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A Comparative Study of the Efficacy of Intravenous Esmolol and Intravenous Magnesium Sulphate in Attenuating Haemodynamic Response to Laryngoscopy and Endotracheal Intubation

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***Abstract*: Background & Objectives:** *Direct laryngoscopy and endotracheal intubation always trigger powerful cardiovascular responses. It may be well tolerated in healthy people, but may be hazardous in patients with hypertension, tachycardia, myocardial infarction, and other complications.Various attempts have been made to attenuate these responses. The present study has been undertaken to make a comparative study of both drugs Esmolol and Magnesium Sulphate in attenuating the haemodynamic changes during laryngoscopy and tracheal intubation.*
Methods: *After IEC approval, a prospective, randomized, double blinded study was conducted on 120ASA I and II adult patients undergoing elective surgeries under general anaesthesia. Patients were randomly divided into three groups of 40 patients in each group - N, M, and E. Group - "N" received normal saline IV, group -"M" received 50 mg per kg magnesium sulfate IV and group -"E" received 2 mg per kg esmolol IV 4 min before intubation. Heart rate, systolic blood pressure, diastolic blood pressure and Mean arterial pressure were measured before induction as baseline, just after giving the study drugs and after tracheal intubation at 1, 3, 5, 10, 15, 30, 45 and 90 minutes. Patients were also observed for any complications.*
Results: *Baseline mean heart rate and mean blood pressure were compared in all the groups (<0.05). Both IVMagnesium sulphate and IV esmolol showed attenuation of hemodynamic response to laryngoscopy and endotracheal intubation which was statistically significant (<0.05). In which esmolol was more effective than magnesium sulfate which was also statistically significant .*
Conclusion: *IV esmolol 2 mg/kg as a bolus done proved to be more effective than IV magnesium sulfate 50 mg/kg in attenuating haemodynamic stress response following laryngoscopy and intubation.*
Keywords: *Esmolol, Magnesium sulphate, Laryngoscopy, Intubation, Haemodynamics.*

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I. Introduction

Endotracheal intubation is very common procedure to secure airway while administering general anaesthesia. It is the translaryngeal placement of endotracheal tube into trachea via the nose or mouth. This procedure includes laryngoscopy and intubation.

Cardiovascular complications are one of the most common causes of anesthesia-related morbidity and mortality.[1]Direct laryngoscopy and endotracheal intubation frequently induces a cardiovascular stress response characterized by hypertension and tachycardia due to reflex sympathetic simulation. The response is transient occurring 30 sec after intubation and lasting for less than 10 min.[2]It may be well tolerated in healthy people, but may be hazardous in patients with hypertension, tachycardia, myocardial infarction, and other complications.[3]
Various pharmacological approaches have been used to attenuate cardiovascular stress response to laryngoscopy and endotracheal intubation including use of adrenergic receptor blockers, calcium channel blockers, opioids, and vasodilators.[4]Each of these approaches have some disadvantages, the most obvious being that the effects of preventive intervention often considerably outlast stressful adrenergic responses.

Esmolol is an ultrashort acting β1adrenergic blocker. It has predominant effect on β receptors and possesses no significant membrane stabilizing activity. It has rapid onset and a short duration of action.[5]Anaesthesiologists may want to suppress sympathetic nervous system response at one time (e.g., before tracheal intubation), but be able to enhance those responses very soon after, Esmolol is an attractive option because of its short duration of action.

Magnesium sulfate is a bivalent salt that produces vasodilatation and causes a drop in blood pressure by diminishing sympathetic excitability of muscle cells.[6]It has been approved as a medication for treatment of

preeclampsia and blood pressure management. Its positive effects on ischemic infectious endocarditis and for management of hemodynamic variables in patients with heart disease are being gradually recognized. Due to its inhibiting effects on release of catecholamines from adrenergic nerve endings and adrenal medulla, magnesium has been an option for minimizing adverse cardiovascular responses during laryngoscopy and intubation.
Therefore, the present study has been undertaken to make a comparative study of both drugs Esmolol and Magnesium Sulphate in attenuating the haemodynamic changes during laryngoscopy and tracheal intubation.

II. Materials And Methods

Ethical statement: The study was approved by the Institutional Ethics Committee, Bokaro General Hospital, India. Informed written consent was obtained after informing the participants about the nature, scope and risks related to the study.
Study location : The study was carried out in the Department of Anaesthesiology, Bokaro General Hospital, Bokaro Steel city, Jharkhand, India.
Study population: Patients came for surgery under general anaesthesia to operation theatre in the Department of Anaesthesiology, Bokaro General Hospital, Bokaro Steel city, Jharkhand.
Study design : It a prospective, randomized double blind, comparative study.
Sample size estimation with two means study[7,8]:
Then the total sample size for the study is as follows
Where
Z_α is the normal deviate at a level of significance (Z_α IS 1.96 for 5% level of significance)
$Z_{1-\beta}$ is the normal deviate at (1- β)% power with β% of type II error (0.84 at 80% power of study)
$r = n_1 / n_2$ is the ratio of sample size required for 2 groups
δ is standard deviation ,d is difference of means of 2 groups .
The total sample size for the study with r = 1 (equal sample size)
The values are obtained from previous study .
Taking the α at 5% and desired power of study as 80%
We will accept a $p<0.05$ as significant. We mean that we are ready to accept that the probability that the result is observed due to chance is 5%
Confidence level = 95%
Confidence interval = 5.22
Sample size = 40
find the smallest sample sizes required to achieve a fixed margin of error, using simple random sampling.
Therefore ,
$n = \{(r+1) (Z_{\alpha/2} + Z_{1-\beta}) \delta^2 \} / r d^2$
$n = (1+1) (1.96+0.84)^2 (10.366)^2 /1* (19.29 - 12.8)^2 = 1684.878 / 42.12 = 40.112 \approx 40$
The total sample size required for the study 120, each group contain 40 patients
(total population = 120)
Study duration : One and half years (October-2015 to March-2017)

