

# Comparison of Esmolol and Magnesium Sulphate for Attenuation of Hemodynamic Stress Response to Laryngoscopy and Intubation in Elective ENT Surgeries

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## Abstract

**Introduction:** The sympathoadrenal response to laryngoscopy and intubation is hazardous in patients with hypertension, coronary artery disease, cerebrovascular disease and intracranial pathology. Various drugs are used to attenuate this stress response. **Aim and Objectives:** This study compares the efficacy of Esmolol and Magnesium Sulphate in attenuating the hemodynamic stress response to laryngoscopy and intubation. **Methodology:** Randomized prospective single blinded study was designed. Ninety patients of ASA PS I and II were randomly allocated into three groups of thirty each. P—received normal saline, E—Esmolol 1.5mg/kg, M—Magnesium Sulphate 50mg/kg. **Statistical Analysis:** ANOVA and Pearson chi square test were used. A p value <0.05 was considered as statistically significant. Tukey's HSD was used to compare between groups. **Observations and Results:** The following observations were made. 1. Group E showed maximum attenuation of heart rate and blood pressure. 2. Group M also showed significant attenuation of blood pressure response but produced tachycardia on infusion of the drug. Heart rate response was not statistically significant compared to group E. 3. All patients recovered well. 4. Incidence of side effects was not significant between the groups. **Conclusion:** Esmolol is effective in blunting the intubation response followed by Magnesium Sulphate which blunts the hypertensive response but produces tachycardia during infusion of the drug. Placebo was ineffective in blunting hemodynamic stress response.

**Keywords:** Esmolol; Hemodynamic Stress Response; Intubation; Laryngoscopy; Magnesium Sulphate.

## Introduction

The induction of anaesthesia, laryngoscopy, tracheal intubation and surgical stimulation evoke cardiovascular responses leading to alteration in heart rate, cardiac rhythm and blood pressure.

The response to laryngoscopy and intubation starts in 5 seconds, peaks within 1-2 minutes and returns to baseline in 5 minutes. This sympatho adrenal response is of little significance in healthy patients but hazardous in patients with hypertension, coronary artery disease, cerebrovascular disease and intracranial pathology. Various drugs are used to attenuate this stress

response like local anaesthetics, narcotics, vasodilators, beta blockers, calcium channel blockers, Magnesium and centrally acting sympatholytics. We have compared Esmolol and Magnesium Sulphate with placebo for attenuation of hemodynamic stress response to laryngoscopy and intubation.

## Methodology

Ninety patients of age group 15-60 years of both sex with ASA physical status I and II undergoing elective ENT surgeries under general anaesthesia

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were included in the study. Institute ethical committee approval and informed written consent from the patient was obtained.

*Inclusion Criteria*

- Age: 15 – 60 years
- ASA: I & II
- Surgery: Elective ENT surgery
- Who have given valid informed consent.

*Exclusion Criteria*

- ASA III or IV
- Anticipated difficult airway
- known sensitivity to the drugs
- Emergency surgery
- Patients on alpha and beta blockers

*Pre Anesthetic Preparation*

Pre anaesthetic check up and investigations were done. All patients were given pre operative night sedation with tablet Alprazolam 0.5mg.

**Method**

The patients were allocated randomly into three groups of thirty patients. Monitors used were NIBP, ECG, EtCO<sub>2</sub> and pulse oximetry. Baseline heart rate and blood pressure was measured. They were premedicated with Inj. Glycopyrrolate 0.2mg and Inj. Midazolam 0.02mg/kg intravenous. Inj. Fentanyl 2µg/kg was given before induction. They were induced with Inj. Propofol 2mg/kg and intubation was done three minutes after Inj. Vecuronium 0.1mg/kg and mask ventilation with Nitrous oxide and Oxygen in a ratio of 66:33 and Sevoflurane 2%. Laryngoscopy and intubation was done in less than 15 seconds.

*Group E* received Esmolol 1.5mg/kg in 15ml normal saline over 15-20 seconds one minute after vecuronium and intubation was done after 2 minutes.

*Group M* received Inj. Magnesium Sulphate 50mg/kg in 100ml of normal saline infusion over 10 minutes before induction.

*Group P* received 15ml of normal saline after induction.

The hemodynamics was recorded at baseline, after premedication, after test drug, after induction, immediately after intubation, thereafter 1, 3 and 5 minutes following intubation.

