Original Article

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Efficacy of Lignocaine and Esmolol in Attenuating the Cardiovascular Responses to Laryngoscopy and Endotracheal Intubation

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Abstract

Background: The present study was undertaken to compare the efficacy of lignocaine and esmolol in attenuating the cardiovascular responses to laryngoscopy and endotracheal intubation. **Subjects and Methods:** 60 patients undergoing elective surgery were divided into two groups of 30 each, group L (Lignocaine) and group E (Esmolol). Baseline hemodynamic parameters - heart rate (HR), systolic blood pressure (SBP), diastolic blood pressures (DBP), mean arterial pressure (MAP) and rate-pressure product (RPP) were recorded. **Results:** There was no statistically significant difference in heart rate among the groups before and after premedication and after induction (P value >0.05). After intubation, there was rise in heart rate in both the groups. The rise was significantly less in esmolol group as compared lignocaine groups (p value <0.05) till 5 minutes of study period. There was no statistically significant difference in systolic blood pressure among the groups before and after premedication. After induction and intubation, there was no statistically significant difference in systolic blood pressure among the groups (p value >0.05). **Conclusion:** Esmolol hydrochloride 1mg/kg IV bolus dose is superior to lignocaine hydrochloride 1.5mg/kg IV bolus to attenuate the haemodynamic responses to laryngoscopy and endotracheal intubation.

Keywords: Esmolol hydrochloride, Endotracheal intubation, Systolic blood pressure

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Introduction

Laryngoscopy and endotracheal intubation are routine procedures of modern balanced general anaesthesia technique. Laryngoscopy and endotracheal intubation frequently induce cardiovascular stress response characterized by raised serum concentration of catecholamines; hypertension and tachycardia which may culminate in increased perioperative morbidity.[1] Haemodynamic changes are generally temporary without any sequelae. However, these changes can facilitate and accelerate the development of myocardial ischemia, cardiac arrhythmias, infarction and cerebral hemorrhage in patients with coronary artery disease, hypertension or cerebrovascular disease.[2]

The quest for effective suppression of these responses continues. Knowledge and studies on the cardiovascular response has led to the development of various techniques to modify this pressor response. Some of these include maintenance of deeper planes of anaesthesia, short duration of laryngoscopy, usage of drugs like intravenous(IV) lignocaine 1.5 mg/kg, intratracheal 4% lignocaine as topical spray, IV bolus fentanyl 11-2 μg/kg, sufentanil 0.2-0.3 μg/kg, sodium nitroprusside 1-2 μg/kg, topical nitroglycerine application, sublingual nifedepine, beta blockers like protalol, metaprolol prior to laryngoscopy and intubation are the various techniques developed for the same.[3] Esmolol, an ultra short acting cardio selective beta-blocker can be effectively used either as infusion or as bolus dose.

The ideal agent should block the haemodynamic responses to laryngoscopy and endotracheal intubation, should be short acting and should not deepen the level of anaesthesia significantly which may lead to myocardial depression, hypotension, and arrhythmias. Lignocaine hydrochloride is an antiarrhythmic agent which possesses membrane stabilizing action. It has been widely used in clinical practice to suppress sympathetic response to laryngoscopy and endotracheal intubation.[4,5] Esmolol, a cardio selective beta-blocker with a rapid onset of action and a short half life has been used by various groups of workers for the same purpose. The present study was undertaken to compare the efficacy of lignocaine and esmolol in

attenuating the cardiovascular responses to laryngoscopy and endotracheal intubation.

Subjects and Methods

This clinical study was conducted in Mediciti Institute of Medical Sciences, Ghanpur, Medchal, Andhra Pradesh. After approval from the hospital ethics committee, study was conducted during the period between October 2010 and 2012. A total of 60 patients undergoing elective surgery were randomly divided into two groups of 30 each, group L (Lignocaine) and group E (Esmolol).

Thorough pre-anaesthetic evaluation was done for all the patients. Written, valid informed consent was obtained both for conduct of study as well as for surgery and anaesthesia. Patients were kept nil by mouth from night before surgery and Tab. alprazolam (0.25 mg) was administered. In the pre-operative room, all the patients were reassessed on the day of surgery. 'Nil by mouth' status was confirmed. Baseline haemodynamic parameters - heart rate (HR), systolic blood pressure (SBP), diastolic blood pressures (DBP), mean arterial pressure (MAP), rate-pressure product (RPP), electrocardiogram (ECG) and SpO_2 were recorded. Intravenous line was secured with 18G cannula and ringer lactate solution was started.

