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Original Article

Efficacy of Intravenous Magnesium Sulphate in Attenuating Hemodynamic Response in Hypertensive Patients to Laryngoscopy and Endotracheal Intubation

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ABSTRACT

Objective: To determine the efficacy of intravenous Magnesium Sulphate in attenuating the hemodynamic response, Systolic Blood Pressure, in hypertensive patients undergoing laryngoscopy and endotracheal intubation compared with a Control Group.

Study Design: Quasi-experimental study.

Place and Duration of Study: Anesthesia Department, Pak Emirates Military Hospital, Rawalpindi Pakistan, from Apr to Oct 2018.

Methodology: A total of 110 diagnosed patients of hypertension, taking anti-hypertensive medication, between 30–65 years of age, belonging to either gender, and undergoing elective surgery were enrolled. Patients were given intravenous Magnesium Sulphate (30 mg/kg) in 20 ml normal saline over a period of 03 minutes before induction of general anesthesia while control Group was given 20 ml of normal saline (placebo). Systolic Blood Pressure for both Groups was recorded on a performa by an observer two minutes after intubation.

Results: The mean age of patients in treatment Group was 43.95±8.39 years and in control Group, 43.84±8.36 years. Out of 110 patients, 41(37.27%) were males and 69(62.73%) were females. The efficacy of MgSO4 was 16(29.09%) and in control Group, it was 04(7.27%) with *p*-value of 0.003(<0.05).

Conclusion: Intravenous Magnesium Sulphate is efficacious in attenuating hemodynamic response to laryngoscopy and intubation in hypertensive patients.

Keywords: Hemodynamic responses, Magnesium sulphate, Tracheal intubation.

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INTRODUCTION

Endotracheal Intubation refers to passing a tube in the trachea to maintain airway by artificial means. A cuff is then usually inflated to ensure positive pressure ventilation, and prevention of gastric contents aspiration.[1] Endotracheal intubation is indicated in severe hypoxemia requiring Positive End Expiratory Pressure, hypercapnia, loss of airway protective reflexes, raised intracranial pressure and facilitation of diagnostic and therapeutic procedures.[2,3] According to WHO, overall prevalence of hypertension in adults aged over 25 years was about 40% in 2008 and is estimated to cause 7.5 million deaths, almost 13% of total deaths.[4]

Endotracheal intubation, being an interventional procedure, causes a series of physiological changes in the human body by triggering sympathetic stimulation.[5] This stimulation results in hemodynamic response in the form of increased heart rate, blood pressure and mean arterial pressure (MAP). These changes may result in intra-operative as well as post-operative complications, particularly in patients with hypertension. Different modalities are used to blunt the hemodynamic changes due to endotracheal intubation such as pharmacological, peripheral blocks and change of techniques like various blades and conduits for intubation.[6,7] Pharmacological methods can include increase in depth of anesthesia, local anesthetics, opioids, alpha-2 agonists, beta-2 blockers and Magnesium Sulphate.8 Magnesium Sulphate acts as a natural calcium-channel blocker, hence, controls arterial hypertension.[9,10] Thus, the aim of this investigation was to elucidate the efficacy of Magnesium Sulphate in preserving cardiovascular homeostasis and attenuating the sympathoadrenal response associated with direct laryngoscopy and endotracheal intubation procedures.

METHODOLOGY

Following clearance of Ethical Review Committee (A/28), the study was carried out at the Anesthesia

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Department, Pak Emirates Military Hospital (PEMH), Rawalpindi Pakistan, from April to October 2018. WHO sample size calculator was used to calculate the sample size with the anticipated population proportion (P1) and (P2) were 28.44% and 7.72% respectively.[11] Nonprobability convenience technique was used for sampling

Inclusion Criteria: Patients undergoing elective surgeries under general anesthesia from both genders with age Group between 30 to 65 years, American Society of Anesthesiologists (ASA) Status II or III, Mallampati Class I or II and diagnosed case of hypertension and on anti-hypertensive medication for last six months were included.

Exclusion Criteria: Pregnant female patients, patients allergic to the drugs being used in our study or with difficult airway for any reason with due to previous comorbidities were excluded.

