International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2021; 4(2): 91-95
Received: 08-05-2021
Accepted: 16-06-2021

Dr. Yugandhar Kandula
Assistant Professor, Department of Anaesthesia, Mamata Medical College, Khammam, Telangana, India

Dr. Shirisha G
Senior Resident, Department of Anaesthesia, Mamata Medical College, Khammam, Telangana, India

Corresponding Author:
Dr. Yugandhar Kandula
Assistant Professor, Department of Anaesthesia, Mamata Medical College, Khammam, Telangana, India

Comparative effects of esmolol and airway blocks in attenuating the hemodynamic response to laryngoscopy and intubation

Yugandhar Kandula and Shirisha G

DOI: https://doi.org/10.33545/26643766.2021.v4.i3b.285

Abstract

Background and Aims: Hemodynamic stability is one of the main goals of any anaesthesiologist. The main cause of transient hemodynamic instability and interruption of patients airway reflexes is laryngoscopy and intubation. This study was done to compare the effects of esmolol and airway blocks in attenuating the hemodynamic response to laryngoscopy and intubation.

Methods: After approval of the study protocol by the institutional ethical committee, written informed consent was obtained from each patient. It was a randomized controlled double blinded study. 60 patients of American Society of Anesthesiologists physical status one and two scheduled for elective surgery under General Anaesthesia , aged between 18 and 65 yrs were randomly allocated into two groups - esmolol (n=30) and airway blocks (n=30). Group 1 received injection esmolol 0.5mg/kg body weight. Group 2 received superior laryngeal nerve both sides with 2ml 2% plain Lignocaine each side and translaryngeal block with 3 ml 4% Lignocaine.

Results: Following laryngoscopy and intubation, the increase in systolic blood pressure, diastolic blood pressure and heart rate were significantly lower ($p<0.05$) in airway blocks group after 1 min and after 5 mins of intubation.

Conclusion: Airway blocks was significantly more effective in attenuating the hemodynamic response to laryngoscopy and intubation in comparison to esmolol 0.5mg/kg.

Keywords: Hemodynamic response, airway blocks, esmolol, laryngoscopy, intubation

Introduction

Hemodynamic stability is one of the main goals of any anaesthesiologist. The main cause of transient hemodynamic instability and interruption of patients airway reflexes is laryngoscopy and intubation [1]. It has detrimental effects on the other organs especially in patients with COPD, heart diseases and high blood pressure and associated with morbidity at times [2, 3]. They are associated with hemodynamic changes due to sympathetic response leading to increase in plasma concentration of adrenaline and noradrenaline.

Hemodynamic response to laryngoscopy and intubation was first described by Reid and Brace in 19404. There are several methods in modifying the hemodynamic response, Eg. deep anesthesia and use of ganglion blockers [5]. Similarly, several cardiovascular drugs such as esmolol, lidocaine, nitroprusside, gabapentin, pregabalin, dexmedetomidine, verapamil and clonidine have been tested to blunt the acute hemodynamic response to tracheal intubation [6-11].

Various studies have shown that esmolol is more effective in attenuating the sympathetic response to laryngoscopy and intubation [12]. Beta-adrenergic receptor blocking drugs, eg. esmolol, is found to be more effective in controlling the increase in heart rate than the rise in blood pressure [13].

One of the indications for awake airway management is severe hemodynamic instability [14].

Lidocaine is the most commonly used local anesthetic because of its rapid onset, high therapeutic index and availability in a wide range of preparations and concentrations [15, 16].

The superior laryngeal nerve, a branch of vagus nerve provides sensory input from the lower pharynx and upper part of larynx, including the glottis surface of the epiglottis and the aryepiglottic folds. Translaryngeal/Transtracheal block provides anaesthesia of the trachea and vocal cords. It makes the presence of the ETT in the trachea more comfortable. The maximum dose of lidocaine for application to the airway is not well established; different sources suggest total doses in the range of 4 to 9 mg/kg [16, 17, 18]. Monitoring for signs and symptoms of lidocaine toxicity, including tinnitus, perioral tingling, metallic taste, light headedness, dizziness and sedation is important. Severe lidocaine overdose can cause hypertension, tachycardia, seizures and cardiovascular collapse [19].

