e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2022; 12(8); 95-105

Original Research Article

Comparison of Clinical effects of Fentanyl and Esmolol for Attenuation of Hemodynamic Responses to Endotracheal Intubation

Shah Bansari Mahendrakumar[1], Shah Darshna Rakesh[2], Shah Sonal Aashish[3], Dimple Kinjalbhai Pandya[4], Akshatkumar Prakashkumar Trivedi[5], Twinkle Jayesh Gupta[6]

[1]Assistant Professor, Department of Anesthesia, M K Shah Medical College and Research Centre, Ahmedabad, Gujarat

[2]Associate Professor, Department of Anesthesia, NHL Municipal Medical College & SVP Hospital, Ahmedabad, Gujarat

[3,4]Assistant Professor, Department of Anesthesia, NHL Municipal Medical College & SVP Hospital, Ahmedabad, Gujarat

[5]Third Year Resident, Department of Anesthesia, NHL Municipal Medical College & SVP Hospital, Ahmedabad, Gujarat

[6]First Year Resident, Department of Anesthesia, NHL Municipal Medical College & SVP Hospital, Ahmedabad, Gujarat

Received: 20-06-2022 / Revised: 18-07-2022 / Accepted: 05-08-2022
Corresponding author: Dr Dimple Kinjalbhai Pandya
Conflict of interest: Nil

Abstract

Objective: The purpose of this experiment was to compare the clinical effects of fentanyl and esmolol for attenuation of hemodynamic responses to endotracheal intubation.

Material and Methods: A prospective randomized study was conducted in 60 patients of ASA grade I or II, AGED 18-60 years who underwent elective surgical procedures. All patients randomly allocated in 2 groups; each having 30 patients. Group E: received esmolol 2mg/kg iv 3 min before intubation. Group F: received fentanyl 2mcg/kg iv 3 min before intubation All patients preoxygenated with 100% O2; Induced with Inj. Thiopentone 6mg/kg iv + Inj. Suxamethonium 2 mg/kg iv Intubated with appropriate ET tube; Maintained with O2 50%, N2O 50%, Vecuronium bromide 0.08 mg/kg Vitals - HR, SBP, DBP, MAP,SpO2 recorded at baseline, after premedication, study drug, at intubation, at L+1, L+3, L+5, L+7, L+10

Results: Readings of HR, BP and Rate pressure product were compared with baseline and among each group. Esmolol was significantly more effective in suppressing HR as compared to fentanyl at all the time. No significant difference noted at baseline, following laryngoscopy and intubation at 1,3,5,7 minutes. SBP was lower in E group than in F group. No statistically significant difference between 2 groups with respect to mean DBP at baseline, after premedication, study drug and intubation. At 1,3,5,7 min DBP lower in F group than in E group. At 1,3,5,7 min the RPP lower in E group than in F group.

Conclusion: Esmolol 2mg/kg IV provides more reliable and consistent protection against increase in mean HR and SBP than Fentanyl 2mcg/kg IV; Fentanyl provides reliable protection against rise in DBP. No significant difference between 2 drugs in terms of effects on MAP. Esmolol better at achieving a low-Rate pressure product than fentanyl which is a good predictor

of myocardial oxygen consumption. Esmolol and fentanyl both can attenuate the hemodynamic responses, but Esmolol provides better hemodynamic stability during laryngoscopy and intubation.

Keywords: Esmolol, Fentanyl, Heart Rate, Laryngoscopy

Introduction

Safe airway management is an essential skill for an anesthesiologist. Laryngoscopy and Endotracheal intubation are gold standard for securing the airway and giving positive pressure ventilation. Direct laryngoscopy has been used since many years as a conventional and routine method to facilitate this procedure [1].

Increase in blood pressure and heart rate occurs most commonly from reflex sympathetic and vagal discharge in response to laryngotracheal stimulation, which in turn leads to increased plasma norepinephrine concentration. These reflexes are of little significance in healthy patients but these changes may be fatal in patients with heart diseases and high blood pressure. Sudden death has also been reported [2,3].

The pressor response to laryngoscopy and endotracheal intubation in form of tachycardia, hypertension and arrhythmias may be potentially dangerous. It has detrimental effects on the other organ systems. In these conditions, an increase in blood pressure may lead to complications, including arrhythmias, myocardial ischemia, increase in intracranial pressure and rupture of cerebral aneurysms. Increase in arterial pressure begins after about 15 seconds and peaks within 30-45 seconds after laryngoscopy [4]. It is associated with significant rise in heart rate as well. However, it returns to baseline within 5 to 10 minutes after intubation.

