

A Comparative Study of 2% Lignocaine vs 50% Magnesium Sulphate for Attenuation of Stress Responses to Laryngoscopy and Endotracheal Intubation

Sachin Padmawar¹, Manish Patil²

ABSTRACT

Introduction: Laryngoscopy and endotracheal intubation are essential parts of induction of general anaesthesia. Present study was undertaken to evaluate and compare the efficacy of lignocaine and magnesium sulphate for attenuating the stress responses to laryngoscopy and endotracheal intubation.

Material and Methods: The study enrolling 100 patients of either sex, age between 18-50 years, ASA grade I and II were randomly allocated in two equal groups to receive either 2% lignocaine (1.5 mg/kg) or 50% magnesium sulphate (40 mg/kg) via intravenous route. Anesthesia was induced with intravenous thiopentone sodium 5 mg/kg followed by injection succinylcholine 1.5 mg/kg. The smooth gentle laryngoscopy and tracheal intubation was performed within 30 second. The haemodynamic parameters like HR, SBP, DBP, MAP and rate pressure product at various time intervals up to 5 minutes post-intubation were recorded and efficacy of both drugs to reduce haemodynamic responses was compared with Z test.

Results: In lignocaine group, there was significant rise in heart rate, blood pressure and rate pressure product in post intubation period which does not come to baseline value at 5 min after intubation. Rate pressure product crossed the angina limit of 12000 in more than 50% patients. In MgSO₄ group, heart rate, blood pressure and rate pressure product were increase significantly only at 1 min after intubation and which came to baseline up to 5 min after intubation. Rate pressure product did not cross the angina limit of 12000 significantly. There were no any complications observed in our study.

Conclusion: We concluded that magnesium sulphate is better alternative to lignocaine for attenuation of stress responses of laryngoscopy and intubation.

Keywords: Lignocaine, Magnesium Sulphate, Stress responses, Laryngoscopy and endotracheal intubation.

INTRODUCTION

It is well recognized that the occurrence of haemodynamic responses in the form of rise in heart rate and BP during and after laryngoscopy and endotracheal intubation mediated by sympathetic response, is a well-known treat. Laryngoscopy and tracheal intubation stimulate somatic and visceral nociceptive afferents of the epiglottis, hypopharynx, peritracheal area, and vocal cords, which¹ leads to various cardiovascular changes like increase in heart rate, blood pressure, intracranial pressure, intra-ocular pressure, dysrhythmias, cardiac asystole and even sudden death.²⁻⁵ These responses may prove to be detrimental especially in patients with ischemic heart disease, cerebral aneurysms, cerebrovascular disease, hypertension, old age and diabetes mellitus. Hence there is a constant search for an ideal drug to attenuate haemodynamic response. In 1951, King et al⁶ highlighted this and since then, various methods including

nitroglycerine,⁷ fentanyl,⁸ esmolol,⁸ calcium channel blockers,⁹ magnesium,¹⁰ lidocaine¹¹ and gabapentin¹² have been tried to attenuate ill desired haemodynamic response. In our institute, we are routinely using 2% lignocaine to attenuate the stress responses of laryngoscopy and endotracheal intubation.

Lignocaine is an aminoethylamide and prototype of amide local anesthetic group.¹³ It is the most widely used local anesthetic drug having membrane stabilizing action, so it is commonly used as an anti-arrhythmic drug in patients with ventricular ectopics. In 1961, Bromage showed that its intravenous (IV) use blunted pressure response to intubation.¹⁴ An IV dose of lignocaine 1.5mg/kg has been proved to attenuate stress responses during laryngoscopy and intubation when given prior to induction.

Magnesium is the fourth most abundant cation in the body and the second most abundant intracellular cation. It activates many of the enzyme system. Magnesium sulfate inhibits the release of catecholamines from the adrenal medulla and adrenergic nerve endings and is effective in attenuating the blood pressure (BP) response to tracheal intubation.¹⁵ Different doses of the drug have been used by different authors to attenuate this response to endotracheal intubation.¹⁶⁻¹⁸ Puri et al¹⁸ showed that MgSO₄ 50 mg/kg administered before laryngoscopy could attenuated the pressor response to tracheal intubation better than lidocaine. So here we have compared the effect of lignocaine 2% and magnesium sulphate 50% in attenuating the pressor response of laryngoscopy and intubation.