Patients were shifted to operating theater. Anaesthesia machine, other equipments, monitors and emergency drugs were checked. Monitors are attached. Patients were premeditated with Inj. glycopyrrolate 0.005mg/kg body weight and Inj. midazolam 0.05mg/kg body weight intravenously 10 minutes before induction. Heart rate, systolic and diastolic blood pressures, mean arterial pressure, ECG (lead II) and SpO_2 were recorded. Preoxygenation was done with 100% oxygen for 3 min. Group L (n=30) patients received lignocaine hydrochloride 1.5 mg/kg IV and group E (n=30) patients received esmolol hydrochloride 2 mg/kg IV.

Haemodynamic parameters (HR, SBP, DBP and MAP) and oxygen saturation were recorded during intubation and thereafter at 1 min, 3 min, 5 min, 7 min and 9 minutes. All the data were tabulated analyzed and compared. P value of less than 0.05 was considered significant.

Results

[Table 1] shows that age group 18-26 years had 11 in group lignocaine and 12 in esmolol group, 27-35 years had 12 in lignocaine and 11 in esmolol, 36-45 years had 7 in lignocaine and 7 in esmolol group.

[Table 2] shows that there were 17 (56.66%) males and 13 (43.33%) females in lignocaine group and 14 (46.66%) males and 16 (53.33%) females in esmolol group.

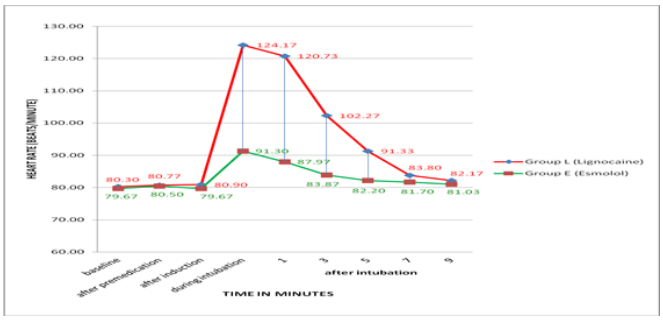

Figure 1: Comparison of heart rate

[Figure 1] shows that before and after premedication and after induction, there was no statistically significant difference in heart rate among the groups (p value >0.05). After intubation, there was rise in heart rate in both the groups. The rise was significantly less in esmolol group as compared lignocaine groups (p value <0.05) till 5 minutes of study period.

[Table 3] shows that before and after premedication, there was no statistically significant difference in systolic blood pressure among the groups (p value >0.05). After induction and intubation, there was no statistically significant difference in systolic blood pressure among the groups (p value >0.05).

[Table 5] shows that before, after premedication and after induction, there was no statistically significant difference in diastolic blood pressure among the groups (p value >0.05). After intubation: There was rise in diastolic blood pressure in both the groups. The rise was significantly less in esmolol group as compared lignocaine groups (p value <0.05) till 1 minutes of study period.

[Table 6] shows that before, after premedication and after induction, there was no statistically significant difference in mean arterial pressure among the groups (p value >0.05). After intubation: There was rise in mean arterial pressure in both the groups. The rise was significantly less in esmolol group as compared lignocaine groups (p value <0.05) till 3 minutes of study period.

[Table 7] shows that before, after premedication and after induction, there was no statistically significant difference in rate pressure product among the groups (p value >0.05). After intubation: There was rise in rate pressure product in both the groups. The rise was significantly less in esmolol group as compared lignocaine groups (p value <0.05) till 5 minutes of study period.

