Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 06, 2024

Original research article

A study to measure and compare the effectiveness of intravenous magnesium sulphate and intravenous esmolol in attenuation of blood pressure response to laryngoscopy and intubation

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Abstract

Attenuation of intubation response has been practiced by various methods and using drugs, topically or systemically. This study was undertaken to compare the effectiveness of magnesium sulphate and esmolol for attenuation of blood pressure response to laryngoscopy and intubation. Following ethical committee approval, patients fulfilling the essential criteria were selected. Patients were randomized and either received 0.5mg/kg esmolol or 30mg/kg magnesium sulphate intravenously and vital parameters were recorded. SBP and DBP in esmolol group showed statistically significant decrease from 1st to 10th minute after intubation from baseline. MAP in esmolol group showed statistically significant increase from baseline at intubation and decrease from 2nd to 10th minute after intubation from baseline. SBP in magnesium sulphate group showed statistically significant decrease from 2nd to 10th minute after intubation from baseline. DBP in magnesium sulphate group showed statistically significant increase from baseline at intubation and statistically significant decrease from 3rd to 10th minute post intubation. MAP in magnesium sulphate group showed statistically significant increase from baseline at intubation and statistically significant decrease from 2nd to 10th minute after intubation from baseline. However, changes in BP were clinically insignificant and both esmolol and magnesium sulphate effectively attenuated BP response in our study.

Keywords: Intravenous magnesium sulphate, intravenous esmolol, blood pressure

Introduction

Laryngoscopy and endotracheal intubation following induction of general anaesthesia is commonly associated with hemodynamic changes due to reflex sympathetic discharge caused by epipharyngeal and laryngopharyngeal stimulation [1]. The more common response to this airway manipulation is hypertension and tachycardia which are mediated by cardioaccelerator nerves and sympathetic chain ganglion [2]. This increased sympatho-adrenal activity may also result in arrhythmias apart from hypertension and tachycardia [3]. The increase in blood pressure and heart rate are usually transitory, variable and unpredictable and are probably of no consequence in healthy individuals [4]. But either or both may be hazardous to those with history of diabetes, pre- eclampsia, myocardial insufficiency or cerebrovascular diseases.

Attenuation of intubation response has been practiced by various methods including deepening the plane of anaesthesia, using advanced airway devices and using drugs, like adrenergic blockers, vasodilators, calcium channel blockers and alpha-2 agonists, topically or systemically.

Magnesium, being a physiological antagonist to calcium, can modify the responses mediated by calcium, blocking the release of catecholamine stores and decreasing the response to adrenergic stimulation [5].

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Esmolol, an ultra-short acting selective beta-1 blocker with rapid onset of action, short elimination half-life and decreased incidence of adverse effects is advantageous compared with longer acting beta blockers [6].

Methodology

Source of Data: Data was collected from patients scheduled for elective surgeries under general anaesthesia with endotracheal intubation in the Department of Anaesthesiology.

Study Design: A prospective randomized study.

Inclusion Criteria

- Patient willing to give informed consent.
- American Society of Anaesthesiologists (ASA) class I patients.
- Aged between 18-60 years posted for elective surgeries under general anaesthesia with endotracheal intubation.

Exclusion Criteria

- Unwilling to participate in the study.
- Allergy to the study drugs.
- Anticipated difficult airway.
- Emergency surgical procedures.
- Patients requiring rapid sequence induction and intubation.
- Baseline heart rate less than 60bpm, baseline systolic blood pressure less than 100mmHg.
- PR interval > 0.24sec, 2nd or 3rd degree heart block on ECG.
- Sick Sinus Syndrome.

Method of study and collection of data

Following ethical committee approval, patients fulfilling the essential criteria were selected. Detailed pre-anaesthetic evaluation was done. An informed and written consent was taken from all patients. Demographic (age, gender), morphologic (weight, height) and vital parameters were recorded. The patients were randomly divided into 2 groups of 36 each using a computer-generated randomization table. The patient and the anaesthesiologist were blinded to the drug to be used. An observer who was not involved further in the study administered the study drugs.

