COMPARISON OF THE EFFICACY OF SINGLE BOLUS INTRAVENOUS LIGNOCAINE WITH MAGNESIUM SULPHATE TO ATTENUATE THE HAEMODYNAMIC RESPONSE OF LARYNGOSCOPY AND INTUBATION

Syed H Majid Waseem,[1] Tassadaq Khurshid,[1] Raheel Azhar,[1] Abdullah Arshad[1]

ABSTRACT

Background: Endotracheal intubation is routinely practiced in general anaesthesia, with potential hemodynamic effects on patients. **Objective**: The objective of this study was to compare the efficacy of single bolus intravenous lignocaine with magnesium sulphate to attenuate the haemodynamic response of laryngoscopy and intubation. **Material and Methods:** A total of 178 patients were included, randomly dividing them in two groups, 89 in each group. Group A, received intravenous 1% lignocaine 1mg/kg and group-B intravenous magnesium sulphate 10mg/kg. The data on heart rate, mean arterial pressure was compared among both groups and with baseline values, for the purpose of comparing efficacy. The data was entered and analyzed in SPSS version 14. Students t test was applied to compare means. A P value of less than 5% was taken as significant. Study design: Double Blind Randomized Clinical Trial. Place and duration of study: Departments of Anesthesiology of CMH Multan, from 1st September, 2010 to 1st March 2011. **Results:** There was statistically significant difference between the two groups in terms of efficacy i.e reduction of pressor response to laryngoscopy and intubation. 20% reductions in Mean Arterial Pressure (MAP) from baseline values were observed in 54% of the patients in Group A and 36.69% in group B. Similarly, 25% reduction in heart rate (HR) from baseline values were observed in 11% of the patients in Group A and 6.23% in Group B. Incidence of > 20% increase in MAP was 4.2 % in Group A versus 20.6 % in group B and > 25% increase in HR 12.35% in group A versus 25.6 % in Group B. Incidence of >20% increase in MAP was 4.2% in group A versus 20.6% in Group B and > 25 % increase in HR 12.35% in group A versus 25.6% in Group B. **Conclusion:** There is statistically significant difference between two groups that is, lignocaine was more effective and efficacious than magnesium sulphate by preventing the increase in MAP and HR after laryngoscopy and intubation.

Key Words: Hemodynamic changes, MAP, HR, Stress response

INTRODUCTION

Endotracheal intubation is routinely practiced in general anaesthesia. This maneuver is known to produce marked increase in heart rate, systemic blood pressure, pulmonary arterial pressure and transient arrhythmias by mechanical stimulation of the epipharynx, laryngopharynx and the tracheobronchial tree.[1] This ushers a flood of reflex sympathetic activities whereby resulting in an increase in blood pressure and heart rate.[2] The degree of reflex response to laryngeal stimulation appears to have a correlation with the depth of anesthesia, the duration and difficulties encountered during laryngotracheal intubation and on patient-dependent variables, including age and health related co-morbidities including a history of diabetes or cardiovascular disease.[3,4] Different noxious stimuli result in varying degrees of hemodynamic responses.[4] There is a relative rank order of the degree of hemodynamic responses of which laryngoscopy and intubation being the most intense stimuli.[5] The insertion of LMA is associated with significantly less hemodynamic changes.[6] The MAC value for endotracheal intubation is about 30% higher than the MAC value for surgical incision.[7] These hemodynamic changes are well tolerated in normotensive individuals but are of greater significance in patients with hypertension, coronary artery disease and cerebrovascular disorders. Hypertensive patients are prone to much greater swings in arterial pressure than normotensive patients of the same age. The excessive shift of arterial pressure curve is of considerable concern. Electro-cardiographic evidence of ischemia is often a part and parcel of these changes.[8] Moreover, these hemodynamic changes also have been recognized as a potential source of a number of complications. Use of intravenous lignocaine and magnesium sulphate to attenuate the haemodynamic response of laryngoscopy and intubation has been advocated in literature.[9,10] In scenarios like this, drugs that tend to

1. Department of Anaesthesiology, Pain & Intensive care. Combined Military Hospital Multan.

Correspondence: Dr. Major Syed H. Majid Waseem, Combined Military Hospital, Rahim Yar Khan.

