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Original Research Article

A Hospital Based Clinical Assessment of the Effectiveness of Intravenous Esmolol and Intravenous Magnesium Sulphate in Reducing the Physiological Reaction to Laryngoscopy and Endotracheal Intubation

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Abstract

Aim: To compare the effectiveness of intravenous esmolol and intravenous magnesium sulphate in reducing the physiological reaction to laryngoscopy and endotracheal intubation

Materials and Methods: This study was conducted in the Department of Anesthesia, Patna Medical College and Hospital, Patna, Bihar, India for 18 months. The total sample size for the study 120, each group contain 40 patients (Total Population = 120) In patient with Informed written consent, ASA grade I and II posted for elective surgery under general anesthesia, Age group 18 -60 years and Weight 45-65 kg were included in this study. 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.

Results: 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}. 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). After 10 minutes SBP became comparable in all the three groups. Baseline value of mean diastolic blood pressure was 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 minutes in Group N and Group M. Whereas Mean diastolic blood pressures were less at various interval compared to baseline value in Group E.

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.

Keywords: Intravenous esmolol, Intravenous magnesium sulphate, Laryngoscopy Endotracheal intubation

Introduction

The hemodynamic response to laryngoscopy and endotracheal intubation is a well-documented phenomenon characterized by transient but significant increases in heart rate and blood pressure. These responses are primarily mediated by sympathetic stimulation and can lead to adverse cardiovascular events, particularly in patients with pre-existing cardiovascular conditions. Therefore, attenuating this response is crucial for improving patient outcomes during anaesthesia induction. Recent studies have explored various pharmacological agents, including intravenous esmolol and intravenous magnesium sulphate, for their efficacy in mitigating these hemodynamic changes. [1-3] Laryngoscopy and endotracheal intubation are essential procedures in the administration of general anaesthesia but are associated with a marked sympathetic response. This response is triggered by the mechanical stimulation of the larynx and trachea, leading to increased catecholamine release. The resultant tachycardia and hypertension can be detrimental, especially in patients with ischemic heart disease, hypertension, or cerebrovascular disease. [4] Esmolol, an ultra-short-acting beta-1 adrenergic receptor antagonist, has been extensively studied for its ability to blunt the hemodynamic response to intubation. Its rapid onset and short duration of action make it an ideal agent for controlling transient cardiovascular responses during surgery. Studies have shown that esmolol effectively reduces both heart rate and blood pressure during laryngoscopy and intubation without significant adverse effects. [5-8] Magnesium sulphate, a non-competitive NMDA receptor antagonist and calcium channel blocker, has also been investigated for its role in attenuating the hemodynamic response to intubation. Magnesium's vasodilatory and sympatholytic properties contribute to its ability to mitigate cardiovascular responses. Additionally, magnesium has an anti-arrhythmic effect, which can be beneficial during the stress of intubation. [9,10]

Materials and Methods

This study was conducted in the Department of Anesthesia, Patna Medical College and Hospital, Patna, Bihar, India for 18 months. Informed written consent was obtained after informing the participants about the nature, scope and risks related to the study. The total sample size for the study 120, each group contain 40 patients (Total Population = 120)

In patient with Informed written consent, ASA grade I and II posted for elective surgery under general anesthesia, Age group 18 -60 years and Weight 45-65 kg were included in this study.

Patient refusal, Hypertension (controlled and uncontrolled both), Systolic blood pressure less than 90 mm Hg, Heart rate less than 60 beats/ min, Coronary artery disease, Pregnant and lactating women and Duration of laryngoscopy >30 seconds (It is defined as the time from the start of laryngoscopy to inflation of the bronchial cuff) were excluded from the study. 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 anesthesia. Besides a long and thorough clinical examination like history, general examination and systemic examination the investigations a blood hemoglobin, 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 creatinine were be done to exclude any systemic illness and also for ASA grading. All the patients will be pre-medicated with oral tab. Ranitidine 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. On arrival in the operation theatre, routine monitoring in the form of ECG (lead II and V5), respiration, NIBP and SPO2 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.