Group E: Esmolol group (n=36) received 100mL plain NS over 10 minutes before induction and 0.5mg/kg esmolol diluted to 10mL given IV over 60seconds after induction.

Group M: Magnesium sulphate (MgSO4) group (n=36) received 30mg/kg magnesium sulphate in 100mL NS given IV over 10minutes before induction and 10mL plain NS given IV over 60seconds after induction.

The same anaesthesiologist did laryngoscopy and intubation for both the study groups and vital parameters were recorded.

Results

Table 1: Comparison of SBP between study groups

SBP (mmHg)		Group E		Group M		p value
		Mean	SD	Mean	SD	
	Preop	123.4	8.5	122.8	10.1	0.782
Intubation	0 Min	125.7	14.0	128.1	18.3	0.545
	1 Min	118.5	14.5	119.6	16.3	0.760
	2 Min	115.0	13.7	116.0	14.4	0.758
	3 Min	112.9	13.6	113.3	13.0	0.880
	4 Min	110.8	13.3	110.8	13.2	1.000
	5 Min	110.2	13.1	109.0	14.3	0.726
	6 Min	108.5	12.4	108.6	13.5	0.986
	7 Min	108.6	12.0	110.6	12.9	0.503
	8 Min	110.1	13.4	111.9	12.4	0.555
	9 Min	111.4	12.4	111.4	12.6	0.999
	10 Min	111.3	12.2	111.6	13.3	0.912

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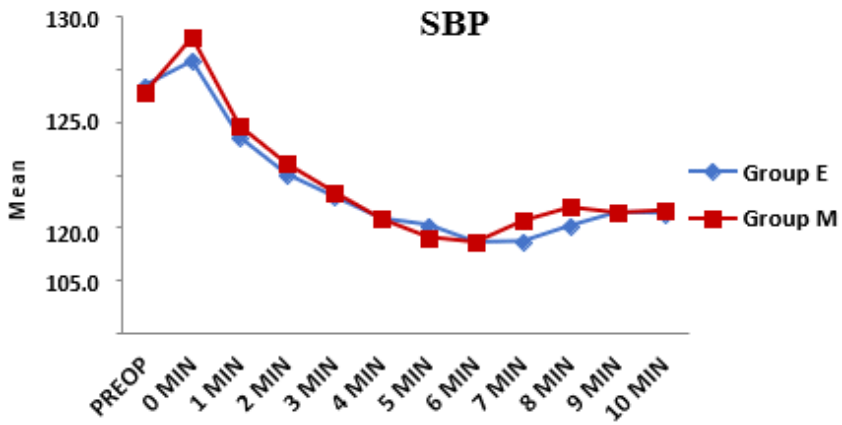


Note: 0 MIN-at intubation.

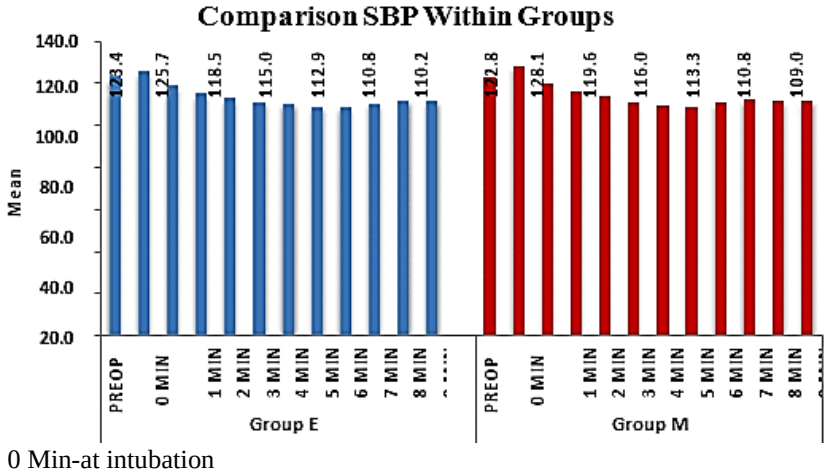
Fig 1: Comparison of SBP between study groups

SBP changes between the two groups were statistically insignificant at all points. Thus, mean SBP was attenuated in both groups comparably.

