ORIGINAL RESEARCH PAPER

Volume - 13 | Issue - 06 | June - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MAGNESIUM SULPHATE VERSUS LIDOCAINE IN ATTENUATING PRESSOR RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION

Anaesthesiology

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ABSTRACT

Background: Processes like laryngoscopy, endotracheal intubation and extubation triggers various hemodynamic stress response and here it has been attempted to reduce by using Intravenous Magnesium sulfate and Lignocaine. **Aim:** To evaluate and compare the efficacy of Lignocaine and Magnesium sulphate for attenuating the stress responses to laryngoscopy and endotracheal intubation. **Materials and Method:** A prospective randomized controlled study was conducted in 50 participants belonging to criteria of ASA I and II ,aged between 18-60 years posted for elective surgery under general anaesthesia. Patients were randomized into two groups: Group L, consisting 25 patients, received intravenous bolus of Lignocaine 2mg/kg, and Group M, consisting 25 patients, received MgSo4, 30 mg/kg. Premedications – inj. Glycopyrolate, Midazolam and Analgesic inj.Fentanyl was given. Study drug was given 90 seconds before induction inj. Propofol and inj.succinylcholine was given to facilitate intubation. Parameters like HR and blood pressure (BP) at baseline, following medication administration, during laryngoscopy, one, three, and five minutes after intubation were monitored. Student t test was used to test the association and SPSS 20.0 version used for data analysis. **Results:** A notable increase in HR that persisted for five minutes after intubation. HR in MgSO4 group increased at first upon drug administration and peaked one minute after intubation; however, it returned to baseline five minutes later and began to decline after ten minutes. SBP, DBP, and MAP increased in both groups, however the MgSO4 group noticed a return to baseline five minutes after intubation, while the Lignocaine group did not experience this. In comparison to the Lignocaine group, there was a consistent decrease in HR ($p<0.05$) and a decrease in MAP ($p<0.05$). No complications were observed during the study. **Conclusion:** Use of MgSo4 was considered as a preferable option over Lignocaine for reducing the stress response during laryngoscopy and intubation.

KEYWORDS

Endotracheal Intubation, Laryngoscopy, Lignocaine, Magnesium Sulphate

INTRODUCTION

The translaryngeal insertion of an endotracheal tube via the oral or nasal cavity into the trachea is known as endotracheal intubation.[1] Sir William Mac Ewens reported the first successful digital intubation of four patients in 1880. Alfred Kirsten performed the first direct laryngoscope intubation in 1885. Reid and Brace first identified the hemodynamic response to endotracheal intubation and laryngoscopy in 1940.[2]

The stimulation of somatic and visceral nociceptive afferents in the epiglottis, hypopharynx, peritracheal area, and vocal cords by laryngoscopy and endotracheal intubation can result in a variety of cardiovascular changes, including an increase in heart rate (HR), blood pressure, intracranial pressure, intraocular pressure, dysrhythmias, cardiac asystole, and even sudden death. Particularly in individuals with ischemic heart disease, hypertension, cerebral aneurysms, cerebrovascular diseases, advanced age, and diabetes mellitus, these reactions may prove to be harmful.[3]

Many methods and substances have been used in contemporary anesthesia treatments to halt sympathetic alterations and maintain hemodynamic stability. The cardiovascular response to laryngoscopy and endotracheal intubation has been reduced by the use of non-pharmacological techniques such as smooth and gentle intubation with a shorter laryngoscopy duration, insertion of LMA in place of endotracheal intubation, and blocking of the glossopharyngeal and superior laryngeal nerves.[4]

Various pharmacological techniques have been tried, including topical and intravenous lignocaine, sympatholytic medications like phentolamine, narcotic agents like nalbuphine, fentanyl, and alfentanil, beta blockers like intravenous labetalol, metoprolol, and esmolol, alpha adrenergic blocking medications like oral and intravenous clonidine, vasodilators like nitrogycerine and hydralazine, calcium channel blockers like diltiazem, and alpha 2 agonists like clonidine and dexmedetomidine have been tried.[5]

The prototype of the amide local anesthetic group is lignocaine, which is an aminoethylamide. Since it is the most widely used local anesthetic and has a membrane stabilizing effect, patients with ventricular ectopics frequently use it as an anti-arrhythmic medication.[6] The use of intravenous (IV) decreased the pressure response to intubation, as demonstrated by Bromage in 1961. Administering 1.5 mg/kg of lignocaine intravenously (IV) prior to induction has been shown to reduce stress reactions during laryngoscopy and intubation.[7]

Magnesium is the second most common cation inside cells and also the fourth most abundant cation overall in the body. Many of the enzyme systems are activated by it. Magnesium sulphate (Mgso4) is a useful medication for reducing the blood pressure (BP) response to tracheal intubation because it suppresses the production of catecholamines from the adrenal medulla and adrenergic nerve endings. Various authors have employed varying dosages of the medication to reduce this reaction to endotracheal intubation.