Materials and methods

This study was done in Mamata Medical College and *Hospital*, Khammam from November 2020 to April 2021 on forty ASA 1 and ASA 2 patients scheduled for elective surgeries under General Anaesthesia and endotracheal intubation. This study was approved by institutional ethical committee and written informed consent from patients.

Patients included in the study were ASA 1 and ASA2, both genders, aged between 18 and 65 years, who underwent General anaesthesia with endotracheal intubation and agreed to participate in study. The exclusion criteria were: Patients with difficult predicted airway, Body mass index (BMI)>35 kg/m^2, Previous use of beta blockers or calcium channel blockers, cardiac arrhythmias, renal dysfunction, airway hyperreactivity, hypersensitivity to drugs used, pregnancy, COPD.

All patients are administered oral alprazolam 0.25 mg on the night before surgery. Using block randomisation, 60 patients satisfying the inclusion criteria were randomly assigned to each group of 30 patients each. Group 1 received injection esmolol 0.5mg/kg body weight. Group 2 received superior laryngeal nerve both sides with 2ml 2% plain Lignocaine each side and recurrent laryngeal nerve block with 3 ml 4% Lignocaine.

In the operation theatre, patients were made to lie supine and intravenous infusion line was secured and standard monitoring devices measuring Non invasive blood pressure (NIBP), Pulse rate (PR), percentage oxygen saturation (SPO_2) and continous echocardiography (ECG) were attached and baseline values were recorded. All patients were premedicated with 0.2 mg iv injection glycopyrrolate, injection Fentanyl 1 mcg/kg iv, injection Midazolam 0.005 mg/kg - 12 minutes before induction of anaesthesia. In Group 1 patients injection esmolol 0.5 mg/kg body weight iv was given 10 mins before induction. In Group 2 patients, superior laryngeal nerve block was done by external approach on both sides by extending the neck to facilitate identification of hyoid bone. Once identified the hyoid bone is gently displaced to the side where block is performed and a 25 gauge needle is inserted from lateral side of neck aiming towards greater cornu of hyoid bone. Once contact has been made, the needle is walked off the bone inferiorly and 2 ml of 2% plain lignocaine is injected after aspirating. This is repeated on the contralateral side. Transtracheal or translaryngeal block is done by extending the neck and the palpating finger is moved in cauded direction until cricoid cartilage is palpated, above it is cricothyroid membrane. The thyroid cartilage is stabilised using thumb and third finger of one hand, then 22 gauge needle should be inserted perpendicular to the skin while continually aspirating the syringe to penetrate the cricothyroid membrane. The appearance of bubbles indicate needle tip is in trachea. Stabilise the needle and 3 ml of 4% plain lignocaine is injected rapidly. This causes the patient to cough anesthetizing the vocal cords and the trachea .This was done 10 mins before induction.

Anaesthesia was induced with injection propofol 1 % at 2 mg/kg body weight and over a period of 15 seconds after preoxygenation for 3 minutes. Endotracheal intubation was performed after giving injection succinylcholine 1.5 mg/kg iv. The laryngoscopes and intubation time were noted. During laryngoscopes PR, SPO_2, SBP, DBP were noted; and then recorded at 1st and 5th minutes of laryngoscopy. Manual ventilation was started at reset of 14 breaths per minute using circle absorption system. Anaesthesia was maintained with 67 % N_2O and 33% O_2 study period. Injection Vecuronium 0.1 mg/kg was given for relaxation and was supplemented as needed. At the end of study period position of patient and surgery was permitted. At the end of surgery, residual neuromuscular paralysis was antagonised with injection neostigmine 0.05 mg/kg body weight and glycopyrrolate 0.01 mg/kg IV. Oropharyngeal suctioning was done and when adequate spontaneous ventilation was established patients were extubated. Subsequently patients were shifted to respective wards.

Results

It is a randomised controlled double blinded study. Students t test was used here to obtain the p value.

In this study, there was no significant difference in demographic and clinical variables among the study groups. The results were shown in table 1.