Table 2: Comparison of SBP within study groups

SBP (mmHg)		Group E		Intra group p	Group M		Intra group p
		Mean	SD	value from basal	Mean	SD	value from basal
	Preop	123.4	8.5	-	122.8	10.1	-
Intubation	0 Min	125.7	14.0	0.241	128.1	18.3	0.064
	1 Min	118.5	14.5	0.036*	119.6	16.3	0.197
	2 Min	115.0	13.7	0.001*	116.0	14.4	0.006*
	3 Min	112.9	13.6	<0.001*	113.3	13.0	<0.001*
	4 Min	110.8	13.3	<0.001*	110.8	13.2	<0.001*
	5 Min	110.2	13.1	<0.001*	109.0	14.3	<0.001*
	6 Min	108.5	12.4	<0.001*	108.6	13.5	<0.001*
	7 Min	108.6	12.0	<0.001*	110.6	12.9	<0.001*
	8 Min	110.1	13.4	<0.001*	111.9	12.4	<0.001*
	9 Min	111.4	12.4	<0.001*	111.4	12.6	<0.001*
	10 Min	111.3	12.2	<0.001*	111.6	13.3	<0.001*

Note: p value* significant at 5% level of significance (p<0.05)



Note: 0 Min-at intubation

Fig 2: Comparison of SBP within study groups

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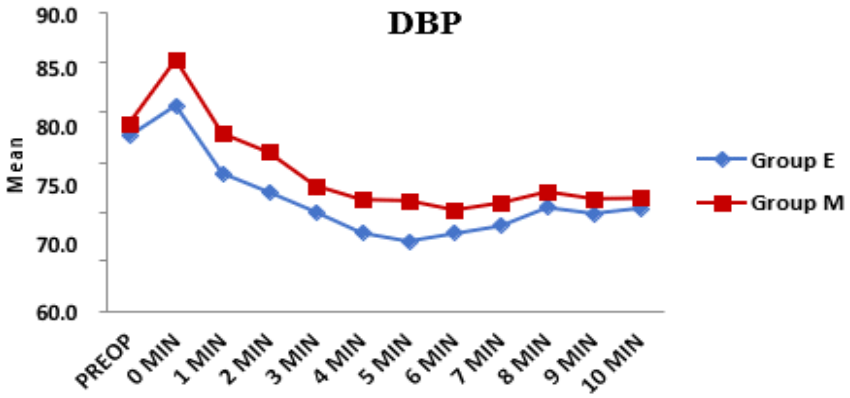
SBP in esmolol group showed statistically significant decrease from 1st to 10th minute after intubation from baseline. SBP in magnesium sulphate group showed statistically significant decrease from 2nd to 10th minute after intubation from baseline. However, changes in SBP in both the groups were clinically insignificant.

Table 3: Comparison of DBP between study groups

DBP (mmHg)		Group E		Group M		p value
		Mean	SD	Mean	SD	
	Preop	77.6	7.7	78.9	8.6	0.518
Intubation	0 Min	80.6	13.3	85.3	15.2	0.173
	1 Min	73.8	12.5	77.8	15.0	0.223
	2 Min	72.0	12.7	75.9	11.8	0.174
	3 Min	70.0	12.1	72.6	10.0	0.326
	4 Min	67.9	10.6	71.2	10.2	0.182
	5 Min	67.0	10.8	71.1	10.9	0.117
	6 Min	67.8	9.7	70.1	10.0	0.320
	7 Min	68.6	10.0	70.9	10.2	0.335
	8 Min	70.4	10.2	72.0	10.3	0.513
	9 Min	69.8	9.8	71.3	9.2	0.520
	10 Min	70.3	10.8	71.3	12.0	0.711



Note: 0 MIN-at intubation.