Although rise in heart rate and blood pressure and disturbances in the cardiac rhythm are short lived, they may have detrimental effects in patients with cardiovascular diseases, increased intracranial pressure or anomalies of cerebral vessels. During and immediately following intubation, there is a reduction in the left ventricular ejection fraction due to reduced ventricular filling because of tachycardia and increased peripheral vascular resistance. This is particularly seen in patients with coronary artery disease and may predispose to myocardial ischemia. This pressor response can be well tolerated in healthy patients but the same response can lead to significant morbidity in compromised patient such as those with underlying cardiovascular disease [5,8].

Hemodynamic stability is an integral and essential goal of anaesthetic management plan. Hypertension and tachycardia have been reported since 1940 during intubation under light anaesthesia complicated by hypoxia, hypercapnia or cough.

Various methods and drugs [9] have been used to attenuate the response to laryngoscopy and intubation. They are:

- Deep inhalation anaesthesia
- Topical Lignocaine 2%
- Lignocaine aerosol 10%
- Intravenous Lignocaine 2% [10]
- Vasodilators - IV Sodium Nitroprusside, IV Nitroglycerine and IV Hydralazine
- Opioids - IV Fentanyl, IV Sufentanil, IV Alfentanil and IV Remifentanil [11]

- Beta blockers – IV Metoprolol, IV Esmolol, IV Propranolol and IV Labetolol
- Calcium channel Blockers- Sublingual and IV Nifedepine, IV Verapamil, IV diltiazem [12]
- General anaesthetics-Propofol

All the above methods need to be studied more to find out the most effective, safe and reliable method for attenuating hemodynamic response due to laryngoscopy and endotracheal intubation.

Various methods for attenuation of response to laryngoscopy and intubation are still in search from the date of its recognition. Several studies have been made for it.

Fentanyl is a phenylpiperidine of the 4-amino piper dine series, structurally related to, but not derived from pethidine. Fentanyl citrate is also effective and frequently used for attenuation of hemodynamic stress responses upon laryngoscopy and intubation like hypertension, tachycardia, myocardial ischemia and increased circulating catecholamines [13]. Fentanyl causes relaxation of pharyngeal, laryngeal and jaw musculature, suppresses cough reflex and provides sedation and analgesia but has associated respiratory depression at higher doses.

Esmolol is an ultra-short acting β-1 cardio selective adrenergic blocker. It has predominant effect on β-receptors and possesses no significant membrane stabilizing activity. It has rapid onset of action. Esmolol is effective in attenuating sympathetic responses to laryngoscopy and intubation, to sternotomy and to emergence from anaesthesia and extubation. There is also a reduction in heart rate and minimal effects on PaO2 and oxygen saturation. Esmolol is potentially safer to use than longer-acting antagonist in critically ill patient who require-adrenoceptor antagonists [14,15].

Hence in this view, we studied the effect of intravenous Esmolol 2 mg/kg and intravenous Fentanyl 2 mcg/kg for attenuation of stress response given as a bolus 3 minutes prior to laryngoscopy. In this study we aimed to compare the clinical efficacies of Fentanyl and Esmolol in preventing the hemodynamic responses to laryngoscopy and intubation.

The aim of the present study is to evaluate the efficacy of IV Fentanyl and IV Esmololfor attenuating the hemodynamic responses to laryngoscopy and endotracheal intubation in patients undergoing elective surgery under general anaesthesia.

Material and Methods

This prospective randomized study was conducted in sixty patients of ASA grade I or II, aged between 18 to 60 years, of either sex, scheduled for elective surgical procedures under general anaesthesia. This study is conducted to evaluate and compare the efficacy of intravenous Fentanyl and Esmolol in attenuation of hemodynamic response to endotracheal intubation. Total sixty patients of either gender, belonging to ASA grade I or II were selected for study and divided in two groups; each group consists of 30 patients each.