Material and Method

After obtaining institutional ethical committee approval and a written informed consent, this prospective randomized study was carried out on 100 ASA grade I and II patients of both sex, aged between 18-50 years, scheduled for either elective or emergency surgery under general anesthesia. Patients with neuromuscular diseases, electrolyte imbalance, preeclampsia eclampsia patients who were already receiving MgSO₄, patients with anticipated difficult intubation, heart disease like ischemic heart disease, arrhythmias, cerebrovascular disease, patient allergic to study drug, patients on whom required duration for laryngoscopy was more than 30 second and required multiple attempts were excluded from the study. Hundred selected

¹Assistant Professor, ²Assistant Professor, Department Of Anaesthesiology, B.Y.L. Nair Ch Hospital, India

Corresponding author: Dr. Sachin Padmawar, House No. 68, Priti Sadan Behind Sunita Building, Anand Nagar, Yavatmal, Maharashtra. 445001, India

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patients were randomly allocated into two groups of 50 patients in each group. Group I (Lignocaine group) received injection 2% lignocaine at a dose of 1.5 mg/kg intravenously and group II (MgSO₄) received injection 50% magnesium sulphate in a dose of 40 mg/kg intravenously. A detailed pre-anaesthetic evaluation including history and a thorough general and systemic examination and all relevant investigations were done for all the patients.

On operation table, standard monitoring devices - ECG, SpO₂, non-invasive blood pressure were applied to the patient and baseline parameters like pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and rate pressure product were recorded. Intravenous access was established and preloading was done with ringers lactate solution. All patients were pre-medicated with injection midazolam 0.03 mg/kg, pentazocine 0.3 mg/kg, ranitidine 1 mg/kg and metoclopramide 0.2 mg/kg 10 minutes prior to induction. Also patients were pre-oxygenated with 100% oxygen for 3 minutes. Patients in group I received 1.5 mg/kg of lignocaine intravenously while patients in group II received 40 mg/kg of 50% magnesium sulphate before induction of anesthesia. Anesthesia was induced with thiopentone sodium (5-7 mg/kg) till loss of eye lash reflex followed by injection succinylcholine (1.5 mg/kg) to facilitate endotracheal intubation. Then patients were intubated with appropriate sized cuffed endotracheal tube and received oxygen: nitrous (50:50). All intubations were smooth and gentle and were done within 30 seconds. Anaesthesia was maintained with 0.4-0.6% halothane. Muscle relaxation was maintained with injection vecuronium bromide (0.008 mg/kg). Any surgical interventions like catheterization, nasogastric tube insertion, incision were requested to do 5 minutes after intubation to avoid disturbances in data recording. At the end of surgery patients received neostigmine 0.05 mg/kg and glycopyrrolate 0.008 mg/kg for reversal of the neuromuscular blockade. All patients were monitored throughout the surgery and observations were made with respective to HR, SBP, DBP, MAP and RPP at various intervals- before premedication, 10 min after premedication, 30 sec after administration of study

drugs, 1, 3, 5 min after intubation. Any adverse effect due to either of drugs i.e. lignocaine and magnesium sulphate were noted. After extubation patients were shifted to the recovery room.

STATISTICAL ANALYSIS

Mean and standard deviation for all values were calculated and compared within the group with baseline values as well as inter group comparison was done. Efficacy of both the drugs to reduce haemodynamic response was compared by Z test.

RESULTS

Hundred patients who underwent elective or emergency surgery under general anesthesia were selected for the study; the demographic profiles of the patients in both the groups were comparable with regards to age, weight and sex and difference was not statistically significant (Table-1).

Table-2 show the comparison of two groups in respect to all observed parameters (mean ± std.dev) at different time intervals. In lignocaine group, there was significant rise in HR in post intubation period which does not come to baseline value at 5 min after intubation. Systolic blood pressure also elevated in post intubation period significantly from baseline and also not came to baseline at 5 minutes after intubation. Similar trends were seen with respect to parameters DBP and MAP, RPP also rise after intubation and it crossed the angina limit of 12000 in more than 50% patients. While in MgSO₄ group, there was initial increase in HR after drug administration which elevated after intubation at 1 minute but it came to baseline up to 5 minutes after intubation. SBP also rises at 1 min interval post intubation but it also came to baseline up to 5 min after intubation. Similar trends were seen with respect to parameters DBP and MAP, RPP increases at 1 min post intubation but did not crossed the angina limit of 12000 significantly.

There were no complications like nausea, vomiting, hypotension and arrhythmias observed in our study.

DISCUSSION

Hypertension and tachycardia have been reported since 1950 during intubation under light anaesthesia.^{2,3} Increase in blood pressure and heart rate occurs most commonly from reflex sympathetic discharge in response to laryngotracheal stimulation, which in turn leads to increased plasma norepinephrine concentration.¹⁹ These changes may be fatal in patients with heart disease and high blood pressure.

