Section: Anaesthesia

Original Research Article

A COMPARATIVE STUDY OF EFFICACY OF LIGNOCAINE ALONE AND LIGNOCAINE AND ESMOLOL COMBINATION IN ATTENUATION OF HEMODYNAMIC STRESS RESPONSE TO LARYNGOSCOPY AND INTUBATION DURING GENERAL ANAESTHESIA IN TERTIARY CARE HOSPITAL

Sama Swapna[1], S Bharat Kumar[2], Ashita Rukmini Vuthaluru[3], Nimmagadda Rajaratnakumar[4], Krishna Saketh Athmakuri[5], Kousalya Chakravarthy[6]

[1]Assistant Professor, Department of Anaesthesia, Osmania Medical College, Hyderabad, Telangana, India.
[2]Assistant Professor, Department of Anaesthesia, Osmania Medical College, MGMH, Petlaburz, Hyderabad, Telangana, India
[3]Senior Resident, All India Institute of Medical Sciences, New Delhi, India
[4]Assistant Professor, Department of Anaesthesia, MediCiti Institute of Medical Sciences, Medchal Mandal Ghanpur, Telangana, India
[5]MBBS Student, Osmania Medical College, Koti, Hyderabad, Telangana, India.
[6]Professor & HOD, Department of Anaesthesia, Government Medical College, Jangaon, Telangana, India.

Received : 22/05/2024
Received in revised form : 13/07/2024
Accepted : 29/07/2024

Keywords:
Esmolol, Lidocaine, myocardial ischemia, hemodynamic responses.

Corresponding Author:
Dr. Nimmagadda Rajaratna Kumar,
Email: drms.rajavicky@gmail.com

DOI: 10.47009/jamp.2024.6.4.80

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (4); 402-406

Abstract

Background: The aim is to evaluate the safety and efficacy of intravenous Lignocaine and combination of intravenous Lignocaine and Esmolol in attenuating cardiovascular response to laryngoscopy and intubation. **Materials and Methods:** A prospective, randomized study included total 50 patients belonging to ASA grade I and II of either sex with age between 20-50 years posted for elective surgeries under general anesthesia. 25 patients in group A(Lignocaine) and 25 patients in group B (Lignocaine and Esmolol) were undertaken to compare the hemodynamic parameters during intubation and to compare efficacy of attenuation of hemodynamic responses & side effect profile of both the drugs. **Result:** The age, sex and ASA grading distribution of both the groups are found to be comparable and statistically insignificant ($p > 0.05$), both the groups were almost similar. Systolic, diastolic blood pressure, heart rate, MAP and Rate pressure product before and after intubation, immediately after 1, 3, 5, 15 minutes of intubation were found to be significant ($p<0.05$). **Conclusion:** Combination of Esmolol and lidocaine is safe and effective that can be used in patients undergoing general anesthesia to attenuate the laryngoscopy responses to both intubation, thereby reducing the myocardial oxygen consumption and perioperative risk of myocardial ischemia.

INTRODUCTION

Endotracheal intubation is the gold standard for airway management, as it provides a definitive airway for delivery of anesthetic gases, protects from aspiration of gastric contents, and useful for positive pressure ventilation with higher airway pressures. Direct laryngoscopy, endotracheal intubation frequently induces a cardiovascular stress response that is characterized by hypertension and tachycardia due to reflex sympathetic simulation and an increase in serum catecholamines. The response is transient occurring 30 seconds after intubation and lasting for less than 10 min and it may be hazardous in patients with hypertension, myocardial infarction and other co-morbidities. Various pharmacological approaches have been used to attenuate the pressure responses.[1,2]

The sympatho-adrenal response to intubation result in an increase in cardiac workload which in turn may culminate in peri-operative myocardial infarction and acute heart failure in susceptible patients. Perioperative myocardial infarction is one of the

causes of postoperative morbidity and mortality due to hypertension and tachycardia. Control of the heart rate and blood pressure response to intubation is essential in preventing adverse cardiovascular outcomes.