Fig 3: Comparison of DBP between study groups

DBP changes between the two groups were statistically insignificant at all points. Thus, attenuation of mean DBP was comparable between the groups.

Table 4: Comparison of DBP within study groups

DBP (mmHg)		Group E		Intra group p	Group M		Intra group p
		Mean	SD	value from basal	Mean	SD	value from basal
	Preop	77.6	7.7	-	78.9	8.6	-
Intubation	0 Min	80.6	13.3	0.077	85.3	15.2	0.01*
	1 Min	73.8	12.5	0.039*	77.8	15.0	0.673
	2 Min	72.0	12.7	0.006*	75.9	11.8	0.134
	3 Min	70.0	12.1	<0.001*	72.6	10.0	0.001*
	4 Min	67.9	10.6	<0.001*	71.2	10.2	<0.001*
	5 Min	67.0	10.8	<0.001*	71.1	10.9	<0.001*
	6 Min	67.8	9.7	<0.001*	70.1	10.0	<0.001*
	7 Min	68.6	10.0	<0.001*	70.9	10.2	<0.001*
	8 Min	70.4	10.2	<0.001*	72.0	10.3	0.001*
	9 Min	69.8	9.8	<0.001*	71.3	9.2	<0.001*
	10 Min	70.3	10.8	<0.001*	71.3	12.0	<0.001*

Note: p value* significant at 5% level of significance (p<0.05)

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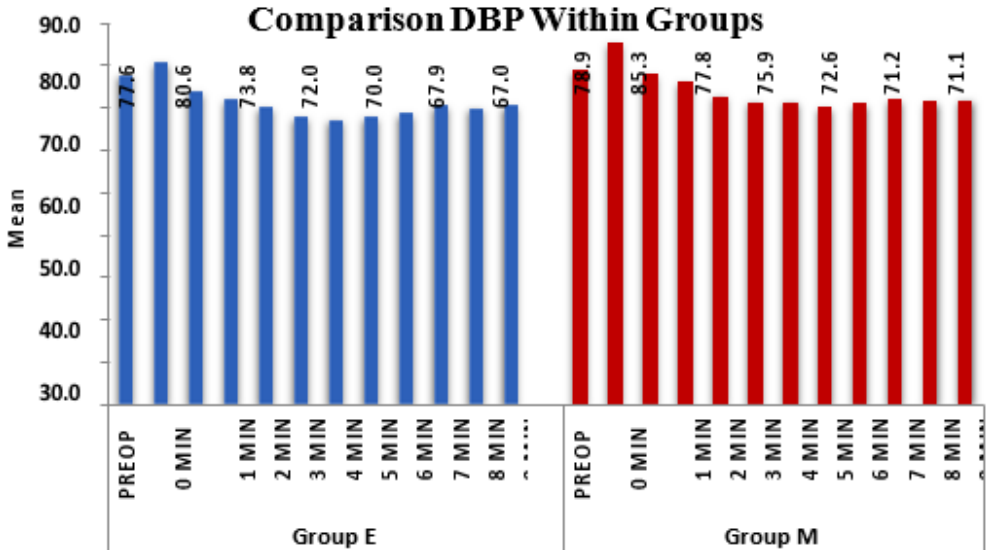

Note: 0 Min-at intubation

Fig 4: Comparison of DBP within study groups

DBP in esmolol group showed statistically significant decrease from 1st to 10th minute after intubation from baseline. DBP in magnesium sulphate group showed statistically significant increase from baseline at intubation which was not clinically significant (only 10% rise) and statistically significant decrease from 3rd to 10th minute post intubation. Thus, both the drugs were comparable in attenuating DBP response to intubation.