Exclusion criteria

• Patients with baseline heart rate < 60 BPM

• History of asthma/reactive airway disease

• History of cardiac disease and hypertension

• On treatment with adrenergic augmenting or depleting drugs

• PR interval >0.24 seconds on ECG

• 2nd and 3rd degree heart block

• History of drug addiction/chronic narcotic use

• Anticipated difficult airway, requiring more than one attempt at intubation or prolonged duration (>15 sec) of laryngoscopy

• Patient who hiccupped or bucked during procedure

Study protocol

- **Preoperative assessment**
  - Detailed history taken, physical and systemic examination of all patients was done on the day prior to operation.
  - Laboratory investigations like CBC, Renal Function Tests, Liver Function Tests, Blood Sugar, Serum Electrolytes, Urine analysis, X ray chest and ECG were reviewed.
  - The nature of study and procedure was explained to the patient.
  - Written informed consent was taken from the patient.
- **Preoperative preparation**
  - All patients were kept Nil By Mouth at least for 6 hrs before surgery.
  - On arrival to the operation theatre, an intravenous line was secured and pulse oximeter, non-invasive blood pressure and ECG were attached and baseline readings taken.
  - All patients were premeditated withInj. Glycopyrrolate 0.004 mg/kg IV, Inj. Ondansetron 0.08 mg/kg IV, Inj. Midazolam 0.02 mg/kg IV 15 minutes before induction.

Method of study

All patients were randomly allocated in 2 groups, each having thirty patients:

- GROUP E: Received Inj. Esmolol 2 mg/kg IV 3 minutes before intubation.
- GROUP F: Received Inj. Fentanyl 2 mcg/kg IV 3 minutes before intubation.

All patients were preoxygenated with 100% oxygen. Respective study drug was injected as mentioned above. Patient was induced with Inj. Thiopentone Sodium 6 mg/kg IV andInj. Suxamethonium 2mg/kg IV to facilitate laryngoscopy and intubation. Patient was intubated with appropriate size endotracheal tube, maintained anaesthesia with O2(50%), N_2O (50%), sevoflurane 1.5% and Inj. Vecuronium Bromide 0.08 mg/kg. All intubations were accomplished within 15 seconds of laryngoscopy. Vitals to be monitored were Heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure and SPO2 and Rate Pressure Product was calculated.

All parameters were recorded at following stages:

- Base line
- After premedication
- After study drug
- At Intubation
- L + 1 (After 1 minute of laryngoscopy)
- L + 3 (After 3 minutes of laryngoscopy)
- L + 5 (After 5 minutes of laryngoscopy)
- L + 7 (After 7 minutes of laryngoscopy)
- L+10 (After 10 minutes of laryngoscopy)

At the end of surgery, residual neuromuscular blockade was reversed with Inj. Glycopyrrolate 0.008 mg/kg IV and Inj. Neostigmine 0.05 mg/kg IV. Extubation was carried out when the patient had adequately recovered from the effect of neuromuscular blockade with regular breathing pattern, good muscle tone / power, hemodynamic stability and was able to respond to verbal commands.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

This study is conducted to evaluate and compare the efficacy of intravenous Fentanyl and Esmolol in attenuation of hemodynamic response to endotracheal intubation. Total sixty patients of either gender, belonging to ASA grade I or II were selected for study and divided in two groups; each group consists of 30 patients each.

Table 1: Demographic Data

Groups	Age (yrs) Mean ± SD	Sex		Weight (kgs) Mean ± SD
		Male	Female	
Group F	38±9.0	16	14	57 ± 5.4
Group E	39± 6.8	14	16	58 ± 6.5

Table-1 shows the age distribution of both the groups which is between 18 to 60 years with mean age of 38 years in Fentanyl group and 39 years in Esmolol group. Sex ratio of group Fentanyl is 16 male and 14 female while that of Esmolol group is 14 male and 16 female. In group F mean weight is 57 kgs and in group E mean weight is 58 kgs.