Email: ans-2008-870@cpsp.edu.pk
Phone: 0332-6091579

block the responses to airway instrumentation may be employed. The rationale of this study is to prevent hemodynamic response of laryngoscopy and intubation which may be detrimental to patients of coronary artery disease or cerebrovascular disorders by choosing the appropriate drug. The objective of this study was to compare the efficacy of single bolus intravenous lignocaine with magnesium sulphate to attenuate the haemodynamic response of laryngoscopy and intubation.

MATERIAL AND METHODS

This double blind, randomized clinical trial was conducted after approval from ethical review committee of the hospital. Patient's consent was taken after explaining the risks and benefits to the patients. This study was conducted at the department of anesthesiology, Combined Military Hospital, Multan. The duration of the study was six months from 1st September, 2010 to 1st March, 2011. The sample size has been calculated by using WHO sample size calculator. Keeping level of significance 5% and power 80%, anticipated population proportion 1 (P1) as 47% and population proportion 2 (P2) as 29%. The sample size was 89 in each group. The total sample size of study was 178.

All ASA I patients of 15 to 50 years of age of either sex coming for elective surgeries, who require general anesthesiology and airway maintenance with endotracheal intubation have been included in this study. The patients of ASA class II and above, history of Allergy/hypersensitivity to lignocaine or magnesium sulphate, difficult intubation/airway abnormalities, requiring rapid sequence induction, known case/history of epilepsy/seizure disorder, hypertension, coronary artery disease, diabetes mellitus and on anti-hypertensive medications were excluded from the study.

Patients were interviewed, explained and counseled about the procedure of the study in pre anaesthesia assessment clinic. As per study, trained anaesthesia assistant prepared the drug according to the body weight of the patient and labelled it as a study drug. An anesthesia resident injected the study drug and monitored the heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) with respect to time, while a senior anesthetist intubated the patients. The values of mean arterial pressure (mmHg) and HR were recorded at baseline, post induction, post intubation, 2 minutes and 5 minutes post intubation. Both anesthetists were kept unaware of the study drugs throughout the study. 178 patients were randomized in two groups 'A' and 'B' by computer generated report. Drugs were given according to the computer generated report. Patients were administered drugs as follows:

1. Group A: 1% Lignocaine 1mg/kg, Intravenous
2. Group B: Magnesium Sulphate 10mg/kg, Intravenous

All patients were premedicated with Injection metoclopramide 10mg and Injection dexamethasone 4mg intravenously, half an hour preoperatively. No patient received any anxiolytic medications before surgery. Baseline haemodynamic variables were measured. All patients were anaesthetized using common anaesthetic technique. General anesthesia was given with controlled ventilation requiring ETT. In the operating room standard monitoring were applied and baseline vitals (blood pressure, heart rate and oxygen saturation) were recorded. Patients were preoxygenated for 3 minutes with oxygen flow rate of 6L/minutes on Bain breathing system. Study drug was administered 3 minutes before induction of anaesthesia intravenously over 30 seconds. The induction of anaesthesia was by using intravenous Sodium Thiopentone 5mg/kg over 30 seconds and Injection Atracurium 0.6mg/kg over 10 seconds and then patients were ventilated with 60% N2O in Oxygen up to 05 minutes. Then after 5 minute of face mask ventilation, patients were intubated. Tube was fixed and secured. The haemodynamic variables were measured till 10 minutes from the start of induction and after 10 minutes patient were handed over for surgical procedure. Maintenance was achieved with oxygen (O2), nitrous oxide (N2O) in 1:2 ratio and Isoflurane 1-2 % with controlled ventilation on circle breathing system. Intraoperative heart rate, systolic and diastolic blood pressures and mean arterial blood pressure measured as, baseline, before administration of induction agent, post

induction, 2 minutes post intubation and 5 minutes post intubation. Any increase or decrease in mean arterial pressure and heart rate more or less than 20% will be managed by the primary anesthetist. Data was analyzed with SPSS version 14. Mean ± SD was calculated for quantitative variables like HR, SBP, DBP, MAP, age. Frequency and percentage was calculated for qualitative variables like gender, efficacy. P value was calculated by two sample independent 't' test.

