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Original Research Article

A Prospective Randomized Assessment of the Effectiveness of Magnesium Sulphate and Lignocaine for Attenuation of Haemodynamic Responses during Laryngoscopy and Intubation

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Conflict of interest: Nil

Aim: To compare the effectiveness of magnesium sulphate and lignocaine for attenuation of haemodynamic responses during laryngoscopy and intubation.

Methodology: It is Prospective Randomized study was done in Department of Anesthesia and critical care, Patna Medical College and Hospital, Patna, Bihar for 12 months. 100 Patients scheduled for various elective surgical procedures under general anaesthesia, belonging to ASA class I and II were included in the study which were divided into two groups with 50 cases in each group. In group A, patients received 1.5mg/kg of preservative free 2% lignocaine intravenously 90 seconds before laryngoscopy. IN group B, patients received 30 mg/kg of magnesium 90 seconds prior to laryngoscopy. The following cardiovascular parameters were recorded in all patients: Heart rate [HR] in beats per minute, systolic blood pressure [SBP] in mm of Hg, diastolic blood pressure [DBP] in mm of Hg, mean blood pressure [MBP] in mm of Hg. All the parameters were monitored in the following time interval of Base line (before giving study drug), Post induction (Pre-laryngoscopy), and 1,3,5 and 10 min after laryngoscopy and intubation.

Results: The age range was 20-60 years in both the groups. There was no statistically significant difference between the groups with regard to age and so they are comparable. ($p=0.62$). In group A, 76% of the patients were male and 24% were females. In group B, 68% of the patients were males and 32% were females. Intergroup comparison between the two groups showed that the SBP at 1, 5 and 10 minute after laryngoscopy in magnesium group were statistically significantly lower compared to lignocaine group ($P<0.05$). At 3 minute SBP was lower in magnesium group but not statistically significant when compared with lignocaine group. In Magnesium group the post induction DBP values was significantly lower compared to its baseline. At 1 minute there was slight increase in mean DBP which returned near baseline value by 3 minutes. At 5 min and 10 minutes values were significantly lower when compared to its baseline. Where as in Lignocaine group statistically significant increase in DBP compared to baseline was seen only at 1 minute after laryngoscopy. MBP at 1 minute after laryngoscopy in magnesium group was statistically significantly lower compared to lignocaine group. At 3, 5 and 10 minutes MBP was lower in magnesium group but not statistically significant when compared with lignocaine group.

Conclusion: The current 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 more

efficient as compared to lignocaine for attenuation of stress responses of laryngoscopy and intubation.

Keywords: Magnesium sulphate, Lidocaine, Laryngoscopy, Endotracheal intubation, Haemodynamics.

Introduction

Direct laryngoscopy and endotracheal intubation are noxious stimuli and almost always associated with haemodynamic changes due to reflex sympathetic stimulation caused by laryngo-pharyngeal stimulation [1]. Though these changes are usually well tolerated by healthy individuals they can be fatal in patients with hypertension, coronary artery disease and intracranial hypertension. Many pharmacological measures have been used to obtund these responses.

Lignocaine is an aminoethylamide and prototype of amide local anesthetic group [2]. 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 [3]. 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 [4].

Laryngoscopy and tracheal intubation stimulate somatic and visceral nociceptive afferents of the epiglottis, hypopharynx, peritracheal area, and vocal cords, which [5] leads to various cardiovascular changes like increase in heart rate, blood pressure, intracranial pressure, intra-ocular pressure, dysrhythmias, cardiac asystole and even sudden death [6-8]. These responses may prove to be detrimental especially in patients with ischemic heart disease, cerebral aneurysms, cerebrovascular disease, hypertension, old age and diabetes mellitus. 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.

Both Magnesium sulphate and Lidocaine showed attenuation to presser response to laryngoscopy and endotracheal intubation with a different success rate in previous studies [9-12]. Many methods have been identified to attenuate these responses including topical anesthesia of oropharynx, laryngotracheal instillation of lidocaine before intubation, intravenous lidocaine, deep inhalational anesthesia, narcotics, vasodilators, intravenous magnesium sulphate, adrenergic and calcium blockers even though these techniques have drawbacks [13, 14].

This study was undertaken with the objective of comparing the effectiveness of magnesium sulphate and lignocaine for attenuation of haemodynamic responses during laryngoscopy and intubation at dosages of 30 mg/kg and 1.5 mg/kg respectively.