Table 1: Demographics and clinical characteristics

Variables	Airway blocks (n=30)	Esmolol (n=30)	P value
Age (Years) Mean, SD	36±8.76	33.16±7.53	0.24
Gender (M/F)	12/18	14/16	0.56
Weight (Kgs)	65.12±8.12	68.65±7.87	0.34
Height (Cms)	165.45±15.25	167.21±18.21	0.65
ASA (I/II)	15/5	16/14	-
Mallampati Grading	18/12	16/14	-

Heart rate

The baseline heart rate was not significantly changed among the study groups. However, in airway block group the heart rate was significantly lower after 1(p=0.004) and 5 mins (p=0.006) laryngoscopy as compared to the Esmolol group. The results were shown in table 2.

Table 2: Heart rate among the study groups

Heart Rate (mins)	Airway blocks (n=30)	Esmolol (n=30)	P value
Baseline	68.13±10.12	69.14±9.87	0.353
1min after laryngoscopy	70.45±12.54	86.54±13.76	0.004
5mins after laryngoscopy	72.26±12.34	81.65±14.13	0.006

Systolic blood pressure

The baseline systolic blood pressure was not significantly changed among the study groups. However, in airway block group the systolic blood pressure was significantly lower after 1(p=0.001) and 5 mins (p=0.008) laryngoscopy as compared to the Esmolol group. The results were shown in table 3.

Table 3: Systolic blood pressure among the study groups

Systolic blood pressure (mm/Hg)	Airway blocks (n=30)	Esmolol (n=30)	P value
Baseline	110.21±25.87	114.35±21.65	0.543
1min after laryngoscopy	120.65±28.12	132.45±31.23	0.001
5mins after laryngoscopy	114.75±22.76	128.32±20.6	0.008

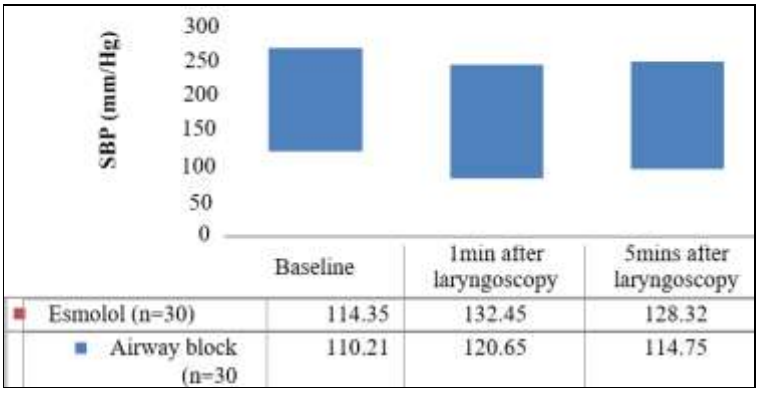

Chart 1: Systolic blood pressure among the study groups

Diastolic blood pressure

The baseline diastolic blood pressure was not significantly changed among the study groups. However, in airway block group the diastolic blood pressure was significantly lower after 1(p=0.004) and 5 mins (p=0.013) laryngoscopy as compared to the Esmolol group. The results were shown in table 4.

Table 4: Diastolic blood pressure among the study groups

Diastolic blood pressure (mm/Hg)	Airway blocks (n=30)	Esmolol (n=30)	P value
Baseline	72.16±9.87	74.65±8.12	0.765
1min after laryngoscopy	74.24±8.14	85.12±8.12	0.004
5mins after laryngoscopy	70.56±7.76	78.45±9.12	0.013