Parameters	Group I	Group II	P value
Age (years)	29.4	30.9	>0.05
Weight (Kg)	51.5	51.1	>0.05
Sex (Male:Female)	12:38	13:37	

Table-1: Demographics profile of the patients

Parameters	Groups	Before premedication	After premedication	After the drug	1 min after intubation	3 min after intubation	5 min after intubation
Heart Rate	Group I	85.6±6.8	79.8±7.1	81.1±8.1	108±7.6	103±7.9	95.5±7.4
	Group II	86.6±5.7	80±5.45	87.7±5.7	96.8±6.6	90±6.5	86.6±6.4
Systolic blood pressure	Group I	115±6.53	110±5.75	109±5.9	138±8.3	131±6.51	124±6.04
	Group II	117±8.73	112±8.34	110±8.7	124±8.8	115±8.6	115±8.6
Diastolic blood pressure	Group I	77.64±4.4	74.6±4.4	74.3±4.4	91.8±6.6	86.4±5.5	82.2±5.8
	Group II	78.28±5.5	74.9±6.2	73±5.6	84.5±6.2	78.7±6.1	78.7±6.1
Mean arterial pressure	Group I	90.2±3.37	86.4±3.9	86±3.84	107±6.21	101±4.64	96.09±4.91
	Group II	91.3±5.78	87.2±6.15	85.4±5.7	97.7±6.06	90.9±6.06	90.95±6.1
Rate pressure product	Group I	9883.6±1236	8786.8±1094	8880.7±1170	14959.9±1612	13447.8±1465	11853.1±1306
	Group II	10159±926	8931.4±834	9650.1±938	12021±136	10350±114	10001±1083

Table-2: Comparison of two groups in respect to all observed parameters (mean ± std. dev) at various points

During recovery from anaesthesia hypertension may occur provoking post operative complications like bleeding, increased intracranial and intraocular pressure. Therefore effective attenuation of the sympathoadrenal stress response to laryngoscopy and endotracheal intubation is an important goal, especially in high risk patients. Many attempts have been made to attenuate the pressure response e.g. deep anaesthesia, topical anaesthesia, use of ganglionic blockers, beta blockers and antihypertensive agents like phentolamine. Sodium nitroprusside and nitroglycerine, calcium channel blockers like sublingual and nifedepine, verapamil, diltiazem, magnesium sulphate, opioids, vasodilators etc. are effective but requires continuous intra arterial blood pressure monitoring.

Various studies have reviewed the effect of lignocaine to blunt the sympathoadrenal pressure response. Lev and Rosen²⁰ in their study using prophylactic lignocaine in a dose of 1.5 mg/kg intravenously prior to intubation produced optimal attenuation sympathoadrenal pressure response to laryngoscopy and intubation without any overt harmful effects. R. K. stoelting²¹ confirmed the protective use of IV lignocaine 1.5 mg/kg given 90 sec prior laryngoscopy but also reported topical anesthesia with viscous lignocaine would be more specific.

The methods and drugs used for attenuate stress responses of laryngoscopy and intubation have disadvantages related to either cardiovascular or respiratory depression; none directly inhibits the release of catecholamines. Among the therapeutic regimens useful in suppressing the hormonal stress response to tracheal intubation, magnesium may be a forerunner as it not only has direct vasodilator properties²², it also significantly suppresses the release of catecholamines.¹⁵ Many studies have showed that MgSO₄ can attenuate cardiovascular responses to endotracheal intubation.^{15,18,23,24} Allen RW. et al¹⁶ showed its effectiveness in hypertensive proteinuric pregnant patients undergoing caesarean section. Also Puri GD. et al¹⁸ showed magnesium sulphate attenuates pressure response in patients with coronary artery disease.

The present study was done in two groups, to evaluate and compare the effect of lignocaine and magnesium sulphate. In group I patients received 1.5 mg/kg lignocaine and in group II patients received magnesium sulphate 40 mg/kg. Variability in heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, rate pressure product and other complications was compared at different time intervals.

Heart rate

Heart rate in both groups after premedication show insignificant differences. In lignocaine group HR decreased after premedication, but it was not increased after lignocaine administration. However average rise in HR at 1 min after intubation was 22.58 beats. Majority (70%) of the patients show rise in HR in the range of 21-30 beats/min from baseline. this raised in HR did not come to baseline even at 5 minutes after intubation. While in magnesium sulphate group HR decreased after premedication, and it was increased after magnesium sulphate administration but rise in HR was insignificant. Average rise in HR at 1 min after intubation was 10.2 beats. Majority (68%) of the patients show rise in HR in the range of 0-10 beats/min from baseline and HR normalizes up to 5 min after intubation. On intergroup comparison between lignocaine and MgSO₄ group, it was noted that though MgSO₄,

does not offer complete protection against HR, the difference between both the groups, in attenuating HR was significant at 1,3,5 minutes interval but HR came to base line towards 5 minutes after intubation in MgSO₄ group but that was not the case with lignocaine group. These findings correlate with other studies.^{15,16,18,25}