Table 5: Comparison of MAP between study groups

MAP (mmHg)		Group E		Group M		p value
		Mean	SD	Mean	SD	
	Preop	91.8	8.6	93.7	8.0	0.344
Intubation	0 Min	95.5	12.6	99.7	15.3	0.209
	1 Min	88.2	13.2	92.9	15.6	0.166
	2 Min	85.6	12.2	89.0	12.2	0.230
	3 Min	83.9	11.8	86.7	10.5	0.290
	4 Min	82.0	11.4	84.9	10.5	0.262
	5 Min	81.7	10.6	84.6	11.3	0.253
	6 Min	81.3	10.9	83.4	10.4	0.396
	7 Min	82.0	10.1	85.0	10.0	0.215
	8 Min	83.1	10.5	85.6	9.7	0.300
	9 Min	83.1	10.4	84.9	9.5	0.438
	10 Min	83.5	10.4	84.2	12.2	0.780

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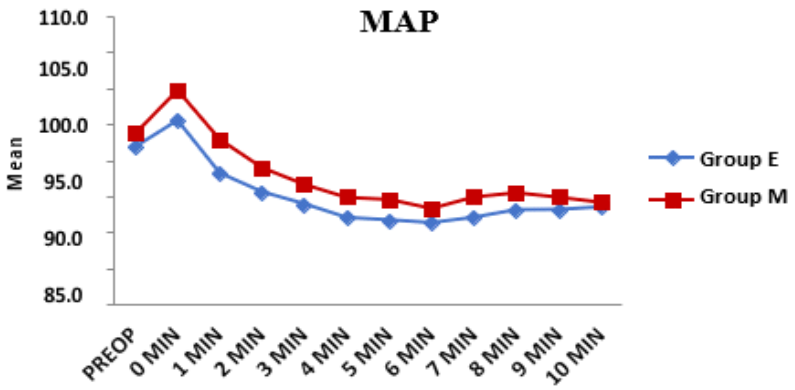


Note: 0 Min-at intubation.

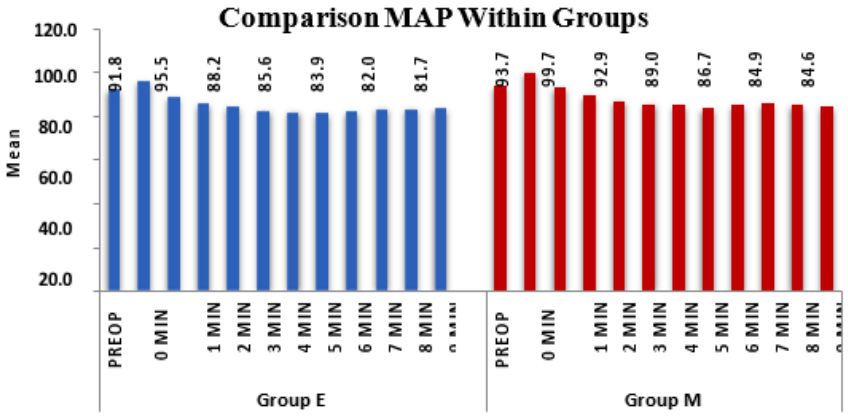
Fig 5: Comparison of MAP between study groups

MAP changes between the two groups were statistically insignificant at all points. Thus, attenuation of mean MAP was comparable between the groups.

Table 6: Comparison of MAP within study groups

MAP (mmHg)		Group E		Intra group p	Group M		Intra group p
		Mean	SD	value from basal	Mean	SD	value from basal
	Preop	91.8	8.6	-	93.7	8.0	-
Intubation	0 Min	95.5	12.6	0.029*	99.7	15.3	0.015*
	1 Min	88.2	13.2	0.079	92.9	15.6	0.749
	2 Min	85.6	12.2	0.001*	89.0	12.2	0.026*
	3 Min	83.9	11.8	<0.001*	86.7	10.5	0.001*
	4 Min	82.0	11.4	<0.001*	84.9	10.5	<0.001*
	5 Min	81.7	10.6	<0.001*	84.6	11.3	<0.001*
	6 Min	81.3	10.9	<0.001*	83.4	10.4	<0.001*
	7 Min	82.0	10.1	<0.001*	85.0	10.0	<0.001*
	8 Min	83.1	10.5	<0.001*	85.6	9.7	<0.001*
	9 Min	83.1	10.4	<0.001*	84.9	9.5	<0.001*
	10 Min	83.5	10.4	<0.001*	84.2	12.2	<0.001*

Note: p value* significant at 5% level of significance (p<0.05)



Note: 0 Min-at intubation.