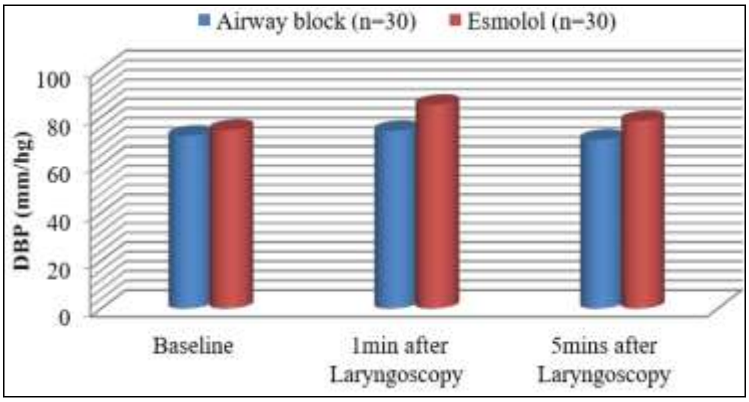

Chart 2: Diastolic blood pressure among the study groups

Oxygen Saturation

In this study, there was no significant difference in the oxygen saturation among the study groups. The results were shown in table 5.

Table 5: Oxygen Saturation levels among the study groups

Saturated Oxygen (%)	Airway blocks (n=30)	Esmolol (n=30)	P value
Baseline	98.44±8.65	97.76±9.12	0.123
1min after laryngoscopy	99.25±10.14	98.65±11.24	0.242
5mins after laryngoscopy	99.45±11.56	99.12±9.87	0.187

Discussion

Insertion and withdrawal of a laryngoscope and endotracheal tube during intubation can irritate the sympathetic nervous system, leading to severe tachycardia, hypertension or arrhythmia [20]. Insertion of a laryngoscope and/or endotracheal tube into the upper airways may directly produce pressure stimulation on laryngeal tissue this causes marked cardiovascular responses by irritating the deep sensory receptors of the larynx.

Anaesthesia applied to the larynx or trachea is effective in supressing intubation induced increases in blood pressure as well as blocking cardiovascular responses to airway irritation.

Superior laryngeal nerve block which anesthetize larynx above the vocal cords level and abolishes glottic closure reflex and transtracheal nerve block which anesthetize larynx below the vocal cords, the trachea and abolish cough reflex were used in this study. Airway nerve blocks provide deep and rapid anesthesia by small doses of local anesthetic, but this technique requires thorough knowledge of upper respiratory system anatomy, operator skill and experience; it also has risk of intravascular injection and sometimes neural injury can not be excluded. In cases of disturbed airway anatomy such as neck swelling, traumatic injury to the face or the neck and local infection, the airway block may become difficult.

The local anesthetic (lignocaine) concentrations used in our study were below the acceptable toxic limits and there were no signs and symptoms of lignocaine toxicity. We found that lignocaine when used for superior laryngeal nerve block and transtracheal block before intubation, can inhibit hemodynamic responses during intubation.

Esmolol is an ultrashort acting, beta-1 cardioselective adrenergic receptor blocker with a distribution half life of 2 min and an elimination half life of 9 min. Esmolol appears quite suitable for use during a short lived stress such as tracheal intubation. Esmolol is effective in a dose dependent manner in the attenuation of the sympathomimetic response to laryngoscopy and intubation. Bensky et al. [21] It is suitable for use during a short lived stress such as tracheal intubation. It causes depressor effect on myocardium. Esmolol has the potential to reduce the requirement of opioids, such as fentanyl, in addition to reducing the incidence of nausea and vomiting in the postoperative period. Bolus administration was chosen due to the practicality and rapid onset of the drug, directed to the transient cardiovascular response under study. Singhal *et al*. concluded that a bolus of 1.5 mg/kg esmolol three minutes before intubation is safe and effective to attenuate hemodynamic changes.

Our study demonstrated that the use of airway blocks was more effective in decreasing the hemodynamic response to laryngoscopy and intubation. In airway block group, the heart rate was significantly lower after 1 ($p=0.004$) and 5 mins ($p=0.006$) laryngoscopy as compared to the esmolol group. In airway block group, the systolic blood pressure was significantly lower after 1 ($p=0.001$) and 5 mins ($p=0.008$) laryngoscopy as compared to the esmolol group. In airway block group, the diastolic blood pressure was significantly lower after 1 ($p=0.004$) and 5 mins ($p=0.013$) laryngoscopy as compared to the esmolol group.

Esmolol group did not reveal any rhythm abnormality. No ST segment changes were seen in any patients. Sabahat et al. used esmolol 1 mg/kg and concluded that esmolol partially attenuated the hemodynamic response but did not abolish it completely.