Discussion

The sequence of induction of anaesthesia, laryngoscopy and endotracheal intubation are associated with marked haemody-

Table 1: Age wise distribution

Age (years)	Lignocaine (n=30)	Esmolol (n=30)
18-26	11 (36.66%)	12 (40%)
27-35	12 (40%)	11 (36.66%)
36-45	7 (23.33%)	7 (23.33%)
Mean ±SD	30.00±7.43	29.87±7.74

Table 2: Gender wise distribution

Gender	Lignocaine	Esmolol
Male	17 (56.66%)	14 (46.66%)
Female	13 (43.33%)	16 (53.33%)

Table 3: Comparison of mean systolic blood pressure between study groups

Time		Lignocaine	Esmolol	P -value
Baseline		122.37±6.04	121.83±5.56	>0.05
After premedication		123.13±5.59	122.73±4.95	>0.05
After induction		122.80±5.30	122.67±4.06	>0.05
During intubation		155.17±4.68	135.87±3.93	<0.05
After Intubation	**1 Minute**	143.73±4.14	131.43±4.07	<0.05
	3 Minute	133.50±4.06	128.57±3.54	<0.05
	5 Minute	127.90±3.96	125.97±4.40	>0.05
	7 Minute	125.03±4.10	124.83±4.09	>0.05
	9 Minute	124.30±4.70	124.77±4.07	>0.05

Table 4: Comparison of mean diastolic blood pressure between study groups

Time		Lignocaine	Esmolol	P-value
Baseline		76.53±4.82	77.27±4.72	>0.05
After premedicaton		77.77±4.64	78.30±4.61	>0.05
After induction		77.03±5.14	77.33±4.37	>0.05
During intubation		98.93±2.29	93.70±2.44	**<0.05**
After Intubation	**1 Minute**	93.17±2.39	88.37±2.57	**<0.05**
	3 Minute	87.10±2.32	85.80±2.66	>0.05
	5 Minute	81.33±4.44	80.97±2.54	>0.05
	7 Minute	79.23±4.74	79.30±3.29	>0.05
	9 M inute	78.60±5.01	78.30±3.86	>0.05

namic changes and autonomic reflex activity and this may be a cause of concern in many high risk patients.[6] Laryngoscopy and intubation are associated with rise in blood pressure and heart rate occasionally cardiac arrhythmias. These potentially dangerous changes disappear within 5 minutes.[7] *Al*though the responses of blood pressure and heart rate are short lived they may have detrimental effects in high risk patients especially those with cardiovascular diseases, increased intracranial pressure or anomalies of the cerebral vessels.[8]

Many factors affect the cardiovascular responses associated with laryngoscopy and intubation. Age, drugs, duration of procedure, depth of anaesthesia, hypoxia, hypercarbia etc., influence the haemodynamic response. Variability of heart rate decreases with increasing age. Younger patients show more extreme changes. Marked fluctuations in haemodynamic responses are often seen in geriatric patients. The age of patients in this study ranged from 18 to 45 years.[9] Antihypertensive drugs can decrease pressor response. In

Table 5: Comparison of mean of mean arterial pressure

Time		Lignocaine	Esmolol	P -value
Baseline		91.81±4.95	92.12±4.63	>0.05
After Premedication		92.89±4.65	93.11±4.31	>0.05
After Induction		92.29±4.98	92.44±3.99	>0.05
During Intubation		116.34±2.55	107.76±2.56	**<0.05**
After Intubation	**1 Minute**	108.02±2.33	102.72±2.58	**<0.05**
	3 Minute	102.57±2.21	100.06±2.48	**<0.05**
	5 Minute	96.86±3.68	95.97±2.79	>0.05
	7 Minute	94.50±4.11	94.48±3.25	>0.05
	9 Minute	93.83±4.54	93.79±3.62	>0.05

Table 6: Comparison of mean rate-pressure product

Time		Lignocaine (n=30)	Esmolol (n=30)	P-value
Baseline		9830.90±839.66	9707.27±763.23	>0.05
After Premedication		9945.07±788.97	9878.80±682.53	>0.05
After Induction		9934.57±854.15	9773.87±608.75	>0.05
During Intubation		19270.10±1078.30	12405.23±767.04	**<0.05**
After Intubation	**1 Minute**	17362.73±1024.36	11560.57±647.08	**<0.05**
	3 Minute	13659.93±1210.21	10781.20±648.08	**<0.05**
	5 Minute	11678.47±641.90	10352.03±639.09	**<0.05**
	7 Minute	10480.73±673.56	10199.20±669.27	>0.05
	9 Minute	10216.30±683.35	10112.93±720.22	>0.05

this study patients on antihypertensive drugs were excluded. Different drugs used for premedication, induction, and muscle relaxation influence the sympathetic response to laryngoscopy and intubation. Midazolam at a dose of 0.2mg/kg IV decreases the blood pressure, and increases the heart rate similar to thiopentone. However, premedication with 0.05 mg/kg I.V has a minimal effect. Midazolam has no effect on sympathetic response to laryngoscopy and intubation. There is increase in catecholamine levels following laryngoscopy and intubation; both nor adrenaline and adrenaline. Laryngoscopy alone may produce most of the cardiovascular responses. [10]