The mechanical stimulation of four different areas of upper respiratory tract viz. nose, epipharynx, laryngopharynx and the trachea-bronchial tree induces reflex cardiovascular responses. These stress responses are seen because of stimulation of epipharynx and laryngopharynx and least with tracheobronchial stimulation. The sensory afferents from the epipharynx and laryngopharynx are carried by glossopharyngeal nerve, while trigeminal and vagus nerves carry sensations from tracheobronchial tree. This results in enhanced neural activity in the cervical sympathetic afferent fibers. These afferent fibers activate vasomotor centre which ends in reflex cardiovascular responses in the form of tachycardia, hypertension and cardiac dysrrhythmias and laryngobronchial spasm.[3,4]

Laryngovagal stimulation causes bradycardia, laryngosympathetic stimulation leads to hypertension and tachycardia and Laryngospinal stimulation leads to hypotension and splanchnic reflexes. The aim is to protect the heart from noxious stimulation arising as a result of laryngoscopy and intubation. Normal patients usually tolerate this increased sympathetic response but patients having valvular heart disease, coronary artery disease, aortic aneurysms, recent myocardial infarction and cerebral aneurysms or intracranial hypertension require careful hemodynamic control during laryngoscopy, intubation, extubation, skin incision and surgical manipulations. The rise in heart rate, systolic and diastolic blood pressure, mean arterial pressure are highly undesirable in such patients.

MATERIALS AND METHODS

A prospective, randomized study was done in Osmania general hospital, Afzalgunj, Hyderabad. The study protocol was approved by the institutional ethical committee and informed consent was taken from each of the patients.

Inclusion Criteria

Patients of age 20 to 50 years of both genders, ASA grade I and II scheduled to undergo surgery under general anesthesia.

Exclusion Criteria

Patient with difficult airways, with known allergies to local anesthetics, contraindications to beta blockers like bronchial asthma, COPD, Basal heart rate <60bpm, Basal systolic blood pressure <100mmhg

The study included total 50 patients belonging to ASA grade I and II of either sex with age between 20-50 years posted for elective surgeries under general anesthesia with 25 patients in group A (Lignocaine) and 25 patients in group B (Lignocaine and Esmolol), undertaken to compare the hemodynamic parameters during intubation and to compare efficacy of attenuation of hemodynamic responses & side effect profile of both the drugs.

All the patients who fulfill inclusion criteria & undergoing elective surgery under general anesthesia in Osmania general hospital Hyderabad,
were thoroughly examined on the day prior to surgery and on the day of surgery pre-operative assessment sheet was checked. The height, weight, body mass index of the patient were measured.

As a part of the pre anesthetic evaluation, history of previous medical and surgical illness, previous anesthetic exposures, drug allergies was taken.

The airway assessment, spine examination and the nutritional status of the patient were evaluated. A detailed general and systemic examination was done. Preoperative investigations like CBP, RBS, Blood grouping and typing, ECG, chest x-ray, Renal and Liver function tests, B.T, C.T, HIV, HbSAg depending on the history & co-morbid conditions of the patient were evaluated properly.

Patient kept nil per oral (NPO) for at least 6 hours prior to surgery. Preoperative vital parameters in the form of baseline pulse, blood pressure and oxygen saturation will be recorded. Anesthesia machine was checked, resuscitation equipment and drugs were checked and kept ready, before undertaking the procedure.

On arrival to operation theatre, routine monitors (ECG, Pulse oximetry, NIBP) attached and baseline vital parameters like heart rate, mean arterial blood pressure (MAP) and arterial oxygen saturation (SpO2) were recorded. An intravenous line with 18G intravenous catheter is secured. After baseline parameters were noted, patients were allocated randomly to the two groups using slips in box method. All patients were pre-medicated with intravenous Glycopyrrolate 5µg/kg, Ondansetron 15µg/kg and intravenous Fentanyl 2mcg/kg. All patients were preoxygenated with 100% O2 for 3 minutes and were induced with Propofol 2mg/kg IV.

Group A: patients received 2% i.v. Lignocaine 1.5 mg/kg (Preservative free) 3 minutes prior to laryngoscopy.

Group B: patients received i.v. Lignocaine 2% 1mg/kg and i.v Esmolol 1mg/kg (3 minutes and 90 sec prior to laryngoscopy)

Intubation was achieved with an appropriate size oral cuffed, portex endotracheal tube by the aid of Macintosh laryngoscope blade.

The recordings were noted at various intervals as detailed below, from the study conducted. Anesthesia was maintained with Atracurium and intermittent positive pressure ventilation with nitrous oxide and oxygen in the ratio of 50: 50 with 1% sevoflurane using circle absorber system connected to the anesthesia workstation.

