Original Article

Comparison of 2% Lignocaine with 50% Magnesium Sulfate in Reducing the Hemodynamic Stress Responses to Laryngoscopy and Endotracheal Intubation

Saima Javaid Joyia, Tariq Bashir and Iqra Batool

ABSTRACT

Objective: The comparison of 2% lignocaine with 50% magnesium sulfate in reducing the hemodynamic stress responses to laryngoscopy and endotracheal intubation in ASA (American Society of Anesthesiologists) grade I and II patients.

Study Design: A randomized control trail.

Place and Duration of Study: This study was conducted at the Anaesthesia department of Bahawal Victoria Hospital, Bahawalpur from July, 2017 to December, 2017.

Materials and Methods: Ninety two patients were divided randomly into two equal groups, Group-L for lignocaine and Group-M for magnesium sulfate. Age and weight of every patient was documented. Heart rate, systolic and diastolic blood pressures and mean arterial pressure were recorded before and after pre-medication, after injecting the drugs under study and at 1, 3 and 5 minutes after intubation. Variables were compared between the two groups and t-test was applied. SPSS v.23 was used to analyze the data. P value was taken as ≤ 0.05.

Results: The mean heart rate was significantly high in group-L at 1 minute ($p=0.006$), 3 minute ($p=<0.001$) and 5 minute ($p<0.001$) after the intubation. Mean systolic blood pressure, diastolic blood pressure and mean arterial pressure were also high in group-L at 1 minute, 3 minute and 5 minute after the intubation with statistically significant difference ($p<0.001$).

Conclusion: It was hereby concluded that significantly better and well-sustained control over hemodynamic stress responses to laryngoscopy as well as tracheal intubation, is obtained by the use of magnesium sulfate, as compare to lignocaine. This shows that magnesium sulfate is superior to lignocaine in offsetting the hemodynamic stress responses to laryngoscopy as well as endotracheal intubation.

Key words: 2% Lignocaine, 50% magnesium sulfate, hemodynamic, stress responses, laryngoscopy, endotracheal intubation

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INTRODUCTION

It is very well recognized fact that laryngoscopy and endotracheal intubation trigger the hemodynamic response by the activation of sympathetic nervous system, in the form of increased heart rate and raised blood pressure. This response is mediated by the enormous release of epinephrine and nor-epinephrine. Somatic as well as visceral somatic afferents of pharynx, epiglottis, larynx, peritracheal area, vocal cords and hypopharynx are stimulated by the laryngoscopy [1] and endotracheal intubation and the results are the occurrence of many cardiovascular as well as cerebrovascular hemodynamic responses such as raised blood pressure, intracranial pressure, intraocular pressure, increase in heart rate, dysrhythmias, cardiac asystole and sudden death [2-4]. In the patients who are elderly, or suffering from cerebrovascular diseases, cerebral aneurysms, ischemic heart disease, hypertension and diabetes mellitus, these responses can be excessively harmful, leading to increase in morbidity and mortality [5]. This problem was highlighted for the first time by King et al. [6] in the year 1951. Since then, many techniques have been tried to mitigate these unwanted hemodynamic reactions, which include the use of vasodilators such as nitroglycerin [7], topical or intravenous lidocaine [8,10], magnesium [8], beta-blocker drugs such as esmolol [9], calcium channel blockers [9,10], opiates in large doses especially alfentanil and fentanyl [11] and gabapentin. All of these techniques work either by reducing the input stimuli or by blocking the adrenergic responses. There is no direct blockade of

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release of catecholamines and these procedures have drawbacks of cardiovascular and respiratory depression. Lignocaine is the most commonly used drug to mitigate the stress responses which occur during and after laryngoscopy and endotracheal intubation. It is an aminoethylamide and belongs to the amide group of local anesthetics. It acts via membrane stabilization, due to which it is also used frequently as an anti-arrhythmic agent n patients having ventricular ectopics. When given intravenously, lignocaine has the ability to reduce the pressor response to laryngoscopy and endotracheal intubation 12. Sufficient effects of lignocaine on pressor response have been observed at an intravenous of 1.5mg/kg body weight. It is also used to perform nerve blocks and to control ventricular tachycardia. The commonly encountered side effects of lignocaine are arrhythmias, bradycardia, hypotension, raised defibrillator threshold, respiratory depression, venous insufficiency, flushing, nausea, vomiting, urticaria, angioedema and visual disturbances.

In the human body, magnesium is the fourth most common cation and it activates many enzyme systems. Magnesium sulfate impedes the discharge of epinephrine and nor-epinephrine from the adrenal medulla as well as adrenergic nerve endings. It is very effective in decreasing the hemodynamic responses to laryngoscopy and the tracheal intubation [13]. Different researchers have found different doses to be effective in obtaining the desired results. Magnesium sulfate at a dose of 50mg/kg body weight can prevent the pressor response to the laryngoscopy and the tracheal intubation, when administered before the procedure. This agent is known to cause a few cardiovascular adverse effects. Magnesium sulfate causes respiratory depression and has the ability to aggravate the effect of non-depolarizing neuromuscular blocking agents.