Numerous research endeavors have been undertaken in an attempt to minimize this stress response, but none have yielded complete success. This study examined the potential of lignocaine and magnesium sulphate (MgSo4) to lessen the negative effects of tracheal intubation and laryngoscopy on blood flow.

AIMS AND OBJECTIVES:

To evaluate and compare the efficacy of lignocaine and magnesium sulphate for attenuating the stress responses to laryngoscopy and endotracheal intubation.

MATERIALS AND METHODS:

Prospective randomised control study was conducted in Sree Mookambika Institute of Medical Sciences, Kulasekharam from January 2023 to December 2023. In total, 50 patients with ASA physical status I and II, aged 18-60 years, and patients scheduled for emergency or elective procedures under GA were included. Patients who were expected to have a difficult intubation, those with an American Society of Anesthesiologists (ASA) physical status of III or higher, those with a history of coronary artery disease (CAD), cardiac arrhythmias, neuromuscular disease, hypomagnesaemia, and elevated intracranial pressure were excluded in the study.

The participants were allocated into two groups of 25, each, using a computer-generated randomized table to pick them. Group L received intravenous lignocaine (2 mg/kg) and Group M received intravenous MgSo4 (30 mg/kg).

Routine tests requested included a complete blood count, a renal function test, serology, chest X-ray, RBS, and ECG. Pre-operative vitals were taken just before taking the patient into the operating room. Injections of Glycopyrrolate (0.01 mg/kg), Midazolam(0.2 mg/kg), and fentanyl (1.0 mcg/kg) were administered intravenously to the patient after the patients were brought into the operating room. Patients received 100% oxygen pre-oxygenation for three minutes following premedication.

Group M was given intravenous MgSo4 (30 mg/kg) gradually diluted in 100ml of normal saline. Intravenous lignocaine (2 mg/kg) was administered to Group L. Ninety seconds before induction, both medications were given. Injections of Propofol (2 mg/kg) were used for induction, and 1.5 mg/kg of succinylcholine was used to ease endotracheal intubation once the mask ventilation was shown to be adequate. Laryngoscopy was performed using a laryngoscope, and a cuffed endotracheal tube of sufficient size was passed while the vocal cords were visualized. The endotracheal tube was secured once it was confirmed that both sides had equal air entry.

Sevoflurane, injection Vecuronium, and 50% nitrous oxide and 50% oxygen were used to maintain anesthesia. During the study period, no surgical or other stimulus was applied. The patient's hemodynamic parameters, which included heart rate (HR), systolic and diastolic blood pressure, mean arterial pressure, and baseline were obtained at layngoscopy, 1, 3, and 5 minutes after intubation, as well as after drug administration. Every patient was monitored for any adverse effects, such as bradycardia, hypotension.

Patients received injections of Glycopyrrolate (0.008 mg/kg) and neostigmine (0.05 mg/kg) to reverse the neuromuscular blockade after surgery. Throughout the procedure, all patients were closely observed, and observations were taken regarding HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) at different points after intubation, post-laryngoscopy, and post-induction at 1, 3, and 5 minutes. Any negative effects brought on by MgSo4 or lignocaine were recorded. Patients were moved to the recovery room following extubation.

SPSS version 20.0 was used for the statistical analysis. To compare different factors between the two groups, the students' independent "t" test was employed. The mean and standard deviation (Mean±SD) of the results were given. The Student t test was used to compare proportions, and the p-value less than 0.05 was considered statistically significant.