Methodology

The patients' lungs were pre-oxygenated with 100 % Oxygen for 2 min. Two minutes after preoxygenation (t = 120s), the study drug was administered intravenously over 30 seconds. Anesthesia was then induced (t = 150s) with inj. Pentazocine 0.5 mg per kg body weight and inj. Propofol was given slowly up to 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 appropriately 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 extubating. Anesthesia was maintained with O2, N2O, Sevoflurane and inj. Vecuronium top up. At the end of surgery anesthesia 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. Both the patient and the anesthesiologist who administered the general anesthesia and recorded the data, were blinded to the study group. An independent anesthesiologist prepared and administered the study drugs. Heart rate (per minute), Systolic blood pressure (mm of Hg), Diastolic blood pressure (mm of Hg), Mean arterial pressure (mm of Hg) and SpO2 were observed.

Base line values of heart rate, respiratory rate, SpO2, 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.

All the data analyzed using SPSS version 22.

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. One way 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.

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}. 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). After 10 minutes SBP became comparable in all the three groups. 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 minutes in Group N and Group M. Whereas Mean diastolic blood pressures were less at various interval compared to baseline value in Group E.

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

Time interval	Group name			Fcal.	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

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

Time interval	Group name			Fcal.	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

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

Time interval	Group name			Fcal.	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

Table 4: Comparison of Mean SpO2 changes among the patients

Time interval	Group name			Fcal.	P – value
	Group –N (n=37)	Group – M (n=36)	Group – E (n=37)		
SpO2 B	98 ± 0.53	98.11 ± 0.52	98.03 ± 0.44	0.492	p> 0.05
SpO2AS	99.05 ± 0.85	99.39 ± 0.60	99.19 ± 0.74	1.900	P> 0.05
SpO2 – 1	99.54 ± 0.56	99.47 ± 0.65	99.35 ± 0.67	0.853	p> 0.05
SpO2 – 3	99.22 ± 0.92	99.19 ± 0.89	99.14 ± 0.89	0.081	p> 0.05
SpO2 – 5	99.27 ± 0.77	99.28 ± 0.81	99.51 ± 0.61	1.306	p> 0.05
SpO2 – 10	99.41 ± 0.69	99.22 ± 0.79	99.40 ± 0.76	0.724	p> 0.05
SpO2 – 15	98.95 ± 1.08	99.39 ± 0.80	99.32 ± 0.75	2.662	p> 0.05
SpO2 – 30	99.22 ± 0.71	99.28 ± 0.70	99.24 ± 0.79	0.064	P> 0.05
SpO2 – 45	99.24 ± 0.76	99.42 ± 0.69	99.51 ± 0.65	1.405	P> 0.05
SpO2 - 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

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 anesthesia [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 hemorrhage 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 cardio selective 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 behavior 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. 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 60 mg/kg body weight Magnesium sulphate intravenous on the catecholamine release and cardiovascular response associated with tracheal intubation. Induction of anesthesia produced no significant changes in heart rate and blood pressure in either group. Heart rate increased by 30.9 bpm 2 minutes after intubation in the control group, whereas in the magnesium group, heart rate remained virtually unchanged from post magnesium values. The difference between groups at 2 minutes after intubation was significant. Our study correlates with this study during first 10 minutes. Dr Santosh kumar et 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.

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 anesthesia 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 correlates with our study as rise in mean SBP after laryngoscopy and endotracheal intubation. Dr Santosh Kumar et 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 endotracheal Intubation, 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 sulphate provides attenuation in rise of mean SBP responses to laryngoscopy and endotracheal intubation, which correlates with our study. 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 when compared 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]

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.

References

1. Gupta A, Wakhloo R, Gupta V, et al. A comparative evaluation of intravenous esmolol and lidocaine for attenuation of pressor response to laryngoscopy and intubation in controlled hypertensive patients. Indian J Anaesth. 2021; 65(5):399-404.
2. Miller DR, Martineau RJ, Wynands JE, Hill J. Bolus administration of esmolol for controlling the haemodynamic response to tracheal intubation: the Canadian multicentre trial. Can J Anaesth. 1991;38(7):849-858.
3. Gupta S, Sharma R, Jha AK. Comparative evaluation of intravenous esmolol and lidocaine for attenuation of hemodynamic response to laryngoscopy and intubation: a randomized controlled study. J Clin Anesth. 2021;68:110 092.
4. Koinig H, Wallner T, Marhofer P, Andel H, Horauf K, Mayer N. Magnesium sulfate reduces intra- and postoperative analgesic requirements. Anesth Analg. 1998;87(1):206-210.