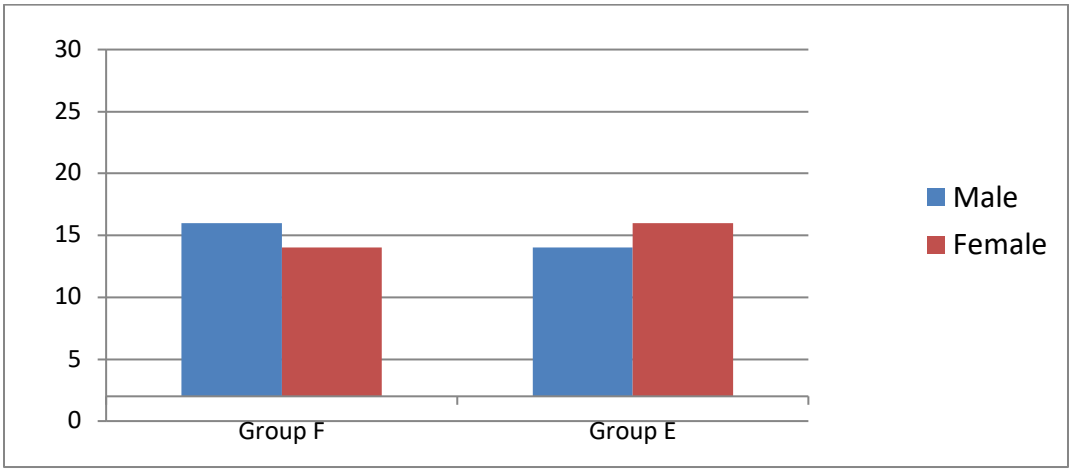

Figure 1: Gender Distribution

The above graph shows the sex distribution in both groups. There is no significant difference between both groups.

The heart rate is measured at baseline, after premedication, after study drug, at intubation, L+1, L+3, L+5, L+7 and L+10 (L is onset of laryngoscopy) (Table 2).

Table 2: Changes in heart rate

Time	Group F		Group E		P value
	Mean ± SD	% change	Mean ± SD	% change	
Baseline	81.9 ± 9.0	-	84.5 ± 9.4	-	>0.05
After premedication	85.0± 6.4	3.7	86.5 ± 10.2	2.4	>0.05
After study drug	83.7 ± 5.9	2.1	81.6 ± 10.1	-3.4	>0.05
At Intubation	83.9± 5.4	2.4	84.7± 6.8	0.5	>0.05
L + 1	101.0± 9.3	23.3	90.6 ± 8.9	7.2	<0.05
L + 3	95.2 ± 7.1	16.2	86.6 ± 7.3	2.5	<0.05

L + 5	88.2 ± 6.0	7.7	77.6 ± 6.4	-8	<0.05
L + 7	83.5 ± 7.2	2	77.1 ± 6.4	-8.7	<0.05
L + 10	81.5 ± 5.9	-0.5	81.3 ± 7.4	-3.9	>0.05

Positive (+) sign indicates % rise in heart rate

Negative (-) sign indicates % fall in heart rate

Heart rate in both groups at baseline, after premedication and after study drug administration is comparable to each other in both groups and there is no statistical difference between them (P value > 0.05). Herat rate at 1, 3, 5 and 7 minutes after intubation in Esmolol group and Fentanyl group is statistically different (P value < 0.05). At 10th minute after laryngoscopy and intubation comparison of Heart rate in Esmolol group and Fentanyl group is not statistically different (P value > 0.05).

Thesystolic blood pressure is measured at baseline, after premedication, after study drug, at intubation, L+1, L+3, L+5, L+7 and L+10 (L is onset of laryngoscopy) (Table 3)

Table 3: Changes in systolic blood pressure

Time	Group F		Group E		P value
	Mean ± SD	% change	Mean ± SD	% change	
Baseline	124.5 ± 9.0	-	123.0± 7.6	-	>0.05
After premedication	124.8 ± 7.2	0	121.2 ± 8.2	-1.5	>0.05
After study drug	124.1 ± 7.3	-0.5	120.3 ± 7.5	-2.2	>0.05
At Intubation	126.2± 6.4	1.1	123.7± 7.6	0.6	>0.05
L + 1	147.3 ± 6.1	18	140.5 ± 5.9	14.2	<0.05
L + 3	140.1 ± 7.5	12.3	134.5 ± 7.6	9.3	<0.05
L + 5	131.0± 7.1	5	125.8 ± 8.4	2.3	<0.05
L + 7	118.7 ± 4.4	-4.9	117.8 ± 8.1	-4.2	>0.05
L + 10	113.4 ± 4.3	-9.1	115.6 ± 7.9	-6	>0.05

Positive (+) sign indicates % rise in systolic blood pressure

Negative (-) sign indicates % fall in systolic blood pressure

Systolic Blood Pressure (SBP) in both groups at baseline, after premedication, after study drug administration and at intubation is comparable to each other and there is no statistical difference between them (P value > 0.05). After laryngoscopy and intubation at 1st, 3rd and 5th minute comparison of SBP in Esmolol group and Fentanyl group is statistically different (P value < 0.05).

At 7th and 10th minute after laryngoscopy and intubation comparison of SBP in Esmolol group and Fentanyl group is not statistically different (P value > 0.05).