Lignocaine, to attenuate the pressor effects of intubation and laryngoscopy, has been studied for long but the use of magnesium sulfate in this respect has been studied very poorly. Current study is aimed as comparing the efficacy of 2% lignocaine and 50% magnesium sulfate in decreasing the hemodynamic reactions occurring during laryngoscopy as well as endotracheal intubation required for general anesthesia.

MATERIALS AND METHODS

It is a randomized control trail. After attaining the approval from the Department ethical committee, total of ninety two patients of ASA (American society of Anesthesiologists) grade I and II were selected and written informed consent was obtained. The data was collected from July, 2017 to December, 2017 in the Anaesthesia department of Bahawal Victoria Hospital, Bahawalpur. Sample size was calculated after taking the study by Padmawar S. [8] as our reference research and was selected by applying the non-probability consecutive sampling technique. The patients who were planned to undergo planned surgical procedure requiring general anesthesia or laryngoscopy were included in the study.

Ninety two patients were divided randomly into two equal groups, Group-L for lignocaine and Group-M for magnesium sulfate, each consisting of forty six patients with equal male to female ratio. Age and weight of every patient was documented. Complete history, examination and related investigation were performed prior to the induction of anesthesia. We excluded those patients from our study who were having electrolyte imbalance, preeclampsia, eclampsia, neuromuscular diseases, arrhythmias, ischemic heart disease, cerebrovascular conditions, allergic to drugs, already on magnesium sulfate, requiring longer than thirty seconds or multiple attempts for laryngoscopy. Inside the operation theatre, the devices to monitor heart rate, non-invasive blood pressure, and SpO2 were attached to the patients. The baseline heart rate, systolic and diastolic blood pressures and mean arterial pressure were recorded before any type of pre-medication. Wide bore intravenous lines were secured and intravenous infusion of ringers lactate was started. Pre-medication included 0.3mg/kg dose of pentazocine, 0.03mg/kg dose of midazolam, 1mg/kg of ranitidine and 0.2mg/kg of metoclopramide. All the patients were injected with these agents intravenously, ten minutes before inducing the anesthesia. Pre-oxygenation was performed with 100% oxygen for a minimum of 3 minutes. Heart rate, systolic and diastolic blood pressures and mean arterial pressure were recorded after pre-medication. Lignocaine injection at a dose of 1.5mg/kg body weight was given to group-L, intravenously. Group-M received a 40mg/kg dose of magnesium sulfate as an intravenous injection. Heart rate, systolic and diastolic blood pressures and mean arterial pressure were recorded, again. Propofol was used to induce anesthesia which was followed by succinylcholine injection to ease the endotracheal intubation. Cuffed endotracheal tube was used in all the patients and the process of intubation was completed in less than 30 seconds. Vecuronium bromide was used to maintain muscle relaxation. Heart rate, systolic and diastolic blood pressures and mean arterial pressure were recorded at one minute, three minutes and five minutes after the intubation and other surgical interpolations such as incision and catheterization were performed after recording the data. At the end of surgery, the patients were sifted to the recovery room after extubation and were monitored for at least half an hour.

Age, weight, heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure was compared between the two groups and t-test was applied. SPSS v.23 was used to analyze the data. Confidence interval was taken as 95%.

RESULTS

Ninety two patients were divided into two equal groups, having male to female ratio of 33:13, each. Both the groups were comparable in terms of age (42.09±6.86 years of group-L and 42.59±6.97 years of group-M) and weight (49.22±6.27Kg of group-L and 50.06±6.05Kg of group-M) with a p-value of 0.730 and 0.511, respectively. (Table-I)

Before and after the premedication the observed heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure was not significantly different in between both the groups. Just after administering the drugs under study, there was a significant rise in heart rate (p=0.007) and systolic blood pressure (p=0.017) in the group receiving Magnesium sulfate. Diastolic blood pressure and mean arterial pressure did not alter significantly (p-value 0.590 and 0.351, respectively). (Table-II)

The mean heart rate 1 minute, 3 minute and 5 minute after the intubation was 104.76±12.63 beats /min and 97.76±11.39 beats /min (p=0.006); 102.09±10.79 beats /min and 91.80±8.87 beats /min (p<0.001); and 93.13±10.07 beats /min and 86.21±5.05 beats /min (p<0.001) in group-L and Group-M, respectively. Mean systolic blood pressure 1 minute, 3 minute and 5 minute after the intubation was 133.59±6.91mmHg and 120.83±8.68 mmHg (p<0.001); 129.48±7.18 mmHg and 115.63±4.70 mmHg (p<0.001); and 123.19±9.55 mmHg and 115.96±4.43mmHg in group-L and Group-M, respectively. The difference was statistically significant. Mean diastolic blood pressure 1 minute, 3 minute and 5 minute after the intubation was 90.50±5.80 mmHg and 83.67±7.70 mmHg (p<0.001); 87.50±8.17 mmHg and 76.48±4.22 mmHg (p<0.001); and 83.24±6.54 mmHg and 78.28±4.62 mmHg (p<0.001) in group-L and Group-M, respectively. Similar trend was seen in mean arterial pressure 1 minute, 3 minute and 5 minute after the intubation with p<0.001 at every time. (Table-2)