Laryngoscopy duration and Cormack Lehane score were noted. Any incidence of hypotension, bradycardia or arrhythmias was noted. Anaesthesia was maintained with Nitrous Oxide and Oxygen, vecuronium 0.01mg/kg and sevoflurane 1-2% as needed.

All patients were reversed with Inj. Glycopyrrolate 0.01mg/kg and Neostigmine 50microgm/kg and extubated after reversal of neuromuscular blockade.

*Primary Outcome Measures*

Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure.

*Secondary Outcomes*

Complications like bradycardia, hypotension, arrhythmias.

*Data Analysis*

ANOVA and Pearson chi square test were used. A p-value of <0.05 was considered as statistically significant. Tukey’s HSD was used to compare between the groups.

**Observations and Results**

There was no statistical significance between three groups in relation to age, sex, weight and basal hemodynamic parameters.

The modified Mallampati Score and Cormack Lehane grade and laryngoscopy duration were comparable between the groups.

Characteristics	Group P	Group E	Group M	p value	
Age (yrs)	29.7±10.06	26.53±9.32	31.13±9.20	0.167	
Sex	Male	11	13	11	0.829
	Female	19	17	19	
Weight (kg)	56.27±8.09	52.93±10.65	52.67±8.92	0.252	

*Heart Rate Changes (Beats/Min)***Table 1:** Comparison of heart rate at various time intervals between the groups

Group	P	E	M	P Value
Baseline	79.80±14.44	86.67±9.79	81.47±14.47	0.112
After Premed	79.83±13.05	86.63±14.30	84.53±16.50	0.191
After Test Drug	77.30±11.30	77.70±13.14	93.27±18.45	0.001
After Induction	72.27±13.26	82.20±15.00	78.33±11.31	0.017
Immediately After Intubation	103.63±12.31	90.67±13.93	97.40±12.57	0.001
1 minute After Intubation	95.87±12.86	87.27±13.48	92.97±10.38	0.026
3 minutes After Intubation	87.83±12.50	84.30±12.79	90.07±9.82	0.167
5 minutes After Intubation	81.73±13.66	81.60±13.31	86.00±9.61	0.296

*Systolic Blood Pressure Changes (mmHg)***Table 2:** Comparison of systolic blood pressure at various time intervals between the groups

Group	P	E	M	p Value
Baseline	125.73±10.72	123.13±8.69	125.90±11.12	0.504
After Premed	123.47±10.54	120.67±9.05	120.30±9.56	0.391
After Test Drug	118.70±13.64	100.10±9.60	112.27±11.65	0.001
After Induction	109.97±13.63	107.70±9.23	98.97±9.74	0.001
Immediately After Intubation	138.57±17.25	114.43±8.76	124.90±17.76	0.001
1 minute After Intubation	128.73±17.04	107.60±9.23	116.80±15.66	0.001
3 minutes After Intubation	119.13±16.16	102.60±9.61	109.80±14.75	0.001
5 minutes After Intubation	111.23±14.34	100.20±9.44	105.47±10.84	0.002

*Diastolic Blood Pressure Changes (mmHg)***Table 3:** Comparison of diastolic blood pressure at various time intervals between the groups

