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# ATTENUATION OF HAEMODYNAMIC RESPONSES TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION: A COMPARISON BETWEEN INTRAVENOUS ESMOLOL HYDROCHLORIDE AND FENTANYL.

Anaesthesiology

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## ABSTRACT

**Background:** The circulatory response to laryngeal and tracheal stimulation following laryngoscopy and tracheal intubation as reflex sympathoadrenal stimulation. They may have detrimental effects in high-risk patients . Norepinephrine, epinephrine levels rise.Therefore, it is important to find an effective means of attenuating sympathetic response to laryngoscopy and intubation. The present study is undertaken to determine the efficacy of esmolol 2mg/kg IV bolus and fentanyl 2µg/kg IV bolus in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation. **Aim:** To evaluate and compare the efficacy of intravenous esmolol and fentanyl in attenuating the hemodynamic responses to laryngoscopy and endotracheal intubation. **Materials and Methods:** This is an observational study, approved by the institutional ethical committee. An individual informed consent was taken from all patients selected for the study. All patients belonging to ASA grade 1 and 2, between the age group of 20 to 50 years posted for elective surgeries with General anesthesia. Patients having coagulation disorders, Cardiac diseases, Patients refusal are excluded. A total of 60 patients were divided into two groups of 30 each, group E (Esmolol) and group F (Fentanyl). **Discussion**: Laryngoscopy and intubation are associated with rise in blood pressure and heart rate. These potentially dangerous changes disappear within 5 minutes.They may have detrimental effects in high-risk patients. In the present study the duration of laryngoscopy and intubation was limited to 20 seconds. Esmolol possesses several properties which makes it a valuable agent to obtund the cardiovascular response. Fentanyl prevents rise in sympathetic response associated with laryngo-tracheal stimulation. **Conclusion:** This study shows that esmolol hydrochloride 2mg/kg IV bolus dose is superior to fentanyl 2µg/kg IV bolus to attenuate the hemodynamic responses to laryngoscopy and endotracheal intubation. No side effects were noted with esmolol hydrochloride and fentanyl citrate.

## KEYWORDS

Laryngoscopy and intubation, Heamodynamic response, Esmolol and Fentanyl citrate.

## INTRODUCTION

Laryngoscopy and endotracheal intubation are routine procedures of modern balanced general anesthesia technique. Endotracheal intubation has become an integral part of the anaesthetic management and critical care of the patient and has been practiced following its description by Rowbotham and Magill in 1921. Forbes and Dally (1970) described the circulatory response to laryngeal and tracheal stimulation following laryngoscopy and tracheal intubation as reflex sympathoadrenal stimulation . Although increase in heart rate and blood pressure due to sympathoadrenal response is short lived they may have detrimental effects in high risk patients especially those with cardiovascular diseases, increased intracranial pressure or anomalies of cerebral vessels . Laryngoscopy and tracheal intubation induced pressor responses have been associated with increase in catecholamine levels. Norepinephrine, epinephrine levels rise. Rise of these catecholamines are associated with elevation of blood pressure and heart rate . Some authors consider the intubation period one of the greatest risk in surgical patients with coronary artery diseases. Although the response may be transient, it is invariable, significant, often persistent, and of great concern. The techniques of laryngoscopy and tracheal intubation are not confined only to the operating room, but are also employed for non anaesthetic purposes.

## MATERIALS AND METHODS

The present clinical observative, analytical study entitled attenuation of haemodynamic responses to laryngoscopy and endotracheal intubation: a comparison between intravenous esmolol hydrochloride and fentanyl.Presentclinical study was conducted in Alluri Sita Rama Raju Academy of Medical Sciences, EluruDistrict, Andhra pradesh. After approval from the hospital ethics committee, studywas conducted during the period between October 2022 and September 2023. A total of 60 patients undergoing elective under general anaesthesia were selected.

**Inclusion criteria:**

1. American Society of Anaesthesiologist (ASA) physical status I & II patients.
2. Age between 20-50 years, both male & female patients.

**Exclusion criteria:**

1. ASA physical status III & above.
2. Pregnancy
3. Patients with raised intra-cranial pressure and intra-ocular pressure.
4. Patients with difficult airways,Modified Mallampati grade III & IV.
5. Any other co-morbid conditions like hepatic and renal disease.
6. patients on antihypertensive drugs.

A total of 60 patients were divided into two groups of 30 each, group E (Esmolol) and group F (Fentanyl).

**Procedure:**

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 night before the surgery.

In the preoperative room, all the patients were reassessed on the day of surgery. "Nil by mouth" status was confirmed.

Patients were shifted to operating room. Anaesthesia machine, other equipment, monitors and emergency drugs were checked. Intravenous line was secured with 18G cannula and ringer lactate solution was started. Monitors were attached.