RESULTS

In our study regarding age distribution, majority of the patients were between 20-49 years. In group A, most of the patients were between the age of 30-39 years i.e. 38 (42.69%) and in group-B majority of the patients were between 30-39 years i.e. 53 (59.55%). Mean age of the patients in group-A was 33±7.4 years and in group-B 34.5±5.6 years.(Table-I) Effects on heart rate (beat/min) in group A and B is given in table II, while effect on mean arterial pressure is given in table III and efficacy is shown in table IV.

Table I: Distribution of cases by age in both groups

Age (Year)	Group -A (Number)	% age	Group -B (Number)	% age
20-29	31	34.83	20	22.47
30-39	38	42.69	53	59.55
40-49	20	22.47	16	17.97
Total	**89**	**100.0**	**89**	**100.0**
Mean±SD	**33±7.4 years**		**34.5±5.6 years**	

Table II: Mean Heart Rate (beats/minutes) in both groups

Time (minutes)	Group -A (Lidocain e)	Group -B ($MgSO_4$)
Baseline	90±8.8	86.6±9.2
Post Induction	74.4 ± 8.8	69.3± 7.3
Post Intubation	71.9 ± 9.5	72.6± 8
2 minutes Post Intubation	69.5 ±8.5	68.6± 7.9
5 minutes Post Intubation	66.3.± 6.2	71± 7.4
Calculated P value at baseline and 5 minutes post intubation	0.001	0.042

Table III: Mean arterial pressure (MAP) (mmHg) in both groups

Time (minutes)	Group -A Lignocaine	Group -B $MgSO_4$
Baseline	92 ±9.20	86.6± 7
Post Induction	80 ±7.98	85.6±12.9
Post Intubation	75 ±8.34	77.8±7.6
2 min Post Intubation	74±7.23	75.1±6.2
5min Post Intubation	69 ±6.6	72.4±5.9
Calculated P value at baseline and 5 minutes post int	0.002	0.11

Table IV: Efficacy of the both drugs

Out come Variable(Efficacy) Comparison at baseline and at 5 minutes post intubation values	**Group -A Lignocaine**	**Group -B ($MgSO_4$)**
20% reduction in **MAP(n=89) from baseline**	54%	36.69%
25% reduction in **Heart Rate (n=89) from baseline**	11%	6.23%
> 20% increase in **MAP** (n=89) **from baseline**	4.2%	20.6%
> 25% increase in HR (n=89) **from baseline**	12.35%	25.6%

DISCUSSION

Laryngoscopy and intubation of trachea often evoke cardiovascular response in the form of increase in arterial blood pressure, heart rate and changes in cardiac rhythm. These responses are believed to be due to the reflex sympathetic adrenal discharge, which may put the patient at risk for conditions such as cerebral haemorrhage, left ventricular failure etc.[12] Magnesium inhibits catecholamine release both from the adrenergic nerve terminals and the adrenal medulla in vitro.[12] The mechanism of action of lignocaine in attenuation of these reflex hemodynamic responses is due to direct cardiac depression and peripheral vasodilatation.[13] Both these drugs have been studied previously in attenuating the response to intubation and have shown promising results. Kim and Woon-Young,