At the end of surgery, neuromuscular blockade was reversed with Neostigmine 50 µg/ kg and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Glycopyrrolate10 µg/kg intravenously. After satisfying the extubation criteria, patient was extubated and transferred to postoperative ward. Patients were observed for any adverse events during postoperative period.

Statistical analysis: The data was expressed as mean & standard deviation. The homogenicity in two groups of mean and standard deviation was analysed using SPSS version, Analysis of variance (ANOVA) for each parameter. Comparison between two groups at a time (inter-group comparison) was done using student's unpaired t- test. P value < 0.05 was considered statistically significant, P value < 0.01 was considered highly significant, P value > 0.05 was considered insignificant.

RESULTS

The present Prospective Randomized comparative study was conducted in the Department of Anesthesiology, Osmania medical college, Hyderabad during the period of 2019 to 2021.A total of 50 patients randomly allocated in two groups, to Group A(Lignocaine) & Group B(Lignocaine and Esmolol) of 25 each undergoing elective surgeries, under GA were studied. Sex, age, and weight were comparable in the two groups. The results were noted.

The age, sex and ASA grading distribution of both the groups are found to be comparable and statistically insignificant (p >0.05) both the groups were almost similar.

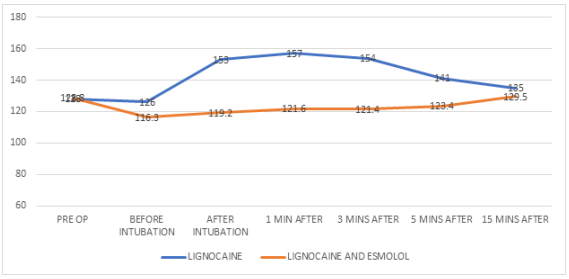

Figure 1: Comparison of SBP between two groups at various intervals

Systolic blood pressure at various time intervals were compared between groups. Systolic blood pressure before and after intubation, immediately after 1, 3, 5, 15 minutes of intubation were found to be significant (p<0.05).

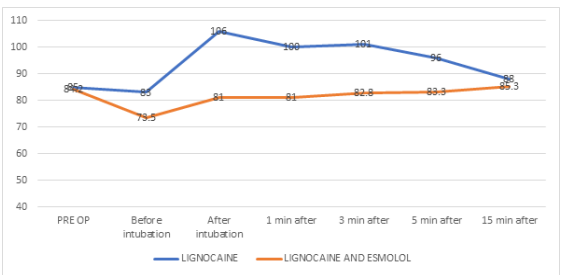

Figure 2: Comparison of DBP between two groups at various intervals

Diastolic blood pressure at various time intervals were compared between groups. Diastolic blood pressure before and after intubation, immediately after 1, 3, 5 minutes of intubation were found to be significant (p<0.05).

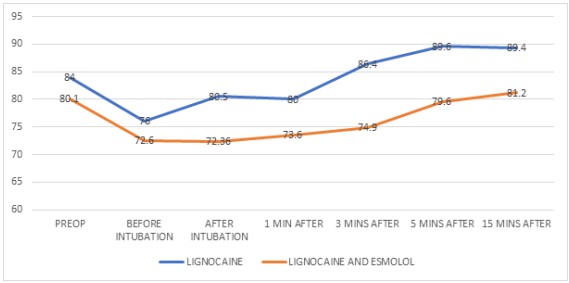

Figure 3: Comparison of HR between two groups at various intervals

Heart rate at various time intervals were compared between groups. The heart rate after intubation, immediately after 1, 3, 5, 15 minutes were found to be significant (p<0.005).

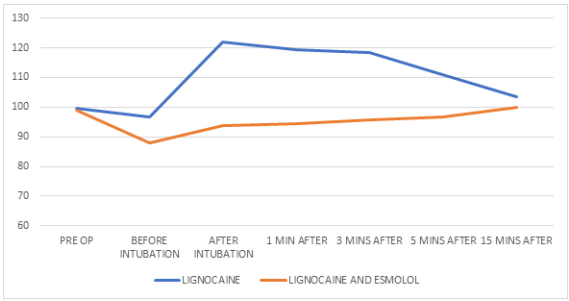

Figure 4: Comparison of map between two groups at various time intervals

Mean arterial blood pressure at various time intervals were compared between groups. Mean arterial blood pressure before and after intubation, immediately after 1min, 3 min, 5mins of intubation were found to be significant (p<0.05).

