuaded by laryngoscopy and endotracheal intubation results in tachycardia and hypertension due to increase in serum catecholamine [1].

These hemodynamic vicissitudes are well tolerated in healthy individuals, but is life threatening in susceptible patients having multiple coexisting diseases [2-4].

In vulnerable persons, these hemodynamic stress responses can cause serious complications such as myocardial ischemia, cerebral hemorrhage, and left ventricular failure etc.[5]

Yu *et al*. concluded in their study that the principal source responsible for mortality and morbidity associated with perioperative MI was tachycardia and hypertension [6].

Esmolol being a cardio selective b1-blocker have faster onset and very short duration of action. It shows myocardial depression; therefore, its use is still controversial in patients with cardiac risk. Intravenous (IV) local anesthetics act by increasing the threshold for airway stimulation and inhibition of sympathetic transmission at central level. However; hypotension, bradycardia, and hypoxia may be observed with high dose of lignocaine [7-10].

Here, it originates in the rationale to continue the quest for an ideal anesthetic technique which is effective as well as safe to attenuate undesirable cardiovascular effects. Various efforts have been prepared to obtund these troublesome reflexes by the utilization of a variety of measures and drugs. Selection of a particular pharmacological additive is tricky since efficacy has to be weighed against its safety.

Hence, the present and clinical study was executed to estimate the effects of Esmolol and Lignocaine for attenuation of hemodynamic strain response to laryngoscopy and endotracheal intubation.

Aim and objectives

The objectives of the study are as follows:

1. To assess and compare the efficiency of esmolol and lignocaine for attenuation of sympathomimetic response to laryngoscopy and endotracheal intubation
2. To observe any adverse or beneficial effects.

METHODS

After approval of the Institutional Ethics Committee and informed consent, this study was conducted on 52 patients of ASA Grade I or II, with age ranging from 20 to 60 years of either sex planned for different surgeries requiring general anesthesia were incorporated in this study.

Pregnant and lactating women, morbid obese, patients with hypertension or known cardiac disease, ASA Grade III, or more and anticipated difficult intubation were excluded from the study.

Sample size estimation

Sample size was calculated at 95% Confidence Pause and 90% Control

$n=2(Z\alpha+Z\beta)^2\sigma^2/d^2$

$Z\alpha=1.96$ at 95% Assurance interval
$Z\beta=1.281$ at 90% power

d=clinically important difference between dual parameters. Sample size occupied in each group was 26.

Intervention plan and group allocation

Patients were kept blinded by sealed envelope technique and observer anesthesiologist was also unaware of drug allocation to avoid observer bias. The anesthesiologist who administered the study drugs did not participated in further study. Finally, based on the study drug to be given, all the selected 52 patients were randomly allocated into two groups:

- Group E: Inj. Esmolol 2.0 mg/kg body weight diluted to 10 mL with normal saline was given intravenously 2 min before intubation.
- Group L: Inj. Labetalol 2.0 mg/kg body weight diluted to 10 mL with normal saline was given intravenously 2 min before intubation.

Pre-anesthetic assessment

Complete history, general physical and systemic examination, airway assessment, along with routine blood investigations, ECG, and CXR, were done for all the selected patients.

Premedication

All the patients were reserved nil orally for minimum 8 h before surgery. Tablet Lorazepam 1 mg and tablet ranitidine 150 mg were given night before surgery. Inj. Glycopyrrolate 0.2 mg intravenously had given to all the patients as premedication.

Anesthesia management

After taking the patient in the process theater, venouscannulation was done and ringer lactate infusion was started. Basal parameters such as heart rate (HR), nasty blood pressure (BP) mean BP, systolic BP (SBP), and diastolic BP (DBP) had been logged. Study drug was given 2 min before intubation.

After preoxygenation with 100% oxygen, general anesthesia was induced with inj. fentanyl 2 μg/kg, inj. Propofol 2 mg/kg body weight. After securing mask ventilation, endotracheal intubation was performed after administration of inj. vecuronium 0.1 mg/kg body weight. Maintenance of anesthesia achieved by 50% oxygen in air with isoflurane, fentanyl, and vecuronium doses intermittently. Vital parameters were recorded immediately after intubation (AI) till completion of surgery and reversal of anesthesia. Any event of bradycardia and hypotension was noted. Reversal from anesthesia was done with inj. Glycopyrrolate 0.01 mg/kg body heaviness and Neostigmine 0.05 mg/kg body weight, after completion of surgical procedure. Any complications observed perioperatively were noted.