OBSERVATION AND RESULTS:

The groups were matched for demographic data, and there was no statistically significant difference found between the groups in age, gender, weight, height, and the mean basal HR, SBP and DBP. (Table 1)

Table 1: Demographic Data and basal vitals among both groups

	Group L	Group M	p value
Age (mean +/- SD)	42.17 ± 4.85	40.08± 6.14	0.243
Gender M/F	15/10	17/8	0.081
Weight (Kg)	67.41 ± 9.82	69.14 ± 11.17	0.112
Height (Mean+/- SD)	166.12± 7.15	169.33± 8.76	0.074
Basal HR (bpm)	73.1 ± 2.98	72.6 ± 2.86	0.412
Basal SBP (mmHg)	122.28 ± 5.92	121.94 ± 6.06	0.093
Basal DBP (mmHg)	79.55 ± 4.32	78.37 ± 4.47	0.188

Any variation from the baseline values was noted when the drug was injected intravenously and after induction, laryngoscopy, and intubation (1 minute, 3 minutes, and 5 minutes). Group M experienced an initial rise in HR following medication delivery, which peaked one minute after intubation and returned to baseline up to five minutes later. After intubation, there was a notable increase in HR in the lignocaine group, and five minutes later, the HR did not return to baseline. After induction, laryngoscopy, and intubation, both the magnesium and lignocaine groups saw a decrease in HR ($p<0.05$). However, the magnesium group experienced a greater reduction in HR than the lignocaine group. (Table 2)

Table 2: Comparison of HR Variation among both groups

	Group L	Group M	p value
Post Induction	81.23 ±6.87	74.44 ±4.13	0.0054
Post Laryngoscopy	85.35 ±6.14	78.13±5.02	0.0001
Post Intubation(1Min)	87.31±6.65	77.35±4.76	0.0001
Post Intubation(3Min)	84.22±5.78	74.23±4.17	0.0001
Post Intubation(5Min)	83.15±6.07	72.89 ±4.08	0.0001

The MgSo4 group experienced a rapid rise in SBP during intubation, which was followed by a prolonged drop in blood pressure starting in the third minute and a return to baseline in the fifth minute. In addition to rising at intervals of one minute following intubation, DBP also returned to baseline upto five minutes later. At 3 and 5 minutes following endotracheal intubation, group M showed a statistically significant decline in systolic blood pressure when compared to group L. ($p<0.05$)

SBP increased in the lignocaine group during induction and after laryngoscopy, and it did not return to baseline five minutes after intubation. Additionally, DBP increased dramatically in the post-intubation interval compared to baseline and returned to baseline five minutes after intubation. At 5 minutes, there was a significant difference in diastolic blood pressure (DBP) across the study groups. ($p<0.05$)

Both groups experienced a notable decrease in MAP; however, the Magnesium group experienced a statistically significant reduction ($p < 0.05$) in comparison to the Lignocaine group. (Table 3)

Table 3: Comparison of MAP Variation between among both groups

	Group L	Group M	p value
Post Induction	85.10 ± 8.98	80.57 ± 8.22	0.0217
Post Laryngoscopy	91.15 ± 8.13	83.34 ± 7.56	0.0105
Post Intubation (1 Min)	88.73 ± 8.47	79.25 ± 7.17	0.0001
Post Intubation (3 Min)	87.56 ± 7.69	78.98± 7.53	0.0001
Post Intubation (5 Min)	86.66 ± 7.93	78.11 ±6.92	0.0001

The incidence of magnesium-related problems such as hypotension, sweating, arrhythmia, nausea, and flushing was monitored until the patients were discharged from the post-anesthesia care unit. In this investigation, no such difficulties were found.

DISCUSSION:

Significant alterations in intracranial pressure and hemodynamics can occur during laryngoscopy and endotracheal intubation, most likely due to the high level of sympathetic nervous system activation. In patients who are at risk of acquiring elevated intracranial pressure, arterial hypertension, and myocardial ischemia, these alterations may be fatal. During laryngoscopy and intubation, airway maintenances result in physiological disruptions that can be harmful to most patients.[9]

The larynx, trachea, and pharynx of the respiratory system are innervated by sympathetic and parasympathetic fibers. Responses to airway stimulation that are defensive in nature include tachycardia, bronchospasm, an increase in intracranial pressure, and a rise in blood pressure. Research has shown that laryngoscopy is the operation that causes an abrupt spike in blood pressure, especially systolic blood pressure, of roughly 20 mmHg. Therefore, intracranial pressure might increase by at least 5 mmHg following even a basic tracheal suction.[10]

Several methods were attempted to reduce these HR reactions, including deep inhalational anesthesia, which has the potential to result in cerebral hypertension. The other method involves giving high doses of thiopental sodium, which can successfully control intracranial and arterial hypertension but has a risk of cardiac depression. Strong vasodilator medications fail to stop tachycardia brought on by laryngoscopy and endotracheal intubation and require higher dosages to lower arterial blood pressure.[11]

The purpose of the current study was to compare and evaluate the effects of magnesium sulfate and lignocaine in two groups. According to the current study, the lignocaine group noticed a considerable increase in HR throughout the post-intubation interval, which did not return to baseline five minutes after intubation. The HR in the MgSO4 group increased at first upon drug administration and peaked one minute after intubation; however, it returned to baseline up to five minutes later and then began to decline after ten minutes. SBP, DBP, and MAP increased in both groups but returned to normal 5 minutes after intubation in the MgSO4 group but not in the lignocaine group. In comparison to the lignocaine group, there was a consistent decrease in HR ($p<0.05$) and a decrease in MAP ($p<0.05$) in MgSo4 group.

