ORIGINAL RESEARCH PAPER

Anaesthesiology

EFFECTS OF INTRAVENOUS MAGNESIUM SULFATE AND LIDOCAINE ON HEMODYNAMIC RESPONSES FOLLOWING DIRECT LARYNGOSCOPY AND INTUBATION IN ELECTIVE SURGERY PATIENTS.

KEY WORDS: Laryngoscopy, Intubation, Hemodynamics, Magnesium sulfate, Lidocaine

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ABSTRACT

Background and objective: Laryngoscopy and Intubation lead to hemodynamic changes like Increase in heart rate, arterial blood pressure, and arrhythmia. Several medical methods have been suggested attenuate this response. This study corresponds to the intravenous administration of lidocaine and magnesium sulfate on unwanted hemodynamic response following laryngoscopy and intubation in elective surgery conditions.

Materials and Methods: This randomized, double-blind chemical trial conducted on Sixty ASA I and II candidates who received magnesium sulfate 30mg/Kg and lidocaine (1.5mg /kg) randomly before intubation. Values of systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate was recorded in both groups in 1st to 5th minutes following administration and compared with baseline values.

Results: In the magnesium group, the increase in systolic blood pressure occurred in the 1st minute, which was significant. The increase in diastolic blood pressure was significant in Lidocaine group in the 1st minute. The mean arterial pressure showed lower values in 1st and 2nd minutes, and mean heart rate was lower in 1st minutes in Magnesium group with statistical significance.

Conclusion: Magnesium sulfate is comparatively more effective in controlling hemodynamics than Lidocaine attenuating pressure response to laryngoscopy and intubation.

INTRODUCTION

The hemodynamic response to stimuli evoked by laryngoscopy and intubation is a common phenomenon. It results from the release of endogenous catecholamine reflexively to the upper airway afferents when stimulated [1]. This inappropriate response may increase perioperative morbidity and mortality, especially in patients with cardiovascular diseases. Therefore, the management of this defensive reflex is essential. It prevents adverse events, such as tachycardia, systemic hypertension, pulmonary hypertension, and arrhythmias, which may result in stroke or myocardial infarction resulting from hemodynamic instability. Many drugs are the subject of studies, including those with good results, such as magnesium sulfate [1-3] and lidocaine.[4-6]

The magnesium sulfate mechanism of action for hemodynamic response attenuation results from the inhibition of catecholamine release from the adrenal medulla [1, 7, 8]. It maintains the plasma concentration of epinephrine and reduces the increased circulating levels of norepinephrine. It also has a systemic and coronary vasodilation effect by antagonizing calcium ion in vascular smooth muscle [1,7,8,9]. Lidocaine has antagonistic action on sodium channels and NMDA receptors reduces the release of substance P, which decreases the airway reactivity. [10,11]

The aim of this study was to compare the effects of intravenous magnesium sulfate with lidocaine on Hemodynamics during intubation.

MATERIAL AND METHODS

This is a randomized, double-blind clinical trial in which 60 patients (30 in each group) were selected for elective surgeries. All patients were in the age range of 20 to 60 years and ASA-I or II stages. This clinical study was conducted in Hi-Tech Medical College and Hospital, Bhubaneswar from January 2019 to May 2019. Patients with diabetes, blood pressure (BP), history of addiction, renal failure, and cardiac arrhythmias, on beta blockers or calcium channel blockers, expected difficult intubation, and body mass index (BMI) ≥35 kg m 2 were excluded from the study. Patients who had undergone neuraxial block before the anesthetic induction, who refused to participate after informed consent presentation, required two or more attempts at laryngoscopy for orotracheal tube placement were also excluded. After institutional ethical committee approval, patients of either sex were randomly allocated into two groups of 30 patients each, namely Group " M"(Magnesium group) and group "L" (Lidocaine group). In the operating room, standard monitoring was done with an electrocardiogram (ECG), a saturation of peripheral oxygen (SpO2), and non-invasive blood pressure (NIBP) monitoring. Venous access was secured with an 18G venous cannula and infusion of Ringer's lactate solution was started. All the patients received premedication with Glycopyrrolate 0.01 mg/kg, Midazolam 0.02mg/kg and Nalbuphine 0.1mg/kg,3 minutes before induction. After 3 minutes of pre-oxygenation, the patient was ready for anesthetic induction. Then, 2 mg/kg propofol was intravenously administered, and after the loss of consciousness, 0.1 mg/kg vecuronium (a muscle relaxant) was given. Magnesium sulfate or lidocaine was administered intravenously over 3 minutes. The control group received 1.5 mg/kg lidocaine, and the study group received 30mg/kg magnesium sulfate. All the drugs were diluted to 10 ml solutions and administered over 3 minutes as intermittent boluses, and intubation was done. Had laryngoscopy taken over 15seconds or did not succeed the first time; the patient would be excluded from the study. Patient's pulse rate and blood pressure were measured and recorded every minute during the first 5minutes following intubation. Statistical analysis was done with Student's t-test and $P<0.05$ was considered statistically significant.