The Diastolic Blood Pressure is measured at baseline, after premedication, after study drug, at intubation, L+1, L+3, L+5, L+7 and L+10 (L is onset of laryngoscopy) (Table 4)

Table 4: Changes in diastolic blood pressure

TIME	GROUP F		GROUP E		P value
	MEAN ± SD	% change	MEAN ± SD	% change	
Baseline	75.6 ± 6.0	-	76.4 ± 5.0	-	>0.05

After premedication	73.0 ± 4.3	3.4	75.2 ± 4.8	-1.6	>0.05
After study drug	71.7 ± 5.0	-5.1	70.5 ± 4.2	-7.7	>0.05
At Intubation	76.5± 4.4	1.2	76.7± 4.8	0.4	>0.05
L + 1	83.3 ± 5.8	10.2	91.0 ± 6.4	19	<0.05
L + 3	80.1 ± 4.5	12.3	85.6 ± 5.9	12	<0.05
L + 5	72.6 ± 9.0	5	80.0 ± 6.0	4.7	<0.05
L + 7	70.6 ± 5.3	-4.9	74.0± 5.0	-3.1	<0.05
L + 10	69.0 ± 4.7	-9.1	74.2 ± 3.9	-2.8	>0.05

Positive (+) sign indicates % rise in diastolic blood pressure

Negative (-) sign indicates % fall in diastolic blood pressure

Diastolic Blood Pressure (DBP) in both groups at baseline, after premedication, after study drug administration and at intubation is comparable to each other as there is no statistical difference between them (P value > 0.05). After laryngoscopy and intubation at 1st, 3rd, 5th and 7th minute DBP in Esmolol group and Fentanyl group is statistically different (P value <0.05). At 10th minute after laryngoscopy and intubation comparison of DBP in Esmolol group and Fentanyl group is not statistically different (P value > 0.05).

The Mean Arterial Pressure is measured at baseline, after premedication, after study drug, at intubation, L+1, L+3, L+5, L+7 and L+10 (L is onset of laryngoscopy) (Table 5)

Table 5: Changes in mean arterial pressure

Time	Group F		Group E		P value
	Mean ± SD	% change	Mean ± SD	% change	
Baseline	92.1 ± 6.4	-	91.9 ± 5.4	-	>0.05
After premedication	90.0 ± 3.6	-2.3	89.7 ± 4.8	-2.4	>0.05
After study drug	88.8 ± 3.7	-3.4	83.7 ± 4.4	-8.9	>0.05
At Intubation	93.0± 3.9	1.0	92.2± 4.3	0.3	>0.05
L + 1	107.7 ± 4.7	16.9	108.8 ± 5.0	18.4	>0.05
L + 3	98.8 ± 4.9	7.3	101.3 ± 6.9	10.2	>0.05
L + 5	89.5 ± 8.0	-2.8	90.9 ± 6.4	-1.1	>0.05
L + 7	86.0 ± 4.3	-6.6	87.9 ± 5.3	-4.3	>0.05
L + 10	83.0 ± 3.4	-9.9	87.5 ± 4.2	4.8	>0.05

Positive (+) sign indicates % rise in mean arterial pressure

Negative (-) sign indicates % fall in mean arterial pressure

Mean arterial pressure in both groups at baseline, after premedication, after study drug administration, at intubation and 1, 3, 5, 7 and 10 minute after laryngoscopy and intubation is comparable to each other as there is no statistical difference between them (P value > 0.05).The Rate Pressure Product is measured at baseline, after premedication, after study drug, at intubation, L+1, L+3, L+5, L+7 and L+10 (L is onset of laryngoscopy) (Table 6)

Table 6: Changes in rate pressure product

Time	Group F		Group E		P value
	Mean ± SD	% change	Mean ± SD	% change	
Baseline	10264 ± 1618	-	10385 ± 1234	-	>0.05

After premedication	10657± 1001	3.8	10466 ± 1320	0.7	>0.05
After study drug	10387 ± 923	1.2	9798 ± 1214	-5.6	>0.05
At Intubation	10590± 905	3.2	10460± 945	0.7	>0.05
L + 1	14906 ± 1529	38.5	12718 ± 1267	22.5	<0.05
L + 3	13336 ± 1233	29.9	11669 ± 1342	12.4	<0.05
L + 5	11521 ± 1053	12.2	9768 ± 1126	-5.9	<0.05
L + 7	9902 ± 905	-3	9091 ± 1068	-12.5	<0.05
L + 10	9249 ± 781	-10	9413 ± 1113	-9.3	>0.05