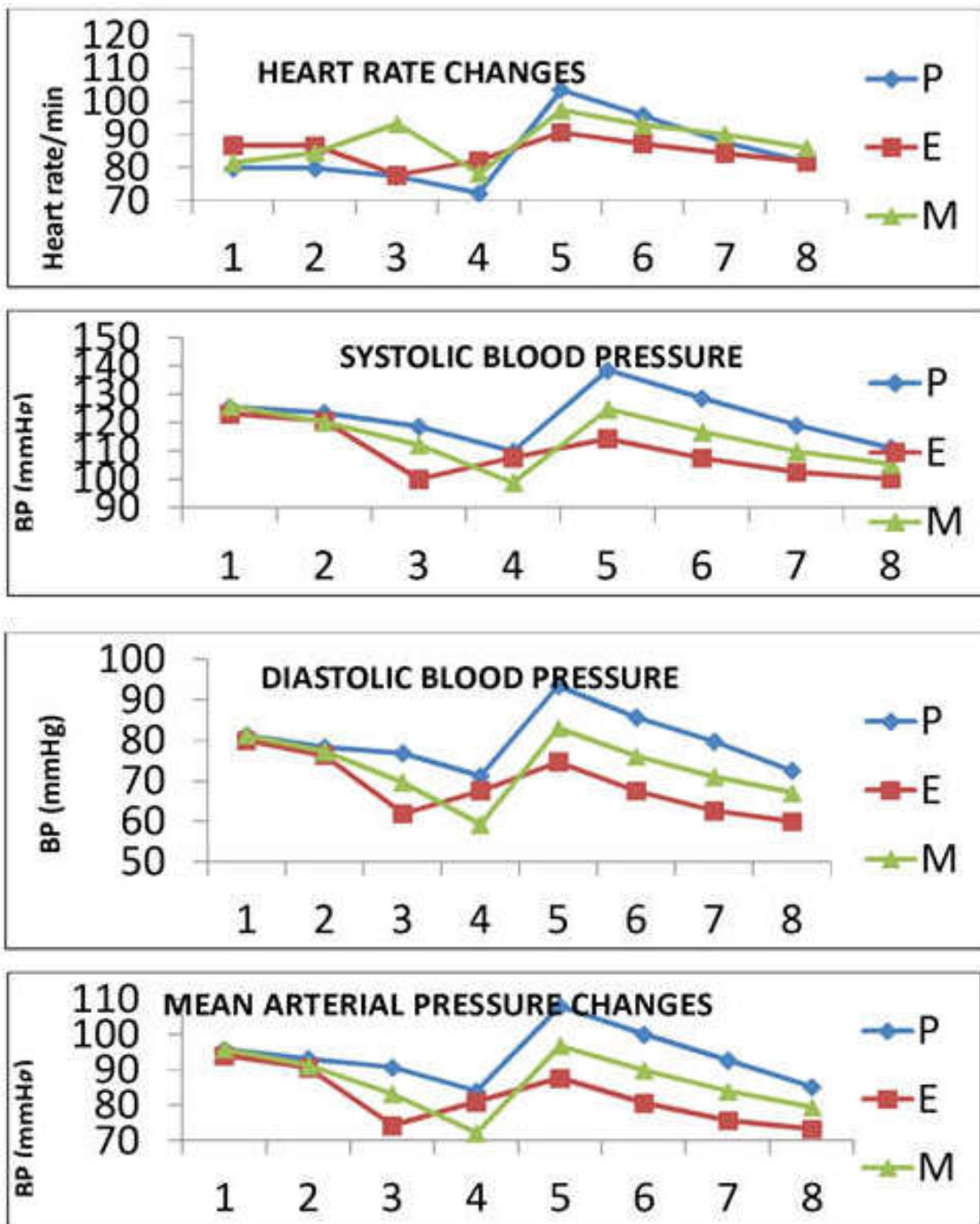
Group	P	E	M	p Value
Baseline	81.33±6.70	80.00±6.50	81.33±8.12	0.707
After Premed	78.40±6.89	76.33±5.82	77.30±8.61	0.541
After Test Drug	76.93±7.38	61.90±8.22	69.70±9.63	0.001
After Induction	71.27±10.28	67.63±8.05	59.30±9.79	0.001
Immediately After Intubation	93.60±12.49	74.73±8.29	83.13±16.74	0.001
1 minute After Intubation	85.77±12.16	67.53±9.97	76.17±15.94	0.001
3 minutes After Intubation	79.80±12.27	62.63±10.19	71.07±14.29	0.001
5 minutes After Intubation	72.63±10.20	60.00±9.93	67.10±12.20	0.001

*Mean Arterial Pressure Changes (mmHg)***Table 4:** Comparison of mean arterial pressure at various time intervals between the groups

Group	P	E	M	p Value
Baseline	95.93±7.46	94.07±6.60	96.00±8.81	0.544
After Premed	93.20±7.49	90.63±6.76	91.30±8.73	0.412
After Test Drug	90.77±8.56	74.30±7.78	83.30±9.84	0.001
After Induction	84.00±10.36	81.00±7.34	72.23±9.34	0.001
Immediately After Intubation	108.10±14.19	87.70±8.01	96.87±16.72	0.001
1 minute After Intubation	100.10±13.49	80.67±9.19	89.97±15.64	0.001
3 minutes After Intubation	92.77±13.17	75.70±9.01	84.00±13.79	0.001
5 minutes After Intubation	85.30±11.17	73.30±8.69	79.50±10.73	0.001

*Side Effects*

Group	Hypotension		Bradycardia		Arrhythmia	
	Yes	No	Yes	No	Yes	No
Group P	0	30	0	30	0	30
Group E	1	29	1	29	0	30
Group M	4	26	1	29	0	30
P value	0.133		0.600			



1. Basal Value,
2. After Premedication
3. After Test Drug,
4. After Induction
5. Immediately after intubation,
6. 1 Minute after intubation
7. 3 Minute after intubation,
8. 5 Minute after intubation

## Discussion

Laryngoscopy and intubation can produce hemodynamic stress response characterised by hypertension and tachycardia. It can lead to acute coronary events, arrhythmias, ventricular failure and rise in intracranial pressure. Many drugs have been reported to attenuate this response.