Inclusion Criteria : In patient with
1. Informed written consent.
2. ASA grade I and II posted for elective surgery under general anaesthesia
3. Age group 18 -60 years.
4. Weight 45-65 kg
Exclusion Criteria:
1. Patient refusal
2. Hypertension (controlled and uncontrolled both)
3. Systolic blood pressure less than 90 mm Hg
4. Heart rate less than 60 beats/ min.
5. Coronary artery disease
6. COPD
7. Morbid obesity
8. Diabetes Mellitus
9. Renal compromise
10. Pregnant and lactating women
11. Duration of laryngoscopy >30 seconds (It is defined as the time from the start of laryngoscopy to inflation of the bronchial cuff)

Study group : The study was carried out on 120 normotensive patients of age group 18 to 60 years of ASA class 1 and 2 posted for elective surgery under general anaesthesia.

Besides a long and thorough clinical examination like history, general examination and systemic examination the investigations a blood haemoglobin, total count and differential count of WBC, ESR, Routine & microscopic examination of urine, ECG, X-Ray chest PA view, blood sugar –fasting and postprandial, Blood urea, serum creatininewerel be done to exclude any systemic illness and also for ASA grading.

Premedication: All the patients will be pre-medicated with oral tab. Rantidine 150 mg and tab. Alprazolam 0.25 mg on the night before surgery. All the patients will remain fasting for overnight for 8 hours prior to surgery.

Intervantion plan: On arrival in the operation theatre, routine monitoring in the form of ECG (lead II and $V_{5)}$, respiration, NIBP and SPO_2 were instituted. Intravenous access was established with 18G intravenous catheter on the dorsum of the non -dominant hand and infusion of lactated Ringer's solution was started.

By use of computer generated random numbers, Patients were randomly allocated in one three groups of 40 each.

Group N :- Patients were given single bolus dose of normal saline 10 ml intravenously before laryngoscopy and intubation.

Group M :- Patients were given single bolus dose of Magnesium sulphate 50 mg/kg body weight (making total volume 10 ml by adding normal saline) intravenously before laryngoscopy and intubation.

Group E :- Patients were given single bolus dose of Esmolol 2 mg/kg body weight (making total volume 10 ml by adding normal saline) intravenously before laryngoscopy and intubation.

The patients' lungs were pre-oxygenated with 100 % Oxygen for 2 min. Two minutes after preoxgenation (t = 120s), the study drug was administered intravenously over 30 seconds. Anaesthesia was then induced (t = 150s) with inj. .Pentazocine 0.5 mg per kg body weight and inj. Propofolwas given slowly upto loss of eye reflexes. All the groups were received inj. Vecuronium 0.1mg/kg body weight for facilitation of intubation of trachea. The patients' lungs were then ventilated with Sevoflurane1% and nitrous oxide 50% in oxygen, maintaining end-expiratory carbon dioxide tension at 4.0±4.5 kPa. Four minutes later (t = 390 s), laryngoscopy was done using standard Macintosh blade. Oral Intubation was done with appropriate sized, disposable, high volume low pressure, portex cuffed endotracheal tube within 30 seconds. Every patient of this study received inj. Ondansetron 4mg i.v. 15 minutes before expected time of extubation. Anaesthesia was maintained with O_2, N_2O, Sevoflurane and inj. Vecuronium top up. At the end of surgery anaesthesia was reversed with inj. Neostigmine 0.05 mg/kg and inj. Glycopyrrolate 0.2mg per mg of Neostigmine intravenously. Patients were shifted to recovery room after adequate reversal and monitored for vital parameters postoperatively.

Rescue interventions: Rescue interventions were planned for bradycardia and hypotension.Bradycardia (<50 BPM) was treated with atropine and hypotension (<20% of baseline value) was treated with mephenteramine.

Blinding: Both the patient and the anaesthesiologistwho administered the general anaesthesia and recorded the data, were blinded to the study group. An independent anaesthesiologist prepared and administered the study drugs.

Parameter of observation: Heart rate (per minute), Systolic blood pressure (mm of Hg), Diastolic blood pressure (mm of Hg), Mean arterial pressure (mm of Hg) and SpO_2were observed

Base line values of heart rate, respiratory rate, SpO_2, Systolic, diastolic, mean arterial blood pressure were recorded just before administering i.v. dose Esmolol or Magnesium sulphate or saline. The same parameter was continuously monitored and recorded just after giving study drugs and after intubation at 1, 3, 5, 15, 30, 45, 90 minutes and postoperatively. Any adverse effects were noted.

Statistical analysis: All the data would be selected randomly and tabulated, and then analyzed with appropriate statistical tools "MedCalc". Data wiil be presented as mean with standard deviation or proportions as appropriate. Mean, median, standard deviation and variance would be calculated. Student's paired T-test,Chi – square Test, Student t-test, and Analysis of variance would be applied for statistical analysis.