5. Kaur S, Singh SP, Passi D, Pandey D. Efficacy of intravenous magnesium sulfate in attenuating hemodynamic stress response to laryngoscopy and tracheal intubation: a randomized controlled trial. Anesth Essays Res. 2020;14(2) :245-251.
6. Singh R, Taneja S, Dahiya D, et al. Effect of intravenous magnesium sulfate on hemodynamic stress response to laryngoscopy and intubation: a prospective randomized controlled trial. J Anaesthesiol Clin Pharmacol. 2022;38 (1):58-63.
7. Sharma S, Dhir RL, Kumar R, Bhattacharya A. Comparative evaluation of esmolol and magnesium sulfate in attenuating hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Diagn Res. 2021;15(4)
8. Harris CE, Murray AM, Anderson JM, Grounds RM, Morgan M. Effects of thiopentanone, etomidate and propofol on the haemodynamic response to tracheal intubation. Anesthesia. 1988; 43:32-6.
9. Black TE, Kay B, Healy TE. Reducing the haemodynamic responses to laryngoscopy and intubation. A comparision of afentanil with fentanyl. Anaesthesia. 1984;39(9):883-7.
10. Slogoff S, Keats AS. Does perioperative myocardial ischemia lead to postoperative myocardial infarction? Aanesthesiology. 1985;62(2): 107-114.
11. Kautto UM. Attenuation of circulatory response to laryngoscopy and intubation by fentanyl. Acta Anaesthesiol Scand 1982;26(3):21 7-21.
12. Panda NB, Bharti N, Prasad S. Minimal effective dose of magnesium sulfate for attenuation of intubation response in hypertensive pateints. J Clin Anesth. 2013; 25:92-7.
13. Kiaee MM, Safari S, Movasegi GR, Mohaghegh Dolatabdi MR, Ghorbalo M, Etemadi M et al. The effects of intravenous magnesium sulfate and lidocaine in haemodynamic response to endotracheal response to endotracheal intubation in elective coronary artery bypass grafting: a randomized controlled clinical trial. Anaesth Pain Med. 2014;4(3):1590-5.
14. James MFM, Beer RE, Esser JD. Intravenous magnesium sulfate inhibits catecholamine release associated with tracheal intubation. Anesth Analg. 1989; 68:772-6.
15. Kumar S, Mishra MN, Mishra LS, Bathla S. Comparative study of the efficacy of i.v. esmolol, diltiazem and magnesium sulfate in attenuating hemodynamic response to laryngoscopy and tracheal intubation. Indian J anaesth. 2003; 47(1):41-4.
16. Sharma J, Sharma V, Rambhushan, Gupta S. Comparative study of magnesium sulfate and esmolol in attenuating the pressor response to endotracheal intubation in controlled hypertensive patients. J Anaesth Clin Pharmacol. 2016; 22(3):255-9.
17. Hussain AM, Sultan ST. Efficacy of fentanyl and esmolol in the prevention of haemodynamic response to laryngoscopy and endotracheal intubation. J Coll Physicians Surg Pak. 2005; 15:454-7.
18. Feng CK, Chan KH, Liu KN, Or CH, Lee TY. A comparision of lidocaine, fentanyl, and esmolol for attenuation of cardiovascular response to laryngoscopy and tracheal intubation. Acta Anaesthesiol Sin. 1996; 34:61-7.
19. Menkhaus PG, Reves JG, Kissin I. Cardiovascular effects of Esmolol in anaesthetized humans. Anaesth Analg. 1985;64:327.
20. Vucevic M, Purdy GM, Ellis FR. Esmolol hydrochloride for management of the cordiovascular stress responses to laryngoscopy and tracheal intubation. Br. J. Anaesth. 1992;68(5): 529-30.
21. Vucevic M, Purdy GM, Ellis FR. Esmolol hydrochloride for management of the cordiovascular stress responses to laryngoscopy and tracheal intubation. Br. J. Anaesth. 1992;68(5): 529-30.
22. Vanderberg AA, Savva D, Honjol NM. Attenuation of the hemodynamic responses to noxious stimuli in patients undergoing cataract surgery. A comparison of magnesium sulphate, esmolol, lignocaine, Nitroglycerin and placebo Given IV with induction of Anaesthesia. Eur J Anaesthesiol. 1997;14(2):134-147.