Positive (+) sign indicates % rise in Rate Pressure Product

Negative (-) sign indicates % fall in Rate Pressure Product

Rate Pressure Product(RPP) in both groups at baseline, after premedication, after study drug administration and at intubation is comparable to each other as there is no statistical difference between them (P value > 0.05). At 1, 3, 5 and 7 minute after laryngoscopy and intubation comparison of RPP in Esmolol group and Fentanyl group is statistically different (P value < 0.05). At 10th minute after laryngoscopy and intubation comparison of RPP in Esmolol group and Fentanyl group is not statistically different (P value > 0.05). We looked for adverse effects like allergic urticaria, muscular rigidity, nausea, vomiting & respiratory depression in both groups but could not find any.

Discussion

The sequence of induction, laryngoscopy and intubation are associated with marked hemodynamic changes and autonomic reflex activity which may be a cause of concern in many high risk patients. Normal hemodynamic response to intubation is seen in all patients but well tolerated by healthy patients. But patients with cardiovascular or cerebral disease may be at increased risk of morbidity and mortality from the tachycardia and hypertension resulting from the stress reflex caused by laryngoscopy and intubation.

Hemodynamic changes due to laryngoscopy and intubation are well documented since along. Where in 1940 Reid LC, Brace *et al* [16], concluded that laryngoscopy and intubation increase the cardiac workload and oxygen demand of myocardium in normal subjects.

So we carried a study with 60 patients of ASA grade I or II, optimal age of 18 yrs to 60 yrs who were scheduled for elective surgeries under general anaesthesia. All patients were divided randomly into two groups for comparison of two drugs IV Fentanyl and IV Esmolol.

Yshi *et al* [17], Donald E. Martin *et al* [18] McClain *et al* [19] studied that with Fentanyl 2 mcg/kg elevation of heart rate and blood pressure after intubation was lower than control group, although not statistically significant.

There was no statistical significant difference between the mean age (yrs) and mean weight (kgs) among both groups. The gender distribution was also almost equal in both groups. (P>0.05)

Heart rate of both groups at baseline, after premedication, after study drug and at intubation was comparable to each other and there was no statistical difference between them (P>0.05). At L+5, L+7 and L+10 intervals heart rate in Group E was below baseline. The result of our study is similar to those carried out by: Hussain AM *et al* [20] in 2005 conducted a study in three Groups: Group A (control) received 10 ml normal saline, Group B and Group C received Fentanyl 2 mcg/kg and Esmolol 2 mg/kg

respectively. Study agent was injected 30 seconds before the induction of anesthesia. The rise in heart rate was minimal in Esmolol Group and was statistically significant (P<0.05). Maximum rise in heart rate occurred at L+1inall three groups**.** Amarjeet D. Patil*et al* [21] in 2014 studied the efficacy of Esmolol and Fentanyl on attenuation of hemodynamic response to laryngoscopy and endotracheal intubation. Their study observed that 1, 3, 5 and 10 minutes after intubation heart rate was higher in Group F (11.7%, 3.5%, -1.3% and -2.4%) than Group E(5%, 2.2%, -4% and -6.5%). Thus they concluded that Esmolol 2 mg/kg provides consistent and reliable protection against the increase in heart rate.

Systolic blood pressure of both groups at baseline, after premedication, after study drug and at intubationwas comparable to each other as there was no statistical difference between them (P>0.05). In both groups SBP at L+3 and L+5 started falling from L+1. But there was rise in SBP in group F (12.3% and 5%) more than group E (9.3% and 2.3%) and it was statistically significant (P<0.05). Feng CK *et al* [7] compared Lidocaine 2mg/kg, Fentanyl 3mcg/kg and Esmolol 2mg/kg. His study also showed that only Esmolol could reliably offer protection against the increase in SBP while Fentanyl (3 mcg/kg) prevented hypertension but not tachycardia.