Patients were premedicated with Inj. Glycopyrrolate 0.005mg/kg body weight and Inj. Midazolam 0.05mg/kg body weight intravenously 10 minutes before induction. Heart rate (HR), Systolic blood pressure (SBP), Diastolic blood pressures (DBP), Mean arterial pressure (MAP), ECG (lead II) and SpO2 were recorded.

Pre-oxygenation was done with 100% oxygen for 3 min. Group E (n=30) patients received esmolol hydrochloride 2mg/kg IV. Group F (n=30) patients received fentanyl 2µg/kg IV.

One minute later induction was done with Inj. Propofol 2 mg/kg IV and haemodynamic parameters (HR, SBP, DBP, MAP and SpO2) were recorded. Then two minutes after induction, endotracheal intubation

was done with Inj. succinyl choline 1.5mg/kg IV.

Haemodynamic parameters (HR, SBP, DBP and MAP) and oxygen saturation were recorded at 1, 3, 5, 7 and 10 min after intubation. Inj. Fentanyl 1mcg/kg was administered after the study period in both the groups. Anaesthesia was maintained with nitrous oxide (66%) and oxygen (33%),sevoflurane 1 MAC, bolus dose of Inj. Vecuronium 0.08mg/kg IV followed by maintenance dose of 0.02mg/kg as and when required and adequate hydration with ringer lactate. At end of the operation neuromuscular blockade was reversed with Inj. Neostigmine 0.05mg/kg and Inj. Glycopyrrolate 0.01mg/kg I.V. Extubation was done after recovery of consciousness and protective airway reflexes.

All the data were tabulated analyzed and compared using Microsoft Office version 2019. Mean and standard deviation calculated for HR, SBP, DBP, MAP for both the groups in the study. Univariate analysis of change in these parameters at baseline, after induction, and at 1, 3, 5, 7 and 10 minutes after intubation carried out by Paired t-tests for within the group comparisons. Unpaired t-tests were done for comparison between the groups. P-value of less than 0.05 was considered significant.

## OBSERVATION AND RESULTS

Objective parameteres were recorded. Base line after premedication, after induction and subsequentlyat 1 minute, 3 minutes, 5 minutes, 7 minutesand 10 minutes post intubation.

- The demographic profile (age wise, gender wise and weight wise distribution) was comparable in all the groups.
- There was no significant difference in the baseline parameters among the groups.

Laryngoscopy and endotracheal intubation resulted in increased heart rate and blood pressure (SBP, DBP and MAP) in all the groups with maximum values at 1 minute. The percentage rise in hemodynamic parameters was as given below:

- Heart rate above baseline in esmolol group was 16% against 26% of fentanyl group.
- Systolic blood pressure above baseline in esmolol group was 16% as compared to 27% of fentanyl group.
- Diastolic blood pressure above baseline in esmolol group was 20%, as compared to 28% of fentanyl group.
- Mean arterial pressure above baseline in esmolol group was 16%, as compared to 27% of fentanyl group.

Following were observations and results of the present study.

**Table Icomparison Of Mean Heart Rate (mean±sd, Beats/min) Between Groups (n=60)**

| Time of assessment | | Esmolol (n=30) | | Fentanyl (n=30) | | P value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| Pre induction | | 79.17 | 5.75 | 80.47 | 6.81 | 0.43 |
| Post induction | | 79.90 | 5.19 | 82.80 | 6.53 | 0.07 |
| After Intubation | 1 Minute | 92.63 | 5.45 | 101.37 | 7.22 | 0.003 |
| | 3 Minutes | 89.43 | 4.34 | 97.33 | 8.74 | 0.003 |
| | 5 Minutes | 84.46 | 5.22 | 91.40 | 6.99 | 0.002 |
| | 7 Minutes | 81.16 | 6.06 | 83.63 | 7.32 | 0.18 |
| | 10 Minutes | 78.53 | 5.68 | 80.80 | 8.17 | 0.21 |

p value < 0.05 – significant

Significant decrease in magnitude of rise in heart rate after intubation was noticed in esmolol group when compared to fentanyl group at 0, 1, 3, 5 minutes of study period (p value < 0.05).