III. Results

One hundred twenty seven patients were assessed for eligibility. Seven patients did not give consent for participation. One hundred twenty patients were enrolled and randomized to either of the three groups; 40 each. Finally, 37 patients in Group N, 36 patients in Group M and 37 patients in Group E were analyzed, the rest being excluded due to laryngoscopy time > 30 seconds.

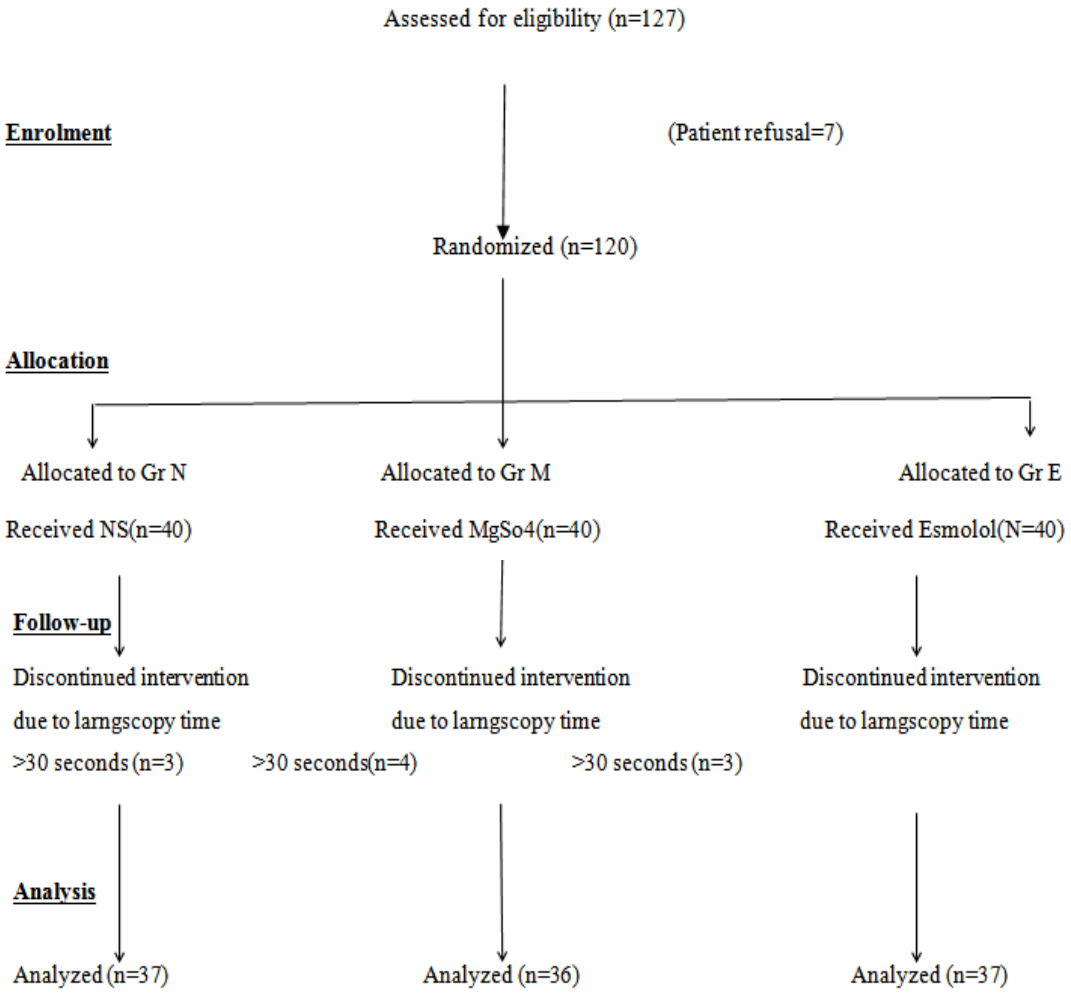


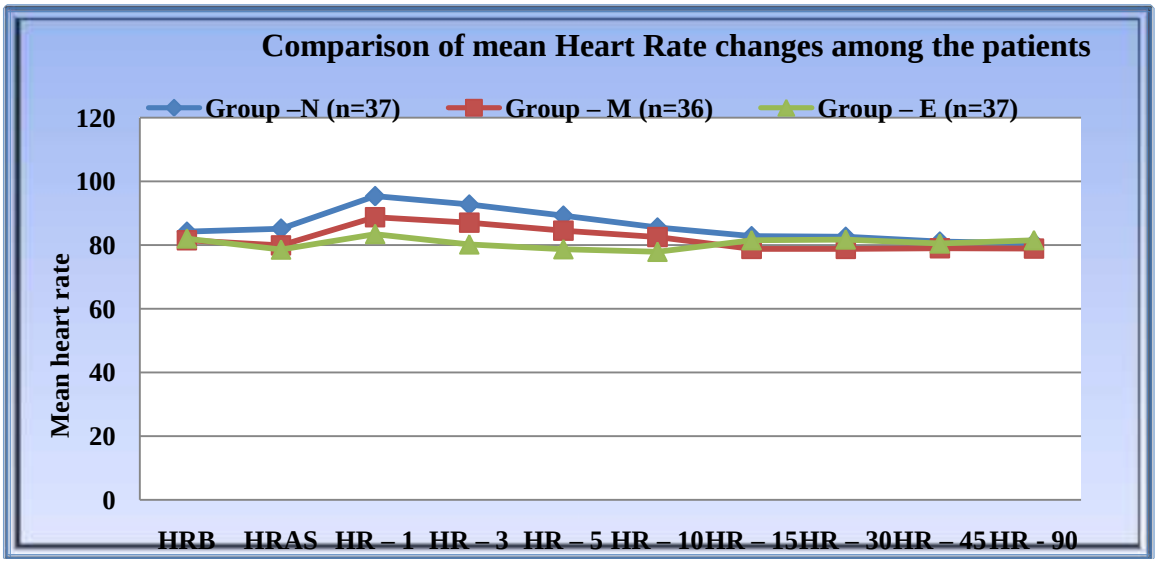
Figure1. CONSORT flow diagram of study participants