Systolic Blood Pressure

Systolic blood pressure in both the groups after premedication and after study drug show insignificant differences. In lignocaine group SBP increase after intubation. Average rise was 22.84 mm Hg at 1 min interval. Majority (44%) of the patients show rise in the range of 21-30 mm Hg from baseline. This raised SBP did not come to baseline and remains significantly raised even 5 minutes after intubation. Similar findings were noted in 1990, by C.D. Miller and S.J. Warren.²⁵ In MgSO₄ group SBP increases significantly only at 1 min after intubation. Average rise was 6.64 mm Hg at 1 min interval and majority (90%) of the patients show rise in the range of 0-10 mm Hg from baseline. This rise in SBP came to baseline value towards 5 minutes and even 50% of the patients show decline in it from baseline. Similar findings were noted in 1989 by James FM.¹⁵ On intergroup comparison, it was noted that SBP increase significantly in lignocaine group as compared with MgSO₄ group at 1,3,5 minutes after intubation. SBP rises in both the groups but it came towards baseline at 3 minutes after intubation in MgSO₄ group but that was not case with lignocaine group, this finding correlates with study of Allen et al.¹⁶

Diastolic Blood Pressure

Diastolic blood pressure in both the groups before and after premedication and after drug show insignificant differences. In lignocaine group DBP increases after intubation and average rise was 14.12 mm Hg at 1 min interval. The majority (56%) of the patients show rise in the range of 11-20 mm Hg from baseline. This raised in DBP does not come to baseline and remains significantly raised even 5 minutes after intubation. While in MgSO₄ group DBP increases significantly only at 1 min after intubation and average rise was 6.24 mmHg at 1 min interval. The majority (92%) of the patients show rise in the range of 0-10 mm Hg from baseline. This raised in DBP came to baseline value towards 3 minute and even 30% of the patients show decline in it from baseline. On intergroup comparison, it was noted that DBP increases significantly in lignocaine group as compared with MgSO₄ group at 1,3,5 minutes after intubation. DBP rises in both the groups but DBP came towards baseline at 3 minutes after intubation in MgSO₄ group but that was not the case with lignocaine group. Similar findings were noted in different studies.^{15,16,18,25}

Mean Arterial Pressure

Mean arterial Pressure in both the groups before and after premedication and after drug show insignificant differences in lignocaine group MAP increases after intubation. Average rise was 17 mm Hg at 1 min interval. Majority (56%) of the patients show rise in the range of 11-20 mm Hg from baseline, this raised in MAP does not come to baseline and remains significantly raised even 5 minutes after intubation. In MgSO₄ group MAP increases significantly only at 1 min after intubation. Average rise was 6.4 mm Hg at 1 min interval. Majority (88%) of the patients show rise in the range of 0-10 mmHg from baseline,

this raised in MAP came to baseline value towards 3 minute and even 36% of the patients show decline in it from baseline. On intergroup comparison, it was noted that MAP increases significantly in lignocaine group as compared with MgSO₄ group at 1,3,5 minutes after intubation. MAP rises in both the groups but MAP came towards baseline at 3 minutes after intubation in MgSO₄ group but that was not the case with lignocaine group. These results were compared with various studies.^{16,18,25}

Rate Pressure Product

Rate pressure product in both the groups before and after premedication was show insignificant differences. In lignocaine group RPP increases after intubation and average rise was 5076.28 at 1 min after intubation. The maximum number of patients (44%) show rise in the range of 5001-6000 from baseline. This rise crosses angina limit of heart i.e. rate pressure product crosses level of 12000 at 1 and 3 minutes after intubation and it not came to baseline even 5 minutes after intubation. In MgSO₄ group RPP increases significantly only at 1 min after intubation. Average rise was 1863 at 1 min interval and maximum number of patients (46%) show rise in the range of 1000-2000 from baseline. 50% of the patients showed decline in their rate pressure product from baseline value. On intergroup comparison between lignocaine and MgSO₄ group, it was noted that RPP increases significantly in lignocaine group as compared with MgSO₄ group at 1,3,5 minutes after intubation. RPP rises in both the groups but RPP came towards baseline at 3 minutes after intubation in MgSO₄ group but that was not the case with lignocaine group.^{16,21,25}

In this study magnesium sulphate was given diluted and slowly to avoid untoward side effects, hence no any complications observed in our study.

CONCLUSION

The present study revealed that magnesium sulphate provide fairly good and sustained control over haemodynamic responses to the stress of laryngoscopy and intubation and is significantly better than lignocaine, so we conclude that magnesium sulphate is better alternative to lignocaine for attenuation of stress responses of laryngoscopy and intubation.

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