Diastolic blood pressure of both groups at baseline, after premedication, after study drug and at intubation was comparable to each other and there was no statistical difference between them (P>0.05). At L+3, L+5 and L+7DBP in both groups started falling from L+1but still there was rise in DBP from baseline in group F(6%, -3.9% and -6.6%) more than group E (12%, 4.7% and -3.1%) respectively which was statistically significant (P<0.05) in favour of Fentanyl. Devavrat Vaishnav *et al* [22] in 2015 study the effects of Esmolol (2mg/kg IV) and Fentanyl (2mcg/kg IV) given 3 minutes before laryngoscopy and intubation in attenuating the sympathetic stress response. They observed that 1, 2, 3, 4, 5 and 10 minutes after intubation rise in DBP in Group F (20%, 14.7%, 8.8%, 6.4%, 0.3% and -3.5%) and in Group E (18.4%, 14.8%, 10.8%, 8.9%, 5.8% and 1.2%) respectively. There was significant difference between two groups at 3rd, 4th, 5th and 10th minutes. Thus they concluded that Esmolol was not able to attenuate DBP as compared to Fentanyl.

Mean Arterial pressure of both groups at baseline, after premedication, after study drug and at intubation was comparable to each other and there was no statistical difference between them (P>0.05). At L+3, L+5, L+7 and L+10 MAP started falling from L+1 in both groups as rise of MAP in Group F (5.9%, -3.9%, -6.6% and -8.7%) and in Group E (10.2% -1.1%, -4.3% and 4.8%) respectively. They were around baseline value which was statistically not significant (P>0.05).

Amarjeet D. Patil *et al* [21] in 2014 studied the efficacy of Esmolol and Fentanyl on attenuation of hemodynamic response to laryngoscopy and endotracheal intubation in two groups, Group F (Fentanyl 2 mcg/kg) and Group E (Esmolol 2mg/kg). They observed a transient rise in MAP at 1 minute post–intubation in group F (7.2%) and group E (3%). At 3, 5 and 10 minutes post intubation, the mean MAP in both groups was near baseline value. They concluded that there was no significant difference in MAP in both groups.

Rate Pressure Product of both groups at baseline, after premedication, after study drug and at intubation was comparable to each other and there was no statistical difference between them (P>0.05). In L+1, there was maximum rise in RPP from baseline in both groups, more with group F (38.5%) than group E (22.5%) so it is statistically highly significant (P<0.0001). At L+3 and L+5 rise of RPP in Group F (29.9% and 12.2%) more than Group E (12.4% and -5.9%) respectively. As it started falling from L+1 in both groups

but still it was statistically highly significant (P<0.0001) in favour of Esmolol. Devavrat Vaishnav *et al* [22] in 2015 study the effects of Esmolol (2mg/kg IV) and Fentanyl (2mcg/kg IV) given 3 minutes before laryngoscopy and intubation in attenuating the sympathetic stress response. They observed that 1, 2, 3, 5 and 10 minutes after intubation rise in RPP in Group F (48.3%, 34.3%, 24.8%, 9.2% and 1.5%) is more than Group E (19.1%, 16.5%, 9.3%, -0.4% and -8.5%) respectively. They observed that the increase was 50 % less in Esmolol treated patient compared to Fentanyl treated patient. Gupta S *et al* [14] (2011) did comparative study of efficacy of Esmolol and Fentanyl for pressure attenuation during laryngoscopy and endotracheal intubation.

They observed that 1, 3, 5 and 15 minutes after intubation rise in RPP in Group F (20.6%, 13.8%, 1.7% and -5.6%) is more than Group E (9.4%, 1.5%, -2.9% and -9.8%) respectively. They concluded that RPP was minimal and statistically lower in Esmolol group than Fentanyl group. In our study, there was no control group as we wanted to attenuate pressor response in each patient.

Conclusion

Esmolol (2mg/kg IV) provides more reliable and consistent protection against increase in mean Heart Rate and SBP than Fentanyl (2mcg/kg IV).Fentanyl (2mcg/kg IV) provides more reliable and consistent protection against increase in DBP than Esmolol (2mg/kg IV).There is no significant difference between two drugs in terms of effect on MAP. Esmolol has proved to be better in achieving a low RPP, which is a good predictor of myocardial oxygen consumption. Esmolol provides better cardio-protection in patients against hyper adrenergic responses to laryngoscopy and endotracheal intubation as evidenced by lower values in Rate Pressure Product. Esmolol appears to be drug of choice in maintaining hemodynamic stability during laryngoscopy and intubation.