Materials and Methods

It is Prospective Randomized study of IV Lignocaine and IV Magnesium Sulphate in the attenuation of sympathetic response to

laryngoscopy and intubation was done. General anesthesia with endotracheal intubation was provided for a duration of 12 months. The study was done in Department of Anesthesia and critical care, Patna Medical College and Hospital, Patna, Bihar. 100 Patients scheduled for various elective surgical procedures under general anaesthesia, belonging to ASA class I and II were included in the study.

Inclusion Criteria

Patients aged between 20 to 60 years of both the sex of ASA physical status class I and II, Mallampatti grade I and II undergoing Elective surgeries under general anaesthesia.

Exclusion Criteria

Patients with hypertension, cardiac, coronary, renal, hepatic, cerebral diseases, peripheral vascular diseases and electrolyte imbalance, Patients with difficult airway and obese patients or those who require more than one attempt for laryngoscopy and intubation, patients with endocrinal disease like hypothyroidism, hyperthyroidism, diabetes mellitus, Pregnant and nursing women.

Pre-anaesthetic evaluation was done on the evening before surgery. A routine pre-anaesthetic examination was conducted assessing and all basic investigations done assessment and investigations. They were informed about the study and an informed consent was taken in all the patients. 100 cases were divided into two groups with 50 cases in each group.

Lignocaine group (Group A): Patients received 1.5mg/kg of preservative free 2% lignocaine intravenously 90 seconds before laryngoscopy.

Magnesium group (Group B): Patients received 30 mg/kg of magnesium 90 seconds prior to laryngoscopy.

The following cardiovascular parameters were recorded in all patients: Heart rate [HR] in beats per minute, systolic blood pressure [SBP] in mm of Hg, diastolic blood pressure [DBP] in mm of Hg, mean blood pressure [MBP] in mm of Hg. The above cardiovascular parameters were monitored in the following time interval of Base line (before giving study drug), Post induction (Pre-laryngoscopy), and 1,3,5 and 10 min after laryngoscopy and intubation

All the patients were pre oxygenated for 3 minutes with 100% oxygen. Induction was achieved Inj. Thiopentone sodium 5mg/kg i.v. given as a 2.5% solution and opioid analgesic Fentanyl 2mcg/kg. After checking the ability to ventilate, Inj. vecuronium was administered at a dose of 0.1 mg/kg i.v. 3 minutes before laryngoscopy. Randomly selected 35 patients were given IV. Lignocaine 1.5 mg/kg 90 seconds prior to laryngoscopy and 35 randomly selected patients were given IV Magnesium sulphate 30mg/kg. The study solution was prepared in a 5 ml syringe by an anaesthesiologist who handed over the syringe in a coded form to the attending anaesthesiologist who records the parameters after injecting the drug. Laryngoscopy was done at the end of 3 mins after vecuronium injection using rigid laryngoscope with standard Macintosh blade. Intubation was done with appropriate sized, disposable, high volume low pressure cuffed endotracheal tube. Laryngoscopy and intubation was done by an experienced anesthesiologist in all cases. Heart rate, systolic and diastolic blood pressure were recorded post induction and at 1, 3, 5 and 10 minute intervals from the onset of laryngoscopy. Patients were connected to closed circuit and anesthesia was maintained with oxygen (50%), air (50%), isoflurane 1% and non-depolarizing muscle relaxant vecuronium bromide at a dose of 0.05 mg/kg i.v. and IPPV. Adequacy of ventilation was monitored by $EtCO_2$ and SPO_2 was maintained at 99-100%. Positioning and surgery was withheld till the completion of recording upto 10

minutes. In the present study, descriptive statistical analysis was used. The significance is determined at a 5% level of significance.

Results

In study included 100 patients which were divided in two group i.e. group A and B including 50 patients each. The age range was 20-60 years in both the groups. There was no statistically significant difference between the groups with regard to age and so they are comparable. (p=0.62). In group A, 76% of the patients were male and 24% were females. In group B, 68% of the patients were males and 32% were females. Both the Groups were comparable with respect to gender.

Table 1: Demographic details according to groups.

Variables		Study groups		P-value
		A	B	
Mean age (in years)		37.68 + 13.21	39.46 + 10.56	0.62
Gender	Males	38 (76%)	34 (68%)	0.48
	Females	12 (24%)	16 (32%)	

Intergroup comparison between the two groups showed that the SBP at 1, 5 and 10 minute after laryngoscopy in magnesium group were statistically significantly lower compared to lignocaine group (P<0.05). At 3 minute SBP was lower in magnesium group but not statistically significant when compared with lignocaine group.