S.A. Aasim et al [1] compared Esmolol 1.5mg/kg and Magnesium sulphate 50mg/Kg in 60 patients. They did not have a control group. They stated that Esmolol group had significantly lower heart rate than MgSO<sub>4</sub> group after intubation till five minutes. There was no significant difference in mean arterial pressure between both groups before and after intubation. They concluded that Esmolol is a better agent as it attenuates rise in both heart rate and blood pressure which is in accordance with our study.

Rajan Sunil et al [2] compared Magnesium Sulphate 50mg/kg and lignocaine for attenuating stress response in major head and neck surgeries. Magnesium was administered as an infusion over 10 min before induction. They said preinduction HR following administration of magnesium sulphate increased significantly from the baseline values and concluded that magnesium sulphate effectively attenuated heart rate and blood pressure than Lignocaine.

In our study, comparison of Esmolol 1.5mg/kg, MgSO<sub>4</sub> 50mg/kg and placebo was done in attenuating haemodynamic stress response to laryngoscopy and intubation. The data was analysed using Microsoft Excel. Statistical significance was assessed by use of ANOVA and Pearson chi square test. TUKEYS HSD was applied to evaluate inter group comparisons.  $p < 0.05$  was considered statistically significant.

### *Heart Rate Changes*

The heart rate immediately after intubation and one minute after intubation was significantly lower in group E than group M and group P ( $p < 0.05$ ). Magnesium infusion increased the heart rate. This was in correlation with the study by Santhosh Kumar et al [3] which stated that MgSO<sub>4</sub> 60mg/kg produced tachycardia and failed to attenuate the rise in heart rate compared to Esmolol 2mg/kg. Michael F M James et al [4] also concluded that MgSO<sub>4</sub> 60mg/kg pretreatment increased heart rate by  $13 \pm 3.9$  beats per minute but attenuated stress response. In our study heart rate increased by

$11.8 \pm 3.98$  beats per minute. Heart rate returned below baseline after three minutes in group E and to near baseline levels after five minutes in group M and group P.

### *Blood Pressure Changes*

There were significant changes in systolic, diastolic and mean arterial pressure between the groups after test drug, after induction, immediately after intubation, at one, three and five minutes after intubation ( $p = 0.001$ ).

### *Systolic Blood Pressure (SBP) Changes*

Immediately after intubation change in systolic blood pressure was significant between the groups ( $p = 0.001$ ). Systolic blood pressure was below the baseline value in group E, near baseline in group M and elevated in group P.

At one, three and five minutes after intubation there was significant fall in SBP between the groups ( $p = 0.001$ ). But there was no statistical significant difference in SBP between Esmolol and MgSO<sub>4</sub> group at three and five minutes after intubation. The study of Juhi sharma et al [5] on controlled hypertensive patients showed no significant difference in systolic and diastolic blood pressure between the groups which received Esmolol 1.5mg/kg and MgSO<sub>4</sub> 40mg/kg.

### *Diastolic Blood Pressure (DBP) Changes*

There was a statistically significant fall in diastolic blood pressure after intubation in group E compared to group M ( $p < 0.05$ ).

### *Mean Arterial Pressure (MAP) Changes*

Immediately after intubation and one minute after intubation, MAP was increased in group P but there was a fall in MAP in group E and group M which was statistically significant ( $p < 0.05$ ).

We did not monitor serum magnesium levels and we had no clinical adverse effects related to magnesium infusion in our study.

### *Side Effects*

One patient in group E and four patients in group M had hypotension ( $MAP < 60$  mmHg). One patient in group M and one patient in group E had bradycardia ( $HR < 60$  /min). There were no incidences of arrhythmia, prolonged neuromuscular

blockade or delayed recovery in any group. One patient in group M had complaints of hot flush in the lower abdomen when Magnesium Sulphate was being infused.

### Conclusion

From this study, it is concluded that hemodynamic stress response to laryngoscopy and intubation can be attenuated by giving intravenous Esmolol 1.5mg/kg. Esmolol is effective in blunting the response followed by Magnesium Sulphate which blunts the hypertensive response but produces tachycardia during infusion of the drug. Placebo was not effective in attenuating stress response.

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