The most important factor influencing the cardiovascular response is found to be the duration of laryngoscopy. A linear increase in heart rate and mean arterial pressure occurs during first 45 seconds. In the present study the duration of laryngoscopy and intubation was limited to 20 seconds. Adequate care was taken to achieve required depth of anaesthesia avoiding hypoxia and hypercarbia which can influence on haemodynamic variations. [11]

Excluding hypoxia and hypercarbia, continued manifestation of anxiety concerning anaesthesia and operation, inj. glycopyrrolate premedication, reflex baroreceptor effect after thiopentone and possible effects of suxamethonium are other contributory causes of hypertension and tachycardia. They seem to be less important than laryngotracheal stimulation during laryngoscopy and intubation. [12]

Various drugs and techniques have been utilized to blunt the haemodynamic response. These drugs minimize the increase in heart rate and blood pressure by attenuating positive chronotropic and inotropic effects due to the increase in adrenergic activity. Esmolol possesses several properties which makes it a valuable agent to obtund the cardiovascular response. Firstly it is a cardio selective agent. Secondly, it has ultra short duration of action (9 minutes) and finally, significant drug interactions with commonly used anaesthetics have not been reported. Lignocaine prevents rise in heart rate, blood pressure, intracranial pressure and intraocular pressure associated with laryngotracheal stimulation. It suppresses cough related to extubation. [8] It is recommended to use at a dose of 1.5 mg/kg IVand optimal time of administration is 3 minutes before laryngoscopy and intubation. [13]

The mean age of patients in lignocaine group of the present study is comparable with those of Bharthi et.al (30±5.3). [14] Singh et al, [15] studied the effect of lignocaine, esmolol and fentanyl in elderly patients. Male: female ratio in the present study, in lignocaine and esmolol groups is comparable with

Suman Shree et al.[16] In lignocaine it is comparable with Ifthikar et al.[17]

In lignocaine and esmolol groups, baseline heart rate was 80.30±4.9 beats/min and 79.67±4.77 beats/min respectively. Arti Rathore et al,[18]reported that patients of esmolol group had increased heart rate after laryngoscopy and endotracheal intubation (14% rise from baseline) as compared to control (35% rise) group.

In the present study after laryngoscopy and endotracheal intubation there was rise in the heart rate in both the groups. In lignocaine group it reached peak of 124.17±5.34 beats/min at 0 minutes of intubation (55% increase over baseline), where as in esmolol group, peak heart rate was 91.30±4.88 beats/min at 0 minutes of intubation (15% increase over baseline). Heart rate subsequently declined to 82.17±3.99 beats/min and 81.03±4.64 beats/min in lignocaine and esmolol group respectively at 9 minutes. Suman Shree et al,[16] in their study, reported that there was 22% rise in DBP in lignocaine group following laryngoscopy and endotracheal intubation, where as in esmolol group there was rise in DBP by 17% above baseline.

Conclusion

Authors concluded that that esmolol hydrochloride 1mg/kg IV bolus dose is superior to lignocaine hydrochloride 1.5mg/kg IV bolus to attenuate the haemodynamic responses to laryngoscopy and endotracheal intubation. No side effects were noted with esmolol and lignocaine hydrochloride.