In Magnesium group the post induction DBP values was significantly lower compared to its baseline. At 1 minute there was slight increase in mean DBP which returned near baseline value by 3 minutes. At 5 min and 10 minutes values were significantly lower when compared to its baseline. Where as in Lignocaine group statistically significant increase in DBP compared to baseline was seen only at 1 minute after laryngoscopy.

Table 2: Comparison of mean heart rate (bpm), SBP and DBP (mmHg) in group A and B.

		Baseline	Post induction	1 minutes	3 minutes	5 minutes	10 minutes
HR	Group A	86.64	86.72	105.66	94.78	87.12	83.04
	Group B	89.22	85.44	97.96	91.75	85.42	81.28
SBP	Group A	130.82	117.94	149.88	135.62	125.26	121.65
	Group B	127.86	115.34	136.97	128.56	115.98	113.54
DBP	Group A	79.24	75.12	91.25	82.96	79.21	77.87
	Group B	78.73	74.97	86.36	80.62	75.63	73.33

Statistically significant increase in heart rate from baseline was observed only at 1 min after laryngoscopy and reached baseline by 5min. Although there was a statistically significant decrease in HR below baseline at 10 min after laryngoscopy, it was not clinically significant.

Table 3: Comparison of Mean Blood Pressure (MBP) (mm Hg) in two groups

MBP	Group A	Group B	P-value
Baseline	98.24 ± 6.26	100.36 ± 8.36	0.21
Post induction	89.25 ± 6.26	91.34 ± 9.26	0.32
1 min	110.62 ± 11.53	105.12 ± 12.52	<0.05
3 min	101.35 ± 9.47	98.15 ± 9.23	0.20
5 min	93.62 ± 8.26	94.16 ± 8.26	0.68
10 min	89.92 ± 10.36	91.46 ± 8.67	0.72

Intergroup comparison between the two groups showed that the MBP at 1 minute after laryngoscopy in magnesium group was statistically significantly lower compared to lignocaine group. At 3, 5 and 10 minutes MBP was lower in magnesium group but not statistically significant when compared with lignocaine group.

Discussion

During direct laryngoscopy, proprioceptors are stimulated by the pressure exerted at the base of tongue which results in increase in heart rate, blood pressure and increase in plasma catecholamine concentration [1]. Passage of endotracheal tube was found to further exaggerate this response by somato-visceral reflex followed by rapid regression of SBP and HR while plasma catecholamine concentration regress more slowly. Reflex sympathetic response produced during laryngoscopy and intubation are usually well tolerated in healthy individuals but can be fatal in patients with ischemic heart disease, hypertension, and raised intracranial pressure. Therefore it is important to take measures to attenuate the pressor response during laryngoscopy and intubation.

Hypertension and tachycardia have been reported since 1950 during intubation under light anaesthesia [6, 7]. 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 [15]. These changes may be fatal in patients with heart disease and high blood pressure.

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 Rosen [16] 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. stoelting [17] 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 properties [18], it also significantly suppresses the release of catecholamines [4].

Many studies have showed that MgSO4 can attenuate cardiovascular responses to endotracheal intubation [4, 19-21]. Allen RW. et al [22] showed its effectiveness in hypertensive proteinuric pregnant patients undergoing caesarean section. Also Puri GD. et al [19] 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.

In lignocaine group, the heart rate decreased from baseline after induction, which was not statistically significant and there was statistically significant increase following intubation only at 1 min and 3 min. At 5-minute heart rate was still above baseline and reached below baseline at 10 minute but these were not statistically significant. Our findings are consistent with K. Montazeri et al [23], who found that there was statistically significant increase in heart rate from baseline in lignocaine group at 1 and 3 minutes followed by statistically non-significant increase at 5 minute. Similar results were seen in study done by Navid nooraei et al [24] with 1.5mg/kg of lignocaine. They found statistically significant increase in mean heart rate after 1 min and at 2 min (P=0.027) followed by statistically non-significant increase at 3, 4 and 5 minutes. Feng CK et al [25] also in their study found that when 2mg/kg lidocaine was used to attenuate the hemodynamic response to laryngoscopy and intubation, heart rate values at 1 minute and 3-minute interval were statistically significantly above baseline (P<0.05). [26]

Conclusion

The current 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 more efficient as compared to lignocaine for attenuation of stress responses of laryngoscopy and intubation. Thus Magnesium sulphate 30 mg/kg IV is a safe alternative to lignocaine with no adverse effects.

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