Oneway ANOVA showed that there were no significant difference in the mean of all the demographic parameters like age, sex, weight and ASA Grading of the three groups (p>0.05). Thus the patients of the three groups were matched for all the demographic parameters.

Table-1: Comparison of mean Heart Rate changes among the patients

Time interval	Group name			$F_{cal.}$	P – value
	Group –N (n=37)	Group – M (n=36)	Group – E (n=37)		
HRB	84.22 ± 12.59	81.50 ± 13.24	82.08 ± 11.36	0.487	p>0.05
HRAS	85.19 ± 11.34	79.89 ± 12.31	78.59 ± 10.49	3.470	P<0.05
HR – 1	95.41 ± 10.84	88.78 ± 11.59	83.49 ± 10.10	11.204	P<0.05
HR – 3	92.76 ± 9.93	87.06 ± 10.32	80.22 ± 10.17	14.189	P<0.05
HR – 5	89.27 ± 9.27	84.58 ± 9.67	78.70 ± 9.18	11.802	P<0.05
HR – 10	85.54 ± 9.16	82.56 ± 9.90	77.89 ± 8.01	6.713	P<0.05
HR – 15	82.81 ± 10.99	78.80 ± 10.16	81.54 ± 6.48	1.722	P>0.05
HR – 30	82.62 ± 10.65	78.81 ± 10.57	81.76 ± 6.90	1.604	P>0.05
HR – 45	81.11 ± 10.11	79.03 ± 9.88	80.51 ± 7.46	0.491	P>0.05
HR - 90	80.64 ± 9.45	78.94 ± 9.94	81.54 ± 6.22	0.841	P>0.05

There were Statistically no significant difference among the groups according to given HR , with p - value { $p > 0.05$ } And When the computed F–ratio is less than the tabulated F–ratio (critical ration) = 3.07}.Then there were statistically significant difference among the groups according to given HR , with p - value { $p < 0.05$ } .