RESULTS

There was no statistical difference in both groups regarding age, sex, weight, height, and Body mass index as well as physical status classification by ASA. There was no statistical difference between groups in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) at admission. There was an increase in heart rate, systolic blood pressure, and diastolic blood pressure in both groups after laryngoscopy compared to baseline. (Table 1).

Comparison of the mean systolic blood pressure among both the group showed an increase in the Magnesium group in the 1st second (P=0.003) compared to the Lidocaine group. In the 2nd second, Magnesium group showed a decrease in mean arterial pressure but not significant (P=0.054). But in the 3rd,4th,5th minutes Lidocaine group showed an increase in mean systolic blood pressure compared to Magnesium group but without statistical significance. After the end of the 3rd minute, the systolic blood pressure came near the baseline values in Magnesium group wherein Lidocaine group after 5th minutes it came near baseline values. (Table 2).

Comparing the diastolic blood pressure (DBP) in both the groups, Magnesium group showed a decrease in diastolic blood pressure, which was statistically significant in 1st second (P=0.042). In 2nd,3rd,4th,5th seconds Magnesium group showed a decrease in diastolic blood pressure compared to Lidocaine group but without statistical significance. In both groups, the diastolic blood pressure came to the baseline values after the 5th second. (Table 2).

The mean heart rate (HR) in the Magnesium group after intubation was lower in the 1st second (P=0.045), which was significant. Despite this value being higher in the 2nd, 3rd, 4th, and 5th minutes in the Lidocaine group, the difference was not significant. In both, the groups, the mean heart rate came near the baseline values after 5th minutes. (Table 3).

Initial Values of patients based on the medication group (Lidocaine and Magnesium)

Table 1. Initial and basic values of patients based on the medication group. All the values are presented in term of Mean± standard deviation.HR: Heart Rate, DBP: Diastolic blood pressure, MAP: Mean arterial pressure, SBP: Systolic blood pressure.

MEDICATION	Number of patients	AGE	HR	SBP	DBP	MAP
Lidocaine	30	36.57±10.38	94.30±24.15	120.06±12.57	78.27±8.94	92.27±9.47
Magnesium	30	33.83±11.00	92.87±16.76	120.40±14.54	75.20±15.07	92.06±9.03
P value		0.327	0.79	0.925	0.342	0.932

Systolic blood pressure changes in lidocaine and magnesium groups after intubation

Table 2. Comparison of systolic and diastolic blood pressure changes in lidocaine and magnesium groups after intubation. All the values are presented in term of Mean± standard deviation.

MEDICATION	1st	2nd	3rd	4th	5th
Lidocaine	129.36±12.48	130.30±11.24	125.60±11.01	123.00±10.83	123.43±11.82
Magnesium	130.63±11.33	128.63±10.45	123.86±12.26	121.66±12.46	121.50±12.57
P value	0.043	0.054	0.267	0.66	0.542
Diastolic blood pressure changes in lidocaine and magnesium groups after intubation					
MEDICATION	1st	2nd	3rd	4th	5th
Lidocaine	87.73±9.34	86.76±7.23	82.50±7.29	80.16±6.95	80.23±8.82
Magnesium	87.63±6.46	85.16±6.37	80.26±7.67	78.46±7.60	77.20±7.06
P value	0.042	0.367	0.253	0.37	0.147

Table 3. Comparison of Heart rate and mean MAP in magnesium and lidocaine groups after intubation. All the values are presented in term of Mean± standard deviation.