demonstrated that Lignocaine attenuated the cardiovascular effects of laryngoscopy, intubation and decreased in BIS after induction but did not prevent increase in BIS values in response to laryngoscopy and intubation. This study showed that lignocaine had significant effects on cardiovascular effects of laryngoscopy and intubation but did not prevent increase in BIS values in response to laryngoscopy and intubation.[13] Minimal effective dose of magnesium sulfate for attenuation of intubation response is 30mg/kg.[14] In a study by Nidhi B et al, magnesium sulfate attenuated the pressor response to laryngoscopy and intubation in all three doses (30, 40, and 50 mg/kg) administered before induction of anesthesia. There was no significant increase in HR or BP as compared with baseline values, after laryngoscopy and intubation in any group of patients. However, patients who received magnesium in doses of 40 and 50 mg/kg developed significant hypotension at various time points requiring interventions.[14] Hossain MPA, Islam MS, Chowdhary MH, et al[15] did comparative study between efficacy of magnesium sulphate and lignocaine in attenuating hemodynamic response to laryngoscopy and endotrachael intubation. In this study it was observed that maximum attenuating response was observed by intravenous magnesium sulphate on cardiovascular system in response to laryngoscopy and intubation, it was also observed that intravenous magnesium sulphate did attenuate the sympathetic responses to laryngoscopy and intubation which come down to baseline 5 minutes after intubation. But the groups of patients which had been treated with lignocaine, their sympathetic responses did not come down to baseline at 5 minutes after laryngoscopy and endotrachael intubation.[15]

In the present study, we have taken 178 normotensive patients of ASA grade 1 and randomly allocated them to receive either lignocaine (1mg/kg) or magnesium sulphate (10mg/kg), 3 minutes before laryngoscopy and intubation and tried to compare the efficacy of both these drugs in terms of reduction in MAP and HR. The groups were comparable with respect to their demographic variables (age, sex) and are in no way different from each other in their baseline haemodynamic variables. There was no significance difference in the heart rate, MAP between the two groups in their baseline values. After the trial drug was given, there was post intubation rise in heart rate from the base line values in the group B i.e. 20.22%, whereas in group A that rise was 12.35%. The heart rate decreased further in group A after 2 minutes post intubation and even after 5 minutes of intubation, the rise in HR was 12.35%, whereas in group B, the rise in HR was 25.6%. After 5 minutes post intubation, there was a significant rise in the heart rate in Group B (25.6%) as compared to group A (12.35%). The baseline mean arterial blood pressure values in both the groups were comparable. After the trial drug, there was no significant rise in the MAP in the group A i.e 5.61% just after intubation as compared to group B which was 12.35%. The rise in MAP was maximum in the first minute of laryngoscopy and ETT in group B which was 15.35% and in group A 5.61%. This increase in MAP at 2 minutes post intubation was 1.12% in group A and 5.6% in group B respectively. At 5 minutes post intubation these increases in MAP were 4.2% in group A and 20.6% in group B respectively.

The drug will be considered efficacious if it does not alter the MAP 20% and HR 25%, when compared baseline values within 5 minutes post intubation values. In group A, 20% decrease in MAP from baseline was observed in 54% patients as compared to Group B which was 36.69%. Similarly, 25% reduction in HR from baseline value was 11% in group A and 6.23% in group B respectively, which is significantly different.

When we compared the baseline and 5 minutes post intubation values in both groups, the level of significance in group A (HR), P value was 0.001 and (MAP), P value was 0.002. Similarly in group B P values were (HR) 0.042, (MAP) 0.11.

When we compared the results with the reference studies, the outcome is slight dissimilar.[16] The limitation of our study is that we used the lowest dose of magnesium sulphate as compared to lignocaine i.e 10mg/kg, therefore our result could be different from other studies. But even at this lowest dose, magnesium sulphate showed reduction in pressor response i.e 20% MAP reduction from baseline in 36.69% population and 25 % reduction in HR from baseline in 6.23% population.

CONCLUSION

There is a statistically significant difference between the two groups in terms of efficacy i.e reduction of pressor response to laryngoscopy and intubation.