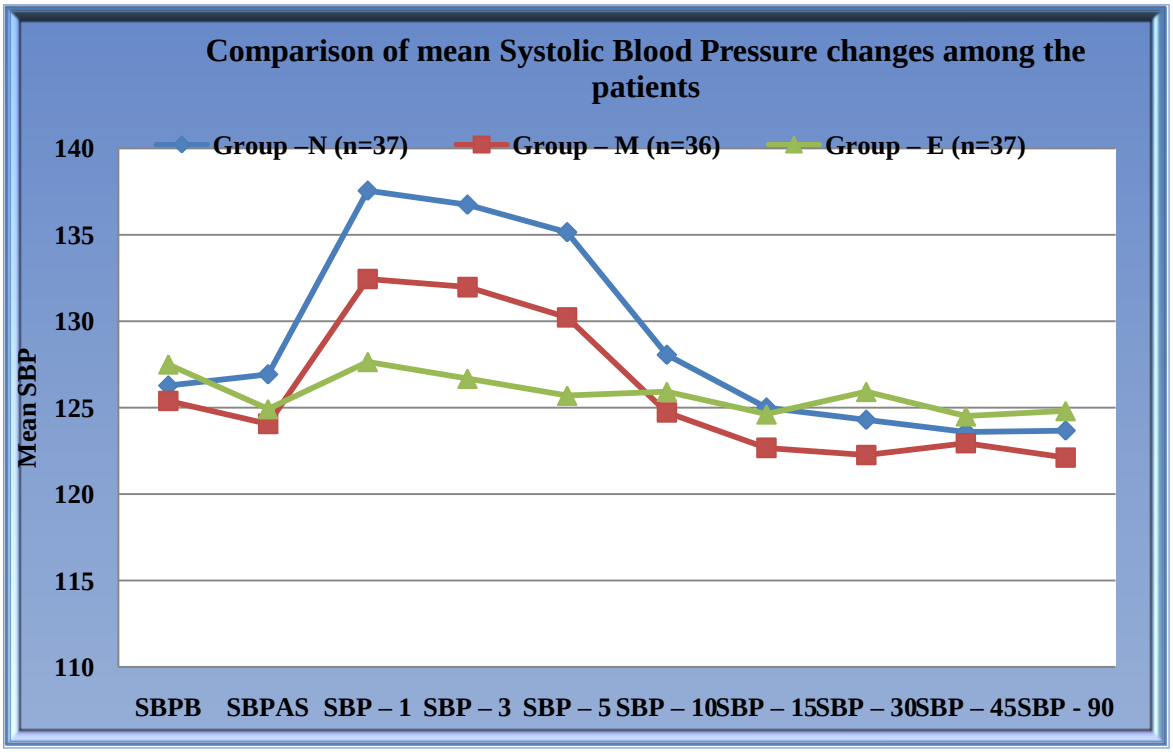


Graph-1: Comparison of mean Heart changes among the patients

Table-2: Comparison of mean Systolic Blood Pressure changes among the patients

Time interval	Group name			$F_{cal.}$	P – value
	Group –N (n=37)	Group – M (n=36)	Group – E (n=37)		
SBPB	126.27 ± 11.48	125.39 ± 10.33	127.51 ± 11.01	0.347	p>0.05
SBPAS	126.92 ± 10.87	124.06 ± 10.73	124.92 ± 10.76	0.679	p>0.05
SBP – 1	137.54 ± 10.18	132.44 ± 10.02	127.65 ± 10.18	8.829	P<0.05
SBP – 3	136.73 ± 10.84	131.97 ± 9.28	126.68 ± 9.56	9.502	P<0.05
SBP – 5	135.14 ± 11.11	130.22 ± 9.09	125.70 ± 9.63	8.249	P<0.05
SBP – 10	128.05 ± 10.26	124.72 ± 8.36	125.92 ± 10.13	1.123	p>0.05
SBP – 15	125 ± 9.30	122.67 ± 8.16	124.62 ± 7.96	0.789	p>0.05
SBP – 30	124.29 ± 7.78	122.25 ± 7.91	125.92 ± 7.99	1.977	P>0.05
SBP – 45	123.59 ± 7.62	122.94 ± 7.26	124.51 ± 8.47	0.373	P>0.05
SBP - 90	123.67 ± 7	122.11 ± 7.18	124.81 ± 6.39	1.421	P>0.05

Baseline SBP Was Comparable in all the three groups (> 0.05). SBP declined in group M and Group E, but statistically not significant (>0.05). SBP was More in Group N compared rest of two groups (<0.05) After10 minutes SBP became comparable in all the three groups.



Graph-2: Comparison mean Systolic blood pressure Changes among the patients.

Table-3: Comparison of mean Diastolic Blood Pressure changes among the patients

Time interval	Group name			$F_{cal.}$	P – value
	Group –N (n=37)	Group – M (n=36)	Group – E (n=37)		
DBPB	77.70 ± 7.85	77.44 ± 8.01	77.57 ± 8.75	0.009	p>0.05
DBPAS	77.94 ± 7.79	77.31 ± 8.41	75.57 ± 8.16	0.848	p>0.05
DBP – 1	83.22 ± 7.95	81.89 ± 8.35	77.87 ± 7.80	5.576	P<0.05
DBP – 3	82.08 ± 7.53	80.08 ± 8.37	76.19 ± 8.09	5.185	P<0.05
DBP – 5	80.03 ± 7.74	79.36 ± 8.31	75.27 ± 8.22	3.736	P<0.05
DBP – 10	77.76 ± 7.37	76.36 ± 8.44	75.13 ± 8.51	0.965	p>0.05
DBP – 15	75.97 ± 7	75.56 ± 8.11	76.24 ± 8.40	0.071	p>0.05
DBP – 30	75.95 ± 6.34	74.92 ± 7.25	76.24 ± 8.28	0.327	P>0.05
DBP – 45	75.81 ± 6.36	75.64 ± 7.50	76.62 ± 8.58	0.178	P>0.05
DBP - 90	75.38 ± 6.93	75.58 ± 7.69	76.86 ± 8.29	0.408	P>0.05

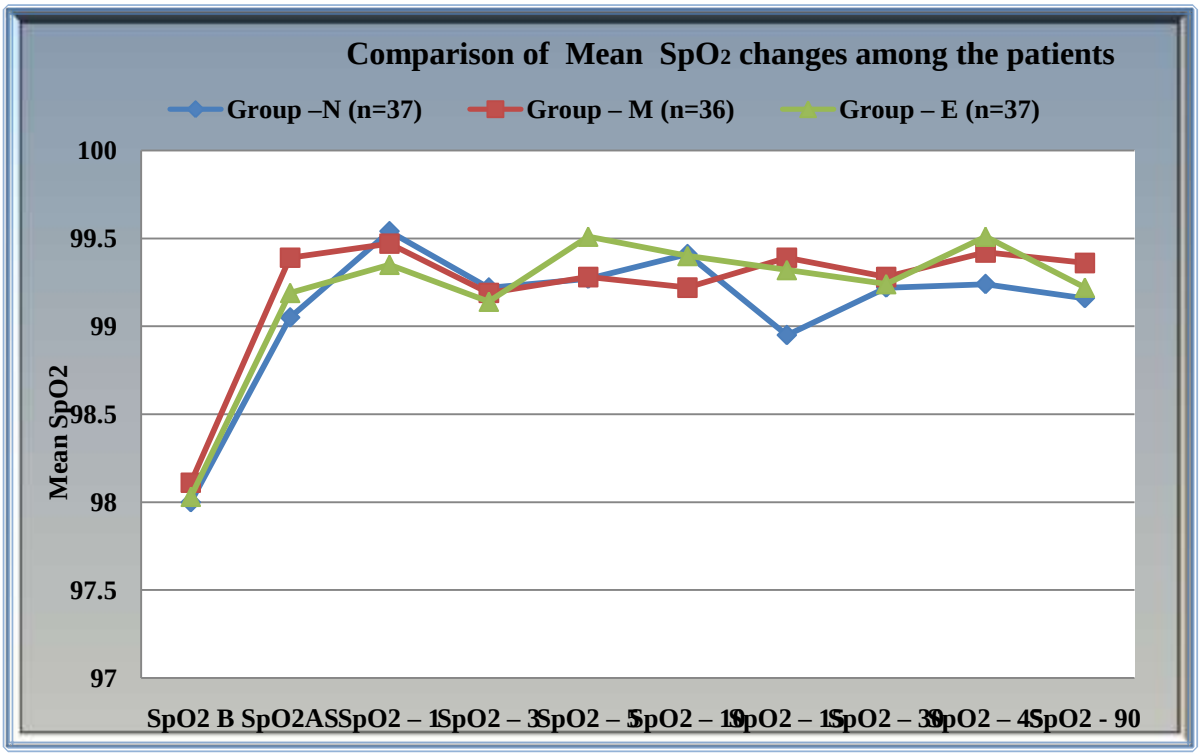
For Test of Significance, Here we use "Analysis of Variance (ANOVA) Or F - Test "0.841