Frequency of data recordings

Hemodynamic parameters were recorded before administration of study drugs as baseline value and then during laryngoscopy and endotracheal intubation (DL). After endotracheal intubation, three more readings were recorded at 1 (AI 1), 3 (AI 3), and 5 (AI 5) min.

Statistical analysis

Statistical analysis was performed with the benefit of SPSS version 19 (SPSS, IBM, Chicago, IL, USA). The education data remained represented as mean±standard deviation. Inter-group comparison was done using Student's t-test. $p>0.05$ and <0.05 were considered statistically insignificant and significant, respectively.

RESULTS

Both the study groups were similar in terms of demographic traits such as age, weight, and height (Table 1).

The baseline HR was comparable among the two groups. Lignocaine group shows significant rise in mean HR during laryngoscopy and intubation, which did not get nearer to baseline level even after 5 min ($p<0.0001$). Significant attenuation of HR was noted in the esmolol group during intubation and thereafter at different time intervals (Table 2).

Esmolol group patients exhibited effectively controlled SBP and DBP as compared to lignocaine group, in which, even after 5 min of intubation, the increase in SBP and DBP did not return to baseline (Tables 3 and 4).

Esmolol group demonstrated a significant attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation. In lignocaine group, mean arterial pressure (MAP) was significantly high from baseline values, particularly during and 1 and 3 min past laryngoscopy and endotracheal intubation (Table 5).

DISCUSSION

The present study exhibited an abrupt but variable hemodynamic stress reply to laryngoscopy and endotracheal intubation in both the groups. Subsequently, all the hemodynamic variables began to decrease all through the study. These stress responses were attenuated to varying extent by both the study drugs but more efficiently suppressed with esmolol. This hemodynamic response is supposed to be due to stimulation of mechanoreceptors in the pharyngeal wall, epiglottis, and vocal cords [11]. Numerous measures have been used to suppress this stress response, such as spray with topical lignocaine, calcium channel blockers, achieving deeper plane of anesthesia with opioids, and vasodilators, but none of these measures were perfect and the exploration for a just right technique is ongoing.

Reid and Brace, in their clinical study, observed laryngeal and tracheal stimulation induced circulatory responses in terms of tachycardia and hypertension [12]. Takeshima *et al*. observed a rise of 20 mmHg in MAP at the time of laryngoscopy and intubation and they concluded that in

Table 1: Demographic profile of the study groups

Parameters	Group E (n=26)	Group L (n=26)	p-value
Age (years)	41.12±10.23	42.32±10.63	0.686 (NS)
Weight (kg)	58.08±6.62	61.48±9.35	0.144 (NS)
Height (cm)	167.15±7.91	168.00±7.47	0.693 (NS)

*NS: Not significant

Table 2: Comparison of mean heart rate between study groups

Recording time	Group E (n=26) (Mean±SD)	Group L (n=26) (Mean±SD)	p-value
BV	84.54±6.59	79.81±6.30	0.0520 (NS)
DL	81.04±6.95	90.73±4.60	0.0001 (HS)
AI 1	78.54±6.98	98.73±6.86	0.0001(HS)
AI 3	76.62±6.63	102.88±6.59	0.0001 (HS)
AI 5	77.15±6.73	99.35±6.56	0.0001 (HS)

BV: Basal value, DL: During laryngoscopy, AI: After intubation, SD: Standard deviation. *NS: Not significant, HS: Highly significant

Table 3: Comparison of callous systolic blood pressure between both the groups

Recording time	Group E (n=26) (Mean±SD)	Group L (n=26) (Mean±SD)	p-value
BV	122.76±7.76	122.16±7.06	0.77 (NS)
DL	127.72±9.41	138.92±12.26	0.00 (HS)
AI 1	123.12±6.10	139.08±10.91	0.00 (HS)
AI 3	121.72±6.52	136.04±11.76	0.00 (HS)
AI 5	120.28±7.71	135±12.23	0.00 (HS)