This was explained by the observation that calcium plays a significant part in the stimulus-response interaction, which includes the release of catecholamines in response to sympathetic stimulation from the adrenal gland and adrenergic nerve terminals. Magnesium has been referred to as the physiological calcium antagonist because it competes with calcium for membrane channels, which allows it to alter a variety of calcium-mediated reactions. Due to its well-established capacity to prevent catecholamine release, magnesium ions have been explored for use in laryngoscopy and intubation as a means of reducing cardiovascular reactions.[12]

Various authors have used lignocaine and IV MgSo4 at different doses and administration techniques to minimize the hemodynamic response following endotracheal intubation. The effects of IV MgSo4 (30 mg/kg) and lignocaine (2 mg/kg) on the reduction of the pressor response to laryngoscopy and endotracheal intubation were compared by Kasar PN et al.[13] The study also found that until five minutes after intubation, Group 1 patients who administered Mgso4 had a significant declining trend in their recorded HR and MAP. the study concluded that compared to lignocaine, MgSo4 can reduce the stress reaction to laryngoscopy and endotracheal intubation because it possesses vasodilator qualities and considerably suppresses catecholamine release.

Sawan ZH et al.[14] and Vallabha R et al.[15] in their study to compare the efficacy of lignocaine and Mgso4 for attenuating stress reactions to laryngoscopy and endotracheal intubation, the researchers concluded that MgSo4 was a better option to lignocaine for attenuating stress responses to laryngoscopy and intubation.

According to Patta S et al.[16] there was a substantial decrease in HR ($p < 0.05$) after induction, laryngoscopy, and intubation in both the magnesium and lignocaine groups. However, the magnesium group witnessed a greater decrease in HR than the lignocaine group. Both groups also experienced a considerable drop in MAP, but the Magnesium group showed a statistically significant decrease ($p < 0.05$) compared to the Lignocaine group.

Vaghela A et al.[17] noted that during laryngoscopy and intubation, there was an increase in HR and BP in both research groups. Following laryngoscopy and intubation, patients receiving Mgso4 and lignocaine demonstrated good hemodynamic management efficacy and stability in both groups. The study came to the conclusion that MgSo4dosages were sufficient to reduce the reaction of hemodynamics following trachea intubation, with outcomes comparable to lignocaine.

Wadud R et al.[18] observed that HR increased in both the Magnesium and Lignocaine groups, although the rise in the Lignocaine group was significantly greater (p value 0.01). Following drug administration, both groups showed an increase in systolic blood pressure ($p < 0.05$). Participants in group L experienced a much higher increase in SBP than those in group M. ($p < 0.05$). Both groups saw a statistically significant (p 0.01) rise in DBP just after intubation; however, three minutes later, both groups' DBP had recovered to pre-intubation levels ($p = 0.01$).

Addepalli S et al.[19] detected a substantial increase in HR, SBP, DBP, and MAP in both groups at 0 min post-intubation, or just after intubation. MgSo4, as opposed to lignocaine, considerably lessened the rise in HR and SBP from the baseline, post-intubation. Vital signs in the lignocaine group showed a declining tendency but did not significantly drop after five minutes after intubation, whereas SBP and MAP significantly reduced in the Mgso4 group. Only SBP and MAP showed a substantial drop from baseline at 10 min post-intubation in the Lignocaine group, while all vital signs in the MgSo4 group continued to decline.

CONCLUSION:

It has been observed that MgSo4 doses are sufficient to blunt the hemodynamic response to tracheal intubation, with results comparable to Lignocaine. We conclude that the used doses of MgSo4 had good efficacy and stability in achieving hemodynamic control during laryngoscopy and intubation with no observed complications thus being a reliable alternative in controlling the stimulation of upper airway in patients undergoing elective surgeries under General anaesthesia.

Financial Support And Sponsorship:
Nil.

Conflicts Of Interest:
There are no conflicts of interest

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