References

1. Tasyuz T, Topcu I, Ozaslan S. Effects of Esmolol on haemodynamic responses to Laryngoscopy and Tracheal intubation in diabetic versus non diabetic patients. Turk J Med Sch. 2007;37(5):289–296.
2. Prerana P, Shuba N, Indula D. Bolus administration of Esmolol in controlling the haemodynamic response to Endotracheal intubation. J Anaesth Clin Pharmacol. 2004;20(1):69–72.
3. Anila D, Malde, Sarode V. Attenuation Of The Haemodynamic Response To Endotracheal Intubation, Fentanyl Versus Lignocaine. Internet Journal of Anesthesiology. 2007;12:1–1.
4. Stoelting RK. Circulatory changes during direct laryngoscopy and tracheal intubation: influence of duration of laryngoscopy with or without prior lignocaine. Anesthesiology. 1977;47(4):381–383. Available from: https://doi.org/10.1097/00000542-197710000-00012.
5. Southworth JL, Mckusick VA, Peirce EC, Rawson FL. Ventricular fibrillation precipitated by cardiac catheterization. Complete recovery of a patient after forty five minutes. J Am Med Assoc. 1950;143(8):717–717. Available from: https://doi.org/10.1001/jama.1950.02910430009003.
6. Adi MNAM, Keszler H, Yacoub JM. Cardiovascular reactions to laryngoscopy and tracheal intubation following small and large intravenous doses of lidocaine. Can Anaesth Soc J. 1977;24(1):12–19. Available from: https://doi.org/10.1007/bf03006808.
7. Yukioka H, Yoshimoto N, Nishimura K, Fujimori M. Intravenous Lidocaine as a Suppressant of Coughing during Tracheal Intubation. Anesth Analg. 1985;64(12):1189–1192. Available from: https://dx.doi.org/10.1213/00000539-198512000-00010.
8. Tam S, Chung F, Campbell M. Intravenous lignocaine: optimal time of injection before tracheal intubation. Anesth Analg. 1987;66:1036–1074.
9. Helfman SM, Gold MI, DeLisser EA, Herrington CA. Which drug prevents tachycardia and hypertension associated with tracheal intubation: lidocaine, fentanyl, or esmolol? Anesth Analg. 1991;72(4):482–86. Available from: https://doi.org/10.1213/00000539-199104000-00011.
10. Wilson IG, Meiklejohn BH, Smith G. Intravenous lignocaine and sympathoadrenal responses to laryngoscopy and intubation. Anaesthesia. 1991;46(3):177–180. Available from: https://dx.doi.org/10.1111/j.1365-2044.1991.tb09403.x.
11. Taneja B, Dali JS, K DC. Lignocaine HCl versus Esmolol HCl - Influence on cardiovascular response to laryngoscopy and endotracheal intubation. J Anaesth Clin Pharmacol. 2003;19(1):53–57.
12. Ugur B, Ogurlu M, Gezer E, Aydin ON, Gürsoy F. Effects of esmolol, lidocaine and fentanyl on haemodynamic responses to endotracheal intubation: a comparative study. Clin Drug Investig. 2007;27(4):269–277. Available from: https://doi.org/10.2165/00044011-200727040-00006.
13. Levitt MA, Dresden GM. The Efficacy of Esmolol versus Lidocaine to Attenuate the Hemodynamic Response to Intubation in Isolated Head Trauma Patients. Acad Emerg Med. 2001;8(1):19–24. Available from: https://dx.doi.org/10.1111/j.1553-2712.2001.tb00541.x.
14. van den Berg AA, Savva D, Honjol NM. Attenuation of the haemodynamic responses to noxious stimuli in patients undergoing cataract surgery. A comparison of magnesium sulphate, esmolol, lignocaine, nitroglycerine and placebo given I.V with induction of anaesthesia. Eur J Anaesthesiol. 1997;14(2):134–147. Available from: https://doi.org/10.1046/j.1365-2346.1997.00069.x.
15. Singh H, Vichitvejpaisal P, Gaines GY, White PF. Comparative effects of lidocaine, esmolol, and nitroglycerin in modifying the hemodynamic response to laryngoscopy and intubation. J Clinic Anesth. 1995;7(1):5–8. Available from: https://dx.doi.org/10.1016/0952-8180(94)00013-t.
16. Shree RS, Badrinarayan V, J R. Evaluation of three regimens of Esmolol for attenuation of cardiovascular response to Endtracheal intubation - A comparision with Intravenous Lignocaine. J Anaesth Clin Pharmacol. 2003;19(1):45–52.
17. Hussian I. Khalid Zaeem Comparison of glyceryltrinitrate with plain lignocaine in attenuating the hypertensive response. Professional Med J. 2007;14(3):466–470.
18. Rathore A, Gupta HK, Tanwar GL, Rehman H. Attenuation of the pressure response to laryngoscopy and endotracheal intubation with different doses of esmolol. Indian J Anaesth. 2002;46(6):449–452.

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