BV: Basal value, DL: During laryngoscopy, AI: After intubation, SD: Normal deviation. *NS: Not significant, HS: Highly significant

Table 4: Comparison of mean diastolic blood pressure among different groups

Recording time	Group E (n=26) (Mean±SD)	Group L (n=26) (Mean±SD)	p-value
BV	78.88±2.94	79.6±5.53	0.56 (NS)
DL	87.16±8.28	98.32±12.13	0.00 (HS)
AI 1	85.16±5.94	94.76±13.09	0.00 (HS)
AI 3	84.32±7.15	91.65±11.75	0.01 (HS)
AI 5	84.04±8.83	90.36±12.29	0.03 (HS)

BV: Basal value, DL: During laryngoscopy, AI: After intubation, SD: Normal deviation. *NS: Not significant, HS: Highly significant

Table 5: Comparison of mean arterial pressure between both the groups

Recording time	Group E (n=26) (Mean±SD)	Group L (n=26) (Mean±SD)	p-value
BV	93.51±3.67	93.786±5.27	0.37 (NS)
DL	90.42±3.40	100.12±4.11	0.00 (HS)
AI 1	88.27±3.28	103.42±4.33	0.00 (HS)
AI 3	86.65±3.49	106.65±4.52	0.00 (HS)
AI 5	86.04±3.36	103.15±4.48	0.00 (HS)

BV: Basal value, DL: During laryngoscopy, AI: After intubation, SD: Standard deviation. *NS: Not significant, HS: Highly significant

comparison with intubation, laryngoscopy was found to be more potent stimulus to produce hypertension [13].

Lignocaine has been a frequently used drug for attenuation of stress responses. It produces bronchodilation, peripheral vasodilation, and suppression of airway reflexes as well as direct myocardial depression. Lignocaine also has analgesic and antiarrhythmic properties.

Wilson *et al*. [10] affirmed the beneficial role of lignocaine for the prevention of tachycardia and hypertension due to laryngoscopy and intubation. Conversely, few studies have questioned the efficacy of lignocaine for attenuation of stress response. Kindler *et al*. [11] van den Berg *et al*. [14] and Singh *et al*. [15] could not established the beneficial role of lignocaine 1.5 mg/kg IV.

Esmolol being a cardio-selective β-1 adrenergic antagonist has quick onset of action causes decrease in cardiac contractility and HR. Different doses of esmolol ranging from 0.5 to 2 mg/kg have been used in the earlier studies. Mulimani *et al*. [16] compared the efficacy of Esmolol and Lignocaine given as bolus dose, to 60 participating patients, for attenuating the sympathomimetic response. They observed a substantial increase in HR, and MAP at intubation and at 1, 2, 3, and 5 min post-intubation in lignocaine group, but study parameters readings were comparable with baseline in esmolol group. They concluded that esmolol was more effective for suppression of intubation response in comparison with lignocaine which was similar to our results. Figueredo and Garcia [17] compared esmolol with placebo to assess sympathomimetic changes elicited by laryngoscopy and tracheal intubation. They concluded that Esmolol is efficient, in a dose-dependent manner, similar to our study.

The present study was also well in accordance with Muralidharan *et al*. [18], demonstrated a better efficacy of Esmolol as compared to Lignocaine for attenuation of stress response to laryngoscopy and intubation.

The present study did not observe any perioperative complications in any of the two groups.

Limitations of this study

The number of study participants was limited, calculated sample size could have been larger.

Invasive arterial line monitoring be situated not castoff which would give a real-time and beat to beat monitoring of BP.

CONCLUSION

The present compared the efficacy of esmolol and lignocaine for attenuation of the hemodynamic stress response during laryngoscopy and endotracheal intubation. We conclude that the laryngoscopy and endotracheal intubation were consistently linked with rise in hemodynamic parameters and bolus dose of esmolol 2 mg/kg IV was found to be more effective for attenuation of hemodynamic stress response to laryngoscopy and intubation under general anesthesia when compared with Lignocaine. However; Lignocaine is also safe and effective to some extent.

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