Fig 6: Comparison of MAP within study groups

MAP in esmolol group showed statistically significant increase from baseline at intubation and decrease from 2nd to 10th minute after intubation from baseline. MAP in magnesium sulphate group showed statistically

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significant increase from baseline at intubation and statistically significant decrease from 2nd to 10th minute after intubation from baseline. However, changes in MAP in both the groups were clinically insignificant.
No significant side effects were observed during the study.

Discussion

SBP and DBP in esmolol group showed statistically significant decrease from 1st to 10th minute after intubation from baseline. MAP in esmolol group showed statistically significant increase from baseline at intubation and decrease from 2nd to 10th minute after intubation from baseline. However, changes in BP were clinically insignificant and esmolol effectively attenuated BP response in our study.

In a study conducted by Sharma *et al*. [7], the group receiving esmolol 1.5mg/kg after induction showed a significant fall in SBP and DBP after intubation till 5 minutes, both of which were clinically insignificant. Norhuzaimah *et al*. [8] in their study observed that patients receiving esmolol 1mg/kg before induction showed a decrease in SBP and DBP after intubation which persisted up to 10 minutes which was comparable to our study. Bensky *et al*. [9] in their study observed that esmolol 0.4mg/kg administered before induction of anaesthesia showed a statistically significant and a clinically insignificant increase in MAP 30 seconds after intubation followed by a return to baseline value by 2 minutes after intubation. In a study by Selvaraj *et al*. [10], when esmolol 0.5mg/kg was administered as a bolus 2 minutes before intubation, there was a statistically significant fall in SBP and MAP and a statistically insignificant fall in DBP from intubation up to 5 minutes after intubation, which were clinically insignificant. Aasim *et al*. [11] observed that when esmolol 1.5mg/kg was administered after induction, there was a statistically significant rise in MAP at intubation followed by a return to baseline values. The findings of the above studies are comparable with our study.

In our study, SBP in magnesium sulphate group showed statistically significant decrease from 2nd to 10th minute after intubation from baseline. DBP in magnesium sulphate group showed statistically significant increase from baseline at intubation and statistically significant decrease from 3rd to 10th minute post intubation. MAP in magnesium sulphate group showed statistically significant increase from baseline at intubation and statistically significant decrease from 2nd to 10th minute after intubation from baseline. BP changes observed were not clinically significant. Four patients in our study, had hypotension (less than 20% from baseline) which did not require any intervention and no patients had hypertension. Thus, magnesium sulphate was effective in the attenuation of BP response in our study.

In a study by Chaithanya *et al*. [12], patients receiving 30mg/kg of magnesium sulphate 10 minutes before induction showed that there were no statically significant changes in SBP, but there was a statistically significant rise in DBP at intubation followed by a return to baseline values. However, none of these changes were clinically significant. Panda *et al*. [13] in their study observed that patients receiving magnesium sulphate 30mg/kg before induction showed that SBP, DBP and MAP showed no statistically or clinically significant increase after intubation and also this group had no hypotensive episodes. In another study conducted by Mendonca *et al*. [14], where they administered magnesium sulphate 30mg/kg before induction, it was observed that there was a rise in SBP and DBP nearing the baseline values at intubation followed by a decrease which was clinically insignificant. Seven patients had hypotension and 3 patients had hypertension in their study, none of which required intervention.

Conclusion

Both esmolol 0.5mg/kg given IV over 60 seconds after induction of anaesthesia and magnesium sulphate 30mg/kg given as an IV infusion over 10 minutes prior to induction of anaesthesia effectively attenuated the pressor response to laryngoscopy and intubation.

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