Table No.1: Demographic Details

Variable	Group-L	Group-M	p-value
Age	42.09±6.86	42.59±6.97	0.730
weight	49.22±6.27	50.06±6.05	0.511
Male: Female	33:13	33:13	

Data are mentioned as Mean ± S.D or Number

Table No.2: Comparison of Observed Parameters between Two Groups

Variable	Groups	Before Premedication	After Premedication	After the Drug	1 minute after Intubation	3 minutes after Intubation	5 minutes after Intubation
Heart Rate (Beats/ min)	Group-L	84.15±6.07	81.41±6.96	82.28±6.40	104.76±12.63	102.09±10.79	93.13±10.07
	Group-M	86.22±5.05	80.61±7.18	86.15±7.03	97.76±11.39	91.80±8.87	86.21±5.05
	p-value	0.079	0.587	0.007	0.006	<0.001	<0.001
Systolic Blood Pressure (mmHg)	Group-L	117.06±3.73	112.43±3.28	110.61±5.26	133.59±6.91	129.48±7.18	123.19±9.55
	Group-M	116.17±5.20	111.80±4.87	113.24±5.06	120.83±8.68	115.63±4.70	115.96±4.43
	p-value	0.348	0.469	0.017	<0.001	<0.001	<0.001
Diastolic Blood Pressure (mmHg)	Group-L	75.84±5.76	74.43±4.55	76.37±4.48	90.50±5.80	87.50±8.17	83.24±6.54
	Group-M	76.78±4.65	75.39±3.47	75.91±3.55	83.67±7.70	76.48±4.22	78.28±4.62
	p-value	0.394	0.260	0.590	<0.001	<0.001	<0.001
Mean Arterial Pressure (mmHg)	Group-L	79.80±3.37	77.41±4.48	79.63±4.06	95.28±5.08	92.24±7.36	86.22±5.64
	Group-M	80.69±3.75	76.89±4.04	80.46±4.38	89.50±5.04	83.17±3.61	80.89±5.37
	p-value	0.234	0.559	0.351	<0.001	<0.001	<0.001

Data are mentioned as Mean ± S.D

DISCUSSION

We witnessed in the current study that there was a rise in heart rate and blood pressure levels when the patients were intubated but the rise was significant in the group which was given lignocaine. The blood pressure level and heart rate in the magnesium sulfate group were relatively much stable and returned to the baseline levels five minutes after the intubation. Similar results were seen in the study conducted by Padmawar S et al 8. They also observed that magnesium sulfate effectively controlled the fluctuations in the heart rate and blood pressure as compared to lignocaine. Also there was some change in the hemodynamics in the group which received magnesium sulfate but it was very mild and returned to the baseline quickly.

Kiaee MM et al. [14] compared the efficacy of both these drugs in the patients who were undergoing elective coronary artery bypass graft. They observed that lidocaine (lignocaine) caused hemodynamic instability in the patents while magnesium sulfate improved the hemodynamic status. When lignocaine was compared

with other drugs such as dexamethasone and esmolol, there was no effect of lignocaine over the stress responses and increase in heart rate, blood pressure and mean arterial pressure was observed [15,16]. Kord Valeshabad A. et al.[17] also observed in his study that a significant rise in heart rate and mean arterial pressure is seen in patients receiving lidocaine. They compared the effects of lidocaine against propacetamol.

Hirmanpour A. et al [18] observed in pregnant women that 60mg/kg dose of magnesium sulfate, when given intravenously at the time of induction of anesthesia, was sufficient to minimize the hemodynamic variations occurring after laryngoscopy and endotracheal intubation. Kotwani MB et al. [19] concluded in their study that a 30mg/kg dose of magnesium sulfate was adequate to attenuate the hemodynamic variations but higher doses were associated transitory tachycardia. Honarmand A. [20] concluded from his study that different doses of magnesium sulfate (30mg/kg, 40mg/kg, and 50mg/kg) were equal in efficacy when used to control the hemodynamic changes following laryngoscopy and endotracheal intubation. There witnessed no significant effect over the heart rate fluctuations.

CONCLUSION

It is hereby concluded that significantly better and well-sustained control over hemodynamic stress responses to laryngoscopy as well as tracheal intubation, is obtained by the use of magnesium sulfate, as contrast with lignocaine. This shows that magnesium sulfate is superior to lignocaine in offsetting the hemodynamic stress responses to laryngoscopy as well as endotracheal intubation.

Author's Contribution:

Concept & Design of Study:	Saima Javaid Joyia
Drafting:	Tariq Bashir
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Revisiting Critically:	Tariq Bashir, Saima Javaid Joyia
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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