**Table 2 Comparison Of Mean Systolic Blood Pressure (mean±sd, Mmhg) Between Groups (n=60)**

| Time of assessment | | Esmolol (n=30) | | Fentanyl (n=30) | | P value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| Pre induction | | 129.00 | 11.13 | 131.63 | 11.29 | 0.30 |
| Post induction | | 128.26 | 11.28 | 129.83 | 10.98 | 0.48 |
| After Intubation | 1 Minute | 137.23 | 10.08 | 148.27 | 11.08 | 0.0001 |
| | 3 Minutes | 134.93 | 9.81 | 145.77 | 11.83 | 0.0003 |
| | 5 Minutes | 129.60 | 10.39 | 137.97 | 10.47 | 0.001 |
| | 7 Minutes | 126.43 | 9.58 | 131.43 | 10.69 | 0.003 |
| | 10 Minutes | 125.80 | 9.60 | 128.63 | 11.09 | 0.20 |

p value < 0.05 – significant

Significant decrease in magnitude of rise in SBP after intubation was noticed in esmolol group when compared to fentanyl group at 1, 3, 5, 7 minutes of study period (p value < 0.05)

**Table 3 Comparison Of Mean Diastolic Blood Pressure (mean±sd, Mmhg) Between Groups (n=60)**

| Time of assessment | | Esmolol (n=30) | | Fentanyl(n=30) | | P value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| Pre induction | | 76.06 | 5.26 | 77.77 | 5.56 | 0.27 |
| Post induction | | 75.27 | 4.74 | 75.93 | 5.45 | 0.61 |
| After Intubation | 1 Minute | 80.13 | 4.85 | 86.50 | 4.48 | 0.002 |
| | 3 Minutes | 79.37 | 4.47 | 85.10 | 3.46 | 0.001 |
| | 5 Minutes | 76.43 | 3.98 | 81.10 | 3.28 | 0.003 |
| | 7 Minutes | 75.47 | 4.52 | 77.63 | 4.45 | 0.11 |
| | 10 Minutes | 75.06 | 4.75 | 75.80 | 4.50 | 0.68 |

p value < 0.05 – significant.

Significant decrease in magnitude of rise in DBP after intubation was noticed in esmolol group when compared to fentanyl group at 1, 3, 5 minutes of study period (p value < 0.05)

**Table 4 Comparison Of Mean Arterial Pressure (mean±sd, Mmhg) Between Groups (n=60)**

| Time of assessment | | Esmolol(n=30) | | Fentanyl(n=30) | | P value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| Pre induction | | 93.68 | 5.70 | 95.65 | 6.22 | 0.18 |
| Post induction | | 93.11 | 5.31 | 93.17 | 7.63 | 0.90 |
| After Intubation | 1 Minute | 98.80 | 4.72 | 106.97 | 5.70 | 0.001 |
| | 3 Minutes | 97.73 | 5.02 | 105.22 | 4.71 | 0.002 |
| | 5 Minutes | 94.12 | 4.96 | 100.07 | 4.09 | 0.001 |
| | 7 Minutes | 92.41 | 5.05 | 95.39 | 4.76 | 0.02 |
| | 10 Minutes | 91.95 | 5.01 | 93.42 | 5.54 | 0.27 |

p value < 0.05 – significant

Significant decrease in magnitude of rise in MAP after intubation was noticed in esmolol group when compared to fentanyl group at 1, 3, 5, 7 minutes of study period (p value < 0.05)

## DISCUSSION

The sequence of induction of anaesthesia, laryngoscopy and endotracheal intubation are associated with marked haemodynamic changes and autonomic reflex activity and this may be a cause of concern in many high riskparients.

Laryngoscopy and intubation are associated with rise in blood pressure and heart rate occasionally cardiac arrhythmias. These potentially dangerous changes disappear within 5 minutes . Although 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.

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 20 to 50 years.

Antihypertensive drugs can decrease pressor response. In 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 decrease the blood pressure, and increases the heart rate similar to thiopentone. However, premedication with 0.05mg/kg IV 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.

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 anesthesia avoiding hypoxia and hypercarbia which can influence on haemodynamic variations.

Excluding hypoxia and hypercarbia, continued manifestation of anxiety concerning anesthesia and operation, inj. glycopyrrolate promethonium are other contributory causes of hypertension and tachycardia. They seem to be less important than laryngotracheal stimulation during laryngoscopy and intubation. Various drugs and techniques have been utilized to blunt the hemodynamic 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 possess 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 (10 minutes) and finally, significant drug interactions with commonly used anesthetics have not been reported.

Fentanyl prevents rise in heart rate, blood pressure, intracranial pressure and intraocular pressure associated with laryngo-tracheal stimulation. It suppresses cough related to extubation. It is recommended to use at a dose of 1- 2 µg/kg IV and optimal time of administration is 3-5 minutes before laryngoscopy and intubation.

## CONCLUSION

The following conclusions can be drawn from this study. It establishes the usefulness of intravenous bolus dose of esmolol to attenuate the hemodynamic responses to laryngoscopy and endotracheal intubation. This study shows that esmolol hydrochloride 2mg/kg IV bolus dose is superior to fentanyl 2µg/kg IV bolus to attenuate the hemodynamic responses to laryngoscopy and endotracheal intubation.

No side effects were noted with esmolol hydrochloride and fentanyl citrate.

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