Baseline value of mean diastolic blood pressure were comparable in all the three groups. After giving the study drugs, all the value were comparable (>0.05). At 1 minute of intubation, mean diastolic blood pressures were maximum in all the groups (<0.05). Rise in Diastolic Blood pressure was minimal in Group E as compared to Group M and Group N. Mean diastolic blood pressure reached near baseline at 10 minute in Group N and Group M. Where as Mean diastolic blood pressures were less at various interval compared to baseline value in Group E.

Table-4: Comparison of Mean SpO_2 changes among the patients

Time interval	Group name			$F_{cal.}$	P – value
	Group –N (n=37)	Group – M (n=36)	Group – E (n=37)		
SpO_2 B	98 ± 0.53	98.11 ± 0.52	98.03 ± 0.44	0.492	p>0.05
SpO_2AS	99.05 ± 0.85	99.39 ± 0.60	99.19 ± 0.74	1.900	P>0.05
SpO_2 – 1	99.54 ± 0.56	99.47 ± 0.65	99.35 ± 0.67	0.853	p>0.05
SpO_2 – 3	99.22 ± 0.92	99.19 ± 0.89	99.14 ± 0.89	0.081	p>0.05
SpO_2 – 5	99.27 ± 0.77	99.28 ± 0.81	99.51 ± 0.61	1.306	p>0.05
SpO_2 – 10	99.41 ± 0.69	99.22 ± 0.79	99.40 ± 0.76	0.724	p>0.05
SpO_2 – 15	98.95 ± 1.08	99.39 ± 0.80	99.32 ± 0.75	2.662	p>0.05
SpO_2 – 30	99.22 ± 0.71	99.28 ± 0.70	99.24 ± 0.79	0.064	P>0.05
SpO_2 – 45	99.24 ± 0.76	99.42 ± 0.69	99.51 ± 0.65	1.405	P>0.05
SpO_2 - 90	99.16 ± 0.73	99.36 ± 0.79	99.22 ± 0.75	0.669	P>0.05

SpO2 was comparable in all the three groups



Graph4-: Comparison of Mean SpO_2 changes among the patients.

III. Discussion

The quest to find an ideal agent which can attenuate the hemodynamic stress response to laryngoscopy and intubation is on for long time. 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 patient.[9] Normal hemodynamic response to intubation is seen in all Patients but well tolerated by healthy subjects . However, in certain patients this response proves to be detrimental to the health or to the successful outcome of the patient. Hemodynamic response to the stress of laryngoscopy and intubation does not present a problem for most patients. However, 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 irritation of the respiratory tract. Increase in blood pressure and heart rate at the time of intubation increases the cardiac workload and oxygen demand of myocardium in normal subjects, this increased requirement is achieved by coronary vasodilatation and increased coronary blood flow. But the patient with the history of Ischemic heart disease are at greater risk of developing a fresh episode of myocardial ischemia and infarction[10] due to fixed coronary blood flow along with fall in cardiac index and ejection fraction.

Many factors like drugs, age, type of procedure , depth of anaesthesia[11] , hypoxia, hypercarbia, status of myocardium and baseline catecholamine level etc. can influence the hemodynamic response associated with laryngoscopy and intubation. These hemodynamic responses need to be attenuated so as to decrease associated risk of myocardial ischemia, myocardial infarction, cerebral haemorrhage and raised intraocular tension which may lead to optic disc ischemia and even blindness in high risk patients.

Therefore, the present study has been undertaken to make a comparative study of both drugs Esmolol and Magnesium Sulphate in attenuating the hemodynamic changes during laryngoscopy and tracheal intubation.

Esmolol is advocated for attenuation of sympathetic responses to laryngoscopy and intubation. It is cardioselective and blunting of sympathetic responses is dose dependent. In high dose esmolol may cause bradycardia and hypotension. It has been used in various bolus doses or in an infusion form. Esmolol 2mg/kg as single bolus successfully attenuated the pressure response to laryngoscopy and endotracheal intubation. Among the Beta Blockers the ultra -short acting like Esmolol owing to its unique pharmacokinetic behaviour is well suited for controlling cardiovascular responses to tracheal intubation. In our present study we gave esmolol 2mg/kg , 4 minute prior to laryngoscopy and intubation.