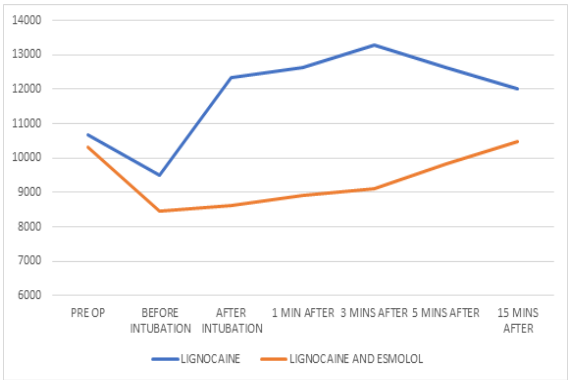

Figure 5: Comparison of rate pressure product (RPP) between two groups at various intervals

Rate pressure product at various time intervals are compared between groups. Rate pressure product before and after intubation, immediately after 1min, 3 min, 5mins, 15 minutes of intubation were found to be significant (p<0.05).

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 1: Demographic details in present study.

Age in years	Lignocaine	Lignocaine and Esmolol	P Value
No.of Cases	25	25	0.153
Mean	36	32.4	
Standard Deviation	10	7.34	
Sex			
Male	11	14	1
Female	14	11	
ASA 1 and 2			
ASA-1	17(68%)	16(64%)	1
ASA-2	8(32%)	9(36%)	

DISCUSSION

One of the most painful stimulation for a patient undergoing surgery under general anesthesia is laryngoscopy and endotracheal tube insitu responses. This causes a major hemodynamic change in the form of increasing heart rate and systolic blood pressure. As age increases, changing vascular tone, existing co morbidities make it detrimental to the patient as these hemodynamic changes are usually met with increased oxygen demand, which if not met will lead to development of myocardial ischemia.

Lidocaine delays the rate of spontaneous phase 4 depolarization by preventing or diminishing the gradual decrease in potassium ion permeability that normally occurs during this phase. The effectiveness of lidocaine in suppressing haemodynamic stress response reflects its ability to decrease the rate of spontaneous phase 4 depolarization.

Lignocaine at a dose of 1.5 mg/kg reduces heart rate without much affecting other parameters like systolic blood pressure, diastolic blood pressure, mean arterial pressure and rate pressure product. Only the combination of drug lignocaine 1mg/kg and esmolol 1mg /kg maintained the haemodynamic parameters near the baseline during laryngoscopy, immediately after intubation, 1, 3 & 5 minutes of intubation. In this study the mean age, gender and ASA grading of the patients was comparable and the difference is not significant.

In this study, after administration of the test drugs, both groups had significant decrease of heart rate values ($p<0.001$), Group B shows sustained decrease in heart rate values till 15 minutes after intubation and in Group A (lignocaine), the decrease in HR is not sustained & its is less than that of Group B.

In this study the systolic and diastolic blood pressure decreased significantly in Group B lignocaine and esmolol ($p<0.05$) immediately after intubation and remained stable upto 5 minutes after intubation, but not in Lignocaine group A were there is a significant increase in all the blood pressures till the 15th minute. Mean Arterial pressure decreased significantly in Group B (with $p<0.05$) which is statistically significant) immediately after intubation & remained stable even after 5 minutes of intubation. In Lignocaine group A, there is a significant increase in MAP till 15th minute.

In Group B (lignocaine and esmolol) rate pressure product, which is an indicator of myocardial oxygen consumption did not overshoot the baseline value during laryngoscopy and intubation. Whereas in group A(lignocaine), rate pressure product was significantly high above baseline leading to increased myocardial oxygen consumption. The RPP levels close to 20,000 are normally associated with angina and myocardial ischemia.[5] RPP 1 min after intubation remained less than 20,000 in study drug groups. This finding confirms the cardio-protective effect of study drugs during laryngoscopy and intubation.

Stoelting et al,[6] included patients with heart disease and reported a favorable response. Studies have shown that there is increased incidence of myocardial infarction when intraoperative heart rates are more than110 beats min-1.[7] In our study none of the patients in study groups showed heart rate >110 beats min-1.