References

1. Bradley RM. Sensory receptors of the larynx. Am J Med. 2000 Mar 6. 108 suppl 4a: 47S-50S
2. Bhalke R, Karale M., Deshmukhu.Comparison of esmolol versus combination of esmolol and fentanyl in preventing cardiovascular stress response to intubation; IJCT;2017; 4;1.
3. Chung Ks, Sinatra Rs, Halevy Jd, Paige D, Silverman Dg. A comparison of fentanyl, esmolol, and their combination for blunting the hemodynamic response during rapid sequence induction. Can J Anaesth. 1992; 39; 774-9.
4. Dahlgren N, Messeter K: Treatment of stress response to laryngoscopy and intubation with fentanyl. Anesthesia 1981; 36:1022-6.
5. Derbyshire Dr, Chmielewski A, Fell D, Vater M, Achola K, Smith G: plasma catecholamine responses to tracheal intubation. Br J Anaesth 1983 Sep 55(9)855-60.
6. Ebert Jp, Pearson Jd, Gelman S, Harris C, Bradley El: Circulatory responses to laryngoscopy. The comparative effects of placebo, fentanyl and esmolol. Can J Anaesthesia. 1989; 36; 301-6.
7. Feng Ck, Chan Kh, Liu Kn, Or Ch, Lee Ty. Comparison of lidocaine, fentanyl and esmolol for attenuation of cardiovascular response to laryngoscopy and tracheal intubation. Acta Anesthesiol Sin. 1996; 34(3):172.
8. Figueredo E, Garcia-Fuentes E.M. Assessment of the efficacy of esmolol on the hemodynamic changes induced by laryngoscopy and tracheal intubation: a metaanalysis Acta AnesthesioScand 2001; 45:1011-1022.
9. Pray Roberts, Green Lt, Meloche R And Foex P: studies of anaesthesia in relation to hypertension. Hemodynamic consequences of induction and endotracheal intubation.

British Journal of Anaesthesia 1971; 43,541-547.
10. Reid Lc, Brace De. Irritation of respiratory tract and its reflex effect upon heart. Surg Gynec and Obstet. 1940; 70: 157-62.
11. Miller DR, Martineau RJ. Wynands Je, Hill J: Bolus administration of esmolol for controlling the hemodynamic responses to tracheal intubation: The Canadian Multicentre Trial. Can J Anaesthesia. 1991; 38; 849-58.
12. Me Clain Da, Hug Cc: Intravenous fentanyl kinetics. Clin Pharmacology the. 1980;28:106-14[PubMed]
13. Karrupiah S, Singh Nr, Singh Km, Singh Th, Meitei AJ, Sinam H: Attenuation of hemodynamic responses to laryngoscopy and intubation using intravenous fentanyl and esmolol: A Study J Med Soc 2015;29:35-9.
14. Gupta S, Tank P: Comparative study of esmolol and fentanyl for pressure attenuation during laryngoscopy and endotracheal intubation. Saudi J Anaesthesia. 2011; 5(1); 2-8.
15. Russel WJ, Morris RG, Frewn DB, Drew SE: ion changes in plasma catecholamine concentration during endotracheal intubation. Br J Anaesth, 1981 aug 53(8); 837-9.
16. Reema Goel, Raka Rani, Op Sing, Deepak Malaviya, S.K. Arya *Et Al*: attenuation of cardiovascular response to laryngoscopy and intubation by various drugs in normotensive patients: Hospital today, 2000,9.
17. Stoelting R.K, Hiller S.C. Pharmacology and Physiology in anesthesia practice. Lippincott Williams and wilkins.2006; 4th edition: 87 -126.
18. Martin De, Rosenberg H, Aukburg Sj, Bartoswki Rr, Edwards Mw, Jr, Greenhow De. Low dose fentanyl blunts responses to tracheal intubation. AnaesAnalg. 1982;61(8):680-4.[PubMed]
19. Me Clain Da, Hug Cc: Intravenous fentanyl kinetics. Clin Pharmacology the. 1980;28:106-14[PubMed]
20. Hussain Am, Sultan St: Efficacy of fentanyl and esmolol in the prevention of hemodynamic response to laryngoscopy and endotracheal intubation. J Coll Physicians Surg Pak. 2005; 15; 454-7.
21. Patil Amarjeet, Ghodke Baliram, Patil Sunita: Attenuation of hemodynamic response to laryngoscopy and endotraceal intubation- A comparative study of fentanyl and esmolol, World J of pharmacy and pharmaceutical sciences 2014; 3; 9, 460-472.
22. Vaishnav D, Chaudhari A: Attenuation of Cardiovascular Responses to Laryngoscopy and intubation: A Comparative Study between IV Esmolol Hydrochloride and Fentanyl Citrate. IJSR; Oct 2016; 5; 10,903-938.