Magnesium sulphate is also recommended for blunting stress response to laryngoscopy and intubation. The ability of magnesium ion in inhibiting the release of catecholamines has long been recognized, hence it is considered for use in laryngoscopy and intubation to minimize unwanted cardiovascular responses.[12] The

different possible mechanisms of action magnesium sulphate have been discussed. It was reported that magnesium sulphate can induce endothelium-derived nitric oxide production that mediates the relaxation of vascular smooth muscles through its vasodilatory effect. In addition, it acts as a vasodilator by increasing the synthesis of prostacyclin as well as inhibiting angiotensin converting enzyme activity. The mechanism of action is unclear, but its blocking effects on calcium channels and N-methyl-D-aspartate (NMDA) receptors seems to play an important role. Magnesium sulphate 50mg/kg as single bolus successfully attenuated the pressure response to laryngoscopy and endotracheal intubation.[13] In this study, the Group M received 50-mg/kg Magnesium sulfate as an IV bolus four minute before the laryngoscopy and intubation to attenuate hemodynamic stress response.

Comparison of mean Heart Rate changes among the patients:[Table-1]

The mean heart rate before giving study drugs was considered as baseline in current study. The baseline mean heart rate of the patient in all the three groups were comparable (>0.05) which were 84.22 ± 12.59, 81.50 ± 13.24 and 82.08 ± 11.36 in Group N, Group M and Group E respectively, which was statistically nonsignificant. Mean heart rate just after giving study drugs were 85.19 ± 11.34, 79.89 ± 12.31 and 78.59 ± 10.49 in Group N, Group M and Group E respectively, which was statistically significant. After laryngoscopy and intubation at 1 minute the mean heart rate increased by maximum of 95.41 ± 10.84, 88.78 ± 11.59 and 83.49 ± 10.10 in Group N, Group M and Group E respectively (<0.05) which was statistically significant. The mean heart rate declined to reach level below baseline by 3 minutes in Group E. The mean heart rate declined to reach near baseline value by 10 minute in Group M where as in Group N the mean heart rate declined to reach level below baseline by 15 minutes.

James et al[14]studied the effects of pretreatment with 60mg/kg body weight Magnesium sulphateintravenous on the catecholamine releaseand cardiovascular response associated withtracheal intubation. Induction of anesthesiaproduced no significant changes in heartrate and blood pressure in either group. Heart rate increased by 30.9 bpm 2 minutesafter intubation in the control group,whereas in the magnesium group, heart rateremained virtually unchanged from post magnesiumvalues. The difference betweengroups at 2 minutes after intubation wassignificant. Our study correlates with this study during first 10 minutes. **DrSantoshkumaret al**[15] compared the efficacy of i.v.esmolol (2mg/kg), diltiazem (0.2mg/kg) and magnesium sulfate(60mg/kg). The baseline mean heart rate of the patient in control group, esmolol group, diltiazem group and magnesium sulfate group (>0.05) which were 94.84 ± 13.62, 92.44 ± 6.40, 89.84 ± 12.42 and 90.76 ± 9.85 in control group, esmolol group, diltiazem group and magnesium sulfate group respectively, which was statistically nonsignificant. . After laryngoscopy and intubation at 1 minute the mean heart rate increased by maximum of 153.40 ± 15.06, 135.08 ± 6.54, 134.56 ± 8.68 and 119.80 ± 9.0 in control group, esmolol group, diltiazem group and magnesium sulphate group respectively (<0.05) which was statistically significant. Findings in esmolol group when compared with their pre-operative values shows significant rise (P<0.05) in heart rate only immediately after intubation and at 1 and 3 minutes after intubation. At 5minutes it comes to less than the pre-operative value (P>0.05). Our study well correlates with this study during first five minutes.

Comparision of mean systolic blood pressure changes among patients:[Table:2]

The mean systolic blood pressure before giving study drugs was considered as baseline in this study. The baseline mean systolic blood pressure of the patient in all the three groups were comparable (>0.05) which were 126.27 ± 11.48 mm of Hg, 125.39 ± 10.33 mm of Hg and 127.51 ± 11.01 mm of Hg in Group N, Group M and Group E respectively, which was statistically nonsignificant. Mean systolic blood pressure just after giving study drugs were 126.92 ± 10.87 mm of Hg, 124.06 ± 10.73 mm of Hg and 124.92 ± 10.76 mm of Hg in Group N, Group M and Group E respectively, which was statistically nonsignificant. After laryngoscopy and intubation at 1 minute the mean systolic blood pressure increased by maximum of 137.54 ± 10.18 mm of Hg, 132.44 ± 10.22 mm of Hg and 127.65 ± 10.18 mm of Hg in Group N, Group M and Group E respectively (<0.05) which was statistically significant.The mean systolic blood pressure declined to reach near baseline value by 10 minute in Group M where as in Group N the mean systolic blood pressure declined to reach level below baseline by 15 minutes. In Group E, mean systolic blood pressure declined to reach level below baseline by 3 minutes. After 10 minutes, mean systolic blood pressure became comparable in all the three groups (>0.05).