Christoph H. Kindler, et al,[8] in his study concluded, esmolol and lignocaine combination group is reliably effective in attenuating HR response to tracheal intubation whereas the lignocaine group does not affect the heart rate. Neither the esmolol nor that of lidocaine affected the BP response. Only the combination of esmolol and lidocaine reduces the systolic blood pressure.

Harbhej Singh et al,[9] in his study concluded, Lidocaine and nitroglycerin were ineffective in controlling the acute hemodynamic response following laryngoscopy and intubation. Esmolol was significantly more effective than either lidocaine or nitroglycerin in controlling the HR response to laryngoscopy and intubation. Esmolol also was significantly more effective than lidocaine in minimizing the increase in MAP

M. Andrew Levitt et al,[10] in his study concluded, Esmolol and lidocaine have similar efficacies to attenuate moderate hemodynamic response to intubation of patients with isolated head trauma.

Sanjeev Singh et al,[11] in his study concluded prophylactic therapy with esmolol is more effective and safe for attenuating cardiovascular responses to laryngoscopy and tracheal intubation compared to lidocaine in a black population.

CONCLUSION

Hence from the above mentioned data in our study, we can conclude that combination of esmolol and lidocaine is safe & effective that can be used in patients undergoing general anesthesia to attenuate the laryngoscopy responses to both intubation,

ISSN (O): 2687-5365; ISSN (P): 2753-6556

thereby reducing the myocardial oxygen consumption and perioperative risk of myocardial ischemia.

REFERENCES

1. Singh S, Laing E, Ansah Owiredu W.K, Singh A: Comparision of esmolol and lidocaine for attenuation of cardiovascular stress response to laryngoscopy and endotracheal intubation in ghanian population. Anesthesia; essays and researches,2013:7(1),83.
2. Tamaskar, A, Bhargava S, Rao M, Singh M: Effect of esmolol hydrochloride on attenuation of stress response during laryngoscopy and intubation in ENT procedures,British journal of anesthesia:2015: 3(11),1370-1377.
3. Mendonça FT, Silva SLD, Nilton TM, Alves IRR. Effects of lidocaine and esmolol on hemodynamic response to tracheal intubation: a randomized clinical trial. Braz J Anesthesiol. 2022 Jan-Feb;72(1):95-102.
4. Begum, M & Akter, Papri & Hossain, Mm & Alim, Sma & Khatun, Uhs & Islam, Smk & Sanjowal, L. A Comparative Study Between Efficacy Of Esmolol And Lignocaine For Attenuating Haemodynamics Response Due To Laryngoscopy And Endotracheal Intubation. Faridpur Medical College Journal. :2011: 5. 10.3329/fmcj.v5i1.6810.
5. Stoelting RK. Circulatory changes during direct laryngoscopy and tracheal intubation: Influence of duration of laryngoscopy with or without prior lidocaine. Anesthesiology. 1977;47:381–3.
6. Tian-long W, Yan J, Ba-xian Y. Effect of nicardipine combined with esmolol on systemic and tissue oxygenation during off-pump coronary artery bypass grafting surgery. Chin Med J. 2005;118:130–5.
7. Elif BS, Emre U, Burcu U, Binnur S. Hemodynamic responses and upper airway morbidity following tracheal intubation in patients with hypertension: Conventional laryngoscopy versus an intubating laryngeal mask airway. Clinics. 2012;67:49–54.
8. Kindler CH, Schumacher PG, Schneider MC, Urwyler A. Effects of intravenous lidocaine and/or esmolol on hemodynamic responses to laryngoscopy and intubation: a double-blind, controlled clinical trial. J Clin Anesth. 1996 Sep;8(6):491-6. doi: 10.1016/0952-8180(96)00109-2. PMID: 8872690.
9. 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 Clin Anesth. 1995 Feb;7(1):5-8.
10. 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 Jan;8(1):19-24. doi: 10.1111/j.1553-2712.2001.tb00541.x. PMID: 11136142.
11. Singh, S & Laing, Edwin & Owiredu, William & Singh, Arti & Singh, Sanjeev. Attenuation of Cardiovascular response by ß-blocker esmolol during laryngoscopy and intubation. Journal of Medicine. 2012:1. 27-33. 10.13140/2.1.3759.8087.

ISSN (O): 2687-5365; ISSN (P): 2753-6556