Conclusion

In this study, based on the results obtained by Students t test, Airway blocks(superior laryngeal nerve block-2 ml of 2% lignocaine each side and translaryngeal block - 3 ml of 4% lignocaine intratracheal) were found to be superior to esmolol 0.5mg/kg IV in controlling the hemodynamic response to laryngoscopy and intubation.

References

1. Bruder N, Ortega D, Granthil C. Consequences and prevention methods of hemodynamic changes during laryngoscopy and intratracheal intubation. Ann Fr Anesth Reanim 1992;11:57-71.
2. Begum M, Akter P, Hossain MM, Alim SMA, Khatun UHS, Islam SMK, *et al*. A comparative study between efficacy of esmolol and lignocaine for attenuating hemodynamics response due to laryngoscopy and endotracheal intubation. Faridpur Med coll J 2010;5(1):25-28.
3. Shepard LC, Gelman S, Reeves JG. Humoral response of hypertensive patients to laryngoscopy. Anesth Analg 1981;60:276-7.
4. Reid LC, Brace DE. Irritation of the respiratory tract and its reflex effect upon heart. Surg Gynecol Obstet 1940;70:157-62.
5. Coleman AJ, Jordan C. Cardiovascular response to anesthesia. Influence of betaadrenoceptor blockade with metoprolol. Anaesthesia 1980;35(10):972-8.
6. Ebert TJ, Bernstein JS, Stowe DF, Roerig D, Kampine JP. Attenuation of hemodynamic responses to rapid sequence induction and intubation in healthy patients with a single bolus of esmolol. J Clin Anesth 1990;2(4):243-52.
7. Rathore A, Gupta HK, Tanwar GL. Attenuation of the pressure response to laryngoscopy and endotracheal intubation with different doses of esmolol. Indian J Anaesth 2002;46:449-52.
8. Stoelting RK. Attenuation of blood pressure response to laryngoscopy and tracheal intubation with sodium nitroprusside. Anesth Analg 1979:58(2):116-9.
9. Mikawa K, Nishina K, Maekawa M, Obara H. Comparision of nicardipine,diltiazem and verapamil for controlling the cardiovascular responses to tracheal intubation. Br J Anaesth 1996;76(2):221-6.
10. Nishikawa T, Namiki A. Attenuation of the pressor response to laryngoscopy and tracheal intubation with intravenous verapamil. Acta Anaesthesiol Scand 1989;33(3):232-5.
11. Ghignone M, Calvillo O, Quintin L. Anesthesia and hypertension: the effect of clonidine on perioperative hemodynamics and isoflurane requirements. Anesthesiology 1987;67:3-10.
12. Wang YQ, Guo QL, Xie D. Effect of different doses of esmolol on cardiovascular responses to tracheal extubation. Hunan Yi Ke Da Xue Xue Bao 2003;28(3):259-62.
13. Parnass SM, Rothenberg DM, Kerchberger JP, Ivankovich AD. A single bolus dose of esmolol in the prevention of intubation induced tachycardia and hypertension in an ambulatory surgery unit. J Clin Anesth 1990;2(4):232-7.
14. Thomas JL. Awake intubation. Indications, techniques and a review of 25 patients. Anaesthesia 1969;24(1):28-35.

15. Bekhit MH. Lidocaine for neural blockade. In: Sinatra RS, et al. eds. The Essence of Analgesia and Analgesics. New York: Cambridge University Press 2011, 279.
16. Simmons ST, Schleich AR. Reg Anesth pain Med 2002;27:180.
17. British Thoracic Society bronchoscopy guidelines committee: a subcommittee of standards of care committee of british thoracic society. Thorax 2001;56(1):1.
18. Williams KA, *et al*. Br J Anaesth.2005;95:549.
19. Reed AP. Chest 1992;101:244.
20. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth 1987;59:295-99.
21. Bensky KP, Donahue-Spencer L, Hertz GE, Anderson MT, James R. The dose – related effects of bolus esmolol on heart rate and blood pressure following largyngoscopy and intubation. AANA J 2000;68:437-42.