Juhi sharma et al[16] showed that when administered before induction of anaesthesia 1.5 mg/Kg of esmolol and magnesium sulfate 40 mg/Kg are effective in suppressing the hemodynamic response to laryngoscopy and endotracheal intubation. Esmolol was more effective to prevent rise in mean SBP as compared to magnesium sulfate. The finding of this study correltes with our syudy as rise in mean SBP after laryngoscopy and endotracheal intubation.**DrSantoshkumaret al**[15] compared the efficacy of IV esmolol (2mg/kg), diltiazem (0.2mg/kg) and magnesium sulphate (60mg/Kg). The baseline mean SBP of the patient in control group, esmolol group, diltiazem group and magnesium sulfate group were comparable. Both esmolol

and magnesium sulphate were effective to prevent rise in mean SBP after laryngoscopy and endotracheal intubation. Here mean SBP is less in magnesium sulphate group compare to esmolol group at various interval. Large dose of magnesium sulphate(60 mg/ Kg) used in this study may be the cause. Our study partially correlates with this study because magnesium sulphate and esmolol attenuate pressor response.**Hussain AM et al**[17]studied the effectiveness of single IV bolus dose of esmolol(2mg/kg) and fentanyl (2 μ g/kg) in attenuating the hemodynamic responses during laryngoscopy and endotracheal intubation. He concluded fentanyl 2μ g/kg given 2 minute prior to laryngoscopy and intubation failed to protect against elevation of both the heart rate and systolic blood pressure, whereas esmolol at 2 mg/kg provided consistent and reliable protection against the increase of heart rate but not arterial blood pressure. In our study Esmolol protect against the rise in mean SBP at all intervals, which correlates with this study.**Feng CK et al**[18]compared lidocaine 2mg/kg, Fentanyl 3μ g/kg and Esmolol 2mg/kg, his study also showed that only Esmolol could reliably offer protection against the increase in both HR and SBP while Fentanyl (3μ g/kg) prevented hypertension but not tachycardia. In our study we concluded that Esmolol provides better attenuation in rise of mean SBP responses to laryngoscopy and endotrachealIntubation, which correlates with our study.**James et al (1989)**[14] observed that intravenous magnesium sulphate inhibit catecholamine release associated with tracheal intubation. Systolic blood pressure increased after intubation from 106.8 ± 3.1 to 121.0 ± 4.4 mm Hg in patients given magnesium and from 106.4 ± 3.12 to 145.1 ± 5.6 mm Hg in the control group (P <0.05) which was statistically significant. Thus, magnesium sulphateprovides attenuation in rise of mean SBP responses to laryngoscopy and endotracheal intubation, which correlates with our study.

Comparision of mean diastolic blood pressure changes among patients:[Table:3]

The mean diastolic blood pressure before giving study drugs was considered as baseline in current study. The baseline mean diastolic blood pressure of the patient in all the three groups were comparable (>0.05) which were 77.70 ± 7.85 mm of Hg, 77.44 ± 8.01 mm of Hg and 77.57 ± 8.75 mm of Hg in Group N, Group M and Group E respectively, which was statistically nonsignificant. Mean diastolic blood pressure just after giving study drugs were 77.94 ± 7.79 mm of Hg, 77.31 ± 8.41 mm of Hg and 75.57 ± 8.16 mm of Hg in Group N, Group M and Group E respectively, which was statistically nonsignificant. After laryngoscopy and intubation at 1 minute the mean diastolic blood pressure increased by maximum of 83.22 ± 7.95 mm of Hg and 81.89 ± 8.35 mm of Hg and in Group N and Group M respectively (<0.05) which was statistically significant. Where as in Group E, it was still lower than baseline value after 1 minue of intubation.The mean diastolic blood pressure declined to reach near baseline value by 10 minute in Group M where as in Group N the mean diastolic blood pressure declined to reach level below baseline by 15 minutes. In Group E, mean diastolic blood pressure declined to reach level below baseline just after giving the study drug. After 5 minutes, mean diastolic blood pressure became comparable in all the three groups (>0.05).

From above data it is quite obvious that rise in mean systolic blood pressure, diastolic blood pressure and mean arterial pressure in quite less in Group E patients i.e. Esmolol group. Esmolol group showed significant fall in systolic and diastolic blood pressure after giving the study drug and also there was significantly less rise in both systolic and diastolic blood pressure soon after at 1 minute after intubation. There was a significant fall (P<O.O5) in systolic and diastolic blood pressure to base line value after 3 minutes intubation. These findings are in agreement with study of Menkhaus et al,[19]Vucevic et al[20] and Kumar S et al.[15] The systolic and diastolic blood pressure did not come to base line value in both group N and group E even after 3 minute of laryngoscopy and intubation. The systolic and diastolic blood pressure in Magnesium Sulphate whencompared to the pre operative values showed that after giving the drug there is insignificant fall. The findings are in similar to that of James MFM et al[14], vanderberg et al[21] and Kumar S et al.[15]

Side effect: No episode of bradycardia, hypotension, nausea, vomiting, hypoxemia, broncospasm or prolongation of neuromuscular blockade was obsereved in any patient.

Limitation: Limitation of this study were following

- Varying degree of resting sympathetic tone of patients can cause interference with the readings.
- ASA grade III and IV patients especially with IHD, MI, HTN were not included in study.
- As our sample size is only of 120 patients, so this study cannot be generalized to all ASA I and II patients and further studies with larger sample size is needed.
- Infusion of study drugs after bolus might have yielded better results than single bolus dose of study drugs. Which require more studies in future.

IV. Conclusion

Our study confirms that IV esmolol (2mg/ Kg) is more effective than IV magnesium sulfate (50 mg/Kg) in controlling the hemodynamic stress response to laryngoscopy and endotracheal intubation.

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