Heart Rate changes in lidocaine and magnesium groups after intubation					
MEDICATION	1st	2nd	3rd	4th	5th
Lidocaine	107.83±19.11	106.96±17.94	101.60±17.15	97.43±16.52	96.16±16.71
Magnesium	106.33±16.32	103.73±16.61	98.63±15.63	95.66±15.58	94.33±16.03
P value	0.045	0.472	0.487	0.672	0.666
Mean Arterial Pressure changes in lidocaine and magnesium groups after intubation					
MEDICATION	1st	2nd	3rd	4th	5th
Lidocaine	101.69±9.56	101.39±7.61	96.81±7.74	94.34±7.52	94.59±8.96
Magnesium	101.12±8.38	99.47±6.79	94.68±8.43	92.68±8.28	91.94±8.03
P value	0.008	0.031	0.314	0.421	0.233

Comparison of mean arterial pressure between the two groups revealed higher values of MAP in the Lidocaine group in the 1st to 5th minutes. However, this value is significant in the first minute (P=0.008) and second minute (P=0.031). In the Magnesium group, the mean arterial blood pressure came to baseline values after 3rd minutes, whereas in Lidocaine group, it happened after 5th minutes. (Table 3).

DISCUSSION

Airway management during laryngoscopy and intubation causes physiological changes that can be harmful to several patients [12]. Pharynx, larynx, trachea, and carina are highly innervated by sympathetic and parasympathetic fibers. Defensive reflex responses to airway manipulation include tachycardia, bronchospasm, increased blood pressure, and intracranial pressure. Studies have shown that laryngoscopy causes 20 mmHg increase in systolic blood pressure[13,1] and a simple tracheal suction causes at least a five mmHg increase in intracranial pressure(15,16).

Many adjuvant drugs, including opioids, vasodilators, calcium channel blockers, and adrenoceptor blockers have been used with variable success to blunt the hemodynamic response to intubation in hypertensive patients [17,18]. All of these techniques 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, it also significantly suppresses the release of catecholamines.

Lidocaine and magnesium sulfate are widely used to decrease the hemodynamic response to laryngoscopy and tracheal intubation. Magnesium sulfate blocks the release of catecholamines from adrenergic nerve terminals and adrenal gland, has cardioprotective and antiarrhythmic action, [10,19] and induces coronary and systemic vasodilation by antagonizing calcium ion in vascular smooth muscle.

In a similar study performed by Nooraei et al., the effect of lidocaine and magnesium sulfate on the hemodynamic variables of laryngoscopy was compared and found better control of blood pressure values with magnesium sulfate [7].

Puri *et al.*, also compared the effects of magnesium sulfate and lidocaine on cardiovascular response to intubation in coronary artery disease patients undergoing CABG and found better attenuation of the hemodynamic variables with magnesium sulfate [1].

Altan *et al.,* [20] reported that magnesium sulfate 30 mg/kg infused over 15 minutes, before the induction of anesthesia with propofol, attenuated the pressure response to intubation in normotensive patients. There was no increase in HR, and BP was better maintained in patients receiving magnesium sulfate than those given Clonidine 3 μg/kg (more hypotension).

In the present study, BP was well maintained in patients receiving 30 mg/kg of magnesium sulfate. None of the patients in this group developed significant hypotension requiring rescue management. Magnesium is an α-adrenergic antagonist and may lead to a transient decrease in BP associated with peripheral vasodilatation [21]. However, despite its vasodilator properties, magnesium does not generally produce significant hypotension in normotensive patients because of a concomitant increase in cardiac output [22].

CONCLUSION

Our study showed that magnesium sulfate and lidocaine have good efficacy and safety for hemodynamic control during laryngoscopy and intubation. Magnesium sulfate was more effective than lidocaine in reducing mean arterial pressure in the first two minutes, systolic blood pressure after a 2^{nd} minute and diastolic blood pressure and heart rate after 1^{st} minutes. So we conclude that magnesium sulfate is more effective than lidocaine in controlling hemodynamic responses following direct laryngoscopy and intubation in elective surgery patients.

Conflicts of interest

There are no conflicts of interest associated with this study.

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