Hence it is concluded that lignocaine is effective and efficacious than magnesium sulphate in reducing the pressor response to laryngoscopy and tracheal intubation.

REFERENCES

1. Montazeri K, Fallah M. A Dose Response Study of Magnesium Sulfate in Suppressing Cardiovascular Responses to Laryngoscopy & Endotracheal Intubation, Journal of Research in Medical Sciences. 2005;10: 82-6.
2. Sharma J, Vikas S, Satyadev Gupta S. Comparative study of Magnesium Sulphate and Esmolol in Attenuating the Pressor Response to Endotracheal Intubation in Controlled Hypertensive Patients. J Anaesth Clin Pharmacol 2006; 22: 255.
3. Min JH, Chai HS. Attenuation of hemodynamic responses to laryngoscopy and tracheal intubation during rapid sequence induction: remifentanil vs. lignocaine with esmolol. Minerva Anestesiol 2010;76:188-92.
4. B, Ogurlu M, Gezer E, Nuri Aydin O, Gürsoy F. Effects of esmolol, lignocaine and fentanyl on haemodynamic responses to endotracheal intubation. Clin Drug Investig 2007; 27:269-77.
5. Kim JT, Shim JK, Kim SH, et al. Remifentanil versus lignocain for attenuating the haemodynamic response during rapid sequence induction using propofol: Double blind randomized clinical trial. Anaesth intensive care 2007; 35(1):20-3.
6. Tej Kaul, Veena Valecha. Catecholamine responses to Endotracheal intubation and Laryngeal Mask Airway Insertion. Indian J Anaesth 1999, 43; 30.
7. Durmus M, But AK, Erdem TB, Ozpolat Z, Ersoy MO. The effects of magnesium sulphate on sevoflurane minimum alveolar concentrations and haemodynamic responses. Eur J Anaesthesiol 2006; 23:54-9.
8. Telci L, Esen F, Akcora D, Erden T, Canbolat A T, Akpir K. Evaluation of effects of magnesium sulphate in reducing intraoperative anesthetic requirements. British Journal of Anaesthesia 2002; 89:594-602.
9. Jee D, Lee D, Yun S, Lee C. Magnesium sulphate attenuates arterial pressure increase during laparoscopic cholecystectomy. Br J Anaesth 2009 Oct; 103(4):484-9.
10. Dube L, Granry JC. The therapeutic use of magnesium in anesthesiology, intensive care and emergency medicine: a review. Can J Anesth 2003; 50: 732-46.
11. Saif Ghaus M, Vinita S, Kumar A, Wahal R. Bhatia V K, Agarwal J. A study of cardiovascular response during laryngoscopy and intubation and their attenuation by ultrashort acting b-blocker esmolol. Indian J Anaesth. 2002; 46 (2) : 104-106.
12. Elsharnouby1 NM, Elsharnouby MM. Magnesium sulphate as a technique of hypotensive anaesthesia. British Journal of Anaesthesia 2006:96 (6): 727-31.
13. Kim Woon, Young MD. Lidocaine does not prevent bispectral index increases in response to Endotracheal Intubation. J Anesthesia & Analgesia 2006;102:156-9
14. Nidhi B. Panda MD, Neerja Bharti DNB, Seema Prasad MD. Minimal effective dose of magnesium sulfate for attenuation of intubation response in hypertensive patients. Journal of Clinical Anesthesia; 2013: 25, 92-97.
15. Hossain MPA, Islam MS, Chowdhary MH, et al. Comparative study between efficacy of magnesium sulphate and lignocain in attenuating haemodynmic response to laryngoscopy and endotrachael intubation. Bangladesh JAFMC 2012;(8):278-81.
16. Jolliffe CT, Leece EA, Adams V, Marlin DJ. Effect of intravenous lidocaine on heart rate, systolic arterial blood pressure and cough responses to endotracheal intubation in propofol-anaesthetized dogs. Vet Anaesth Analg 2007;34:322-30