Patients were randomly allocated to one of two Groups, labelled Group A and Group B, by lottery method on daily basis. Keeping the study protocol in view, the procedure was explained to all the patients included in the study and written, informed consent was taken. Before reporting to operation theatre, a detailed pre-anesthesia assessment was done on all patients and all necessary laboratory investigations were carried out.

On the day of surgery, systolic blood pressure was recorded by noninvasive method. Pulse oximeter and ECG electrodes were attached and 18G IV cannula was passed under aseptic conditions. All patients were pre-medicated with intravenous injections of Nalbuphine 0.1 mg/kg, Dexamethasone 0.08 mg/kg and Metoclopramide 0.1 mg/kg. Patients were pre-oxygenated with 100% oxygen for 3 mins. Induction was done with intravenous injection of Propofol at a dose of 2mg/kg. Muscle relaxation was achieved with 0.5 mg/kg of intravenous injection Atracurium followed by laryngoscopy and intubation by a qualified anesthetist six minutes later.

Patients in Group-A were given intravenous Magnesium Sulphate (30 mg/kg) in 20 ml normal saline over a period of 03 minutes before induction of general anesthesia and in Group-B, 20 ml of normal saline (placebo) was given. Systolic blood pressure was recorded on data collection tool by trainee anesthesiology or anesthesia assistant at 02 minutes after intubation.

Data analyzed using SPSS Version 21. Descriptive statistics were used to calculate quantitative and qualitative variables. Mean and Standard deviation were calculated for quantitative variables, such as, age and weight. If data was not normally distributed, then median was calculated. Frequency and percentages were calculated for qualitative variables like gender, smoking, frequency of disease, systolic blood pressure and efficacy of drug. Chi-square test was performed and *p*-value of ≤0.05 was considered as significant.

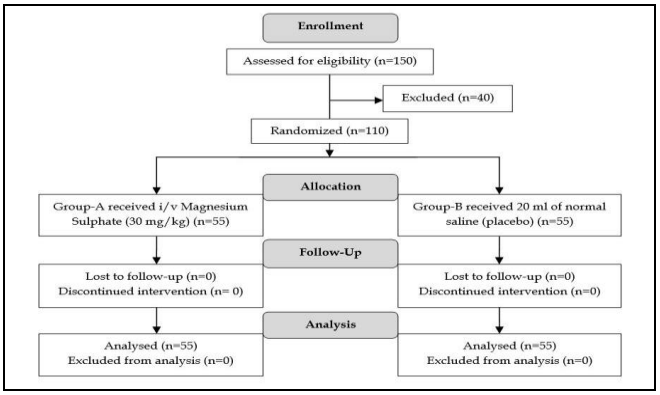

Figure: Patient Flow Diagram (n= 110)

RESULTS

Out of 110 patients, 41(37.27%) were males and 69(62.73%) were females with male to female ratio of 1:1.7. Age range in this study was from 30 to 65 years with mean age of 43.89±8.37 years. The mean age of patients in Group A was 43.95±8.39 years and in Group B was 43.84±8.36 years. Majority of the patients (64, 58.18%) were between 18 to 40 years of age. Mean weight was 84.97±11.62 kg. Mean duration of disease was 4.97±1.62 years. Baseline characteristics along with distribution of patients according to ASA status, SBP, smoking, and type of diagnosis are shown in Table-I.

Efficacy of intravenous magnesium sulphate in Group-A was 16(29.09%) and in Group-B was 04(7.27%) with *p*-value significant at 0.003, as shown in Table-II.

DISCUSSION

Laryngoscopy and intubation, evoke sympathetic activity significantly. Mean arterial pressure and heart rate, can rise suddenly within 30 seconds however usually return within range in 5–10 minutes.[12] Intravenous (IV) magnesium sulphate has shown notable role in reduction of sympathetic response secondary to laryngoscopy and intubation as shown by a study [13] in which percent change in systolic blood

Table-I: Baseline Characteristics (n=110)

Characteristics	Group-A	Group-B
Age (years)		
30-45	32(58.18%)	32(58.18%)
46-65	23(41.82%)	23(41.82%)
Gender		
Male	23(41.82%)	18(32.73%)
Female	32(58.18%)	37(67.27%)
Disease Duration (years)		
≤ 5	37(67.27%)	38(69.09%)
> 5	18(32.73%)	17(30.01%)
Smoker		
Yes	21(38.18%)	20(36.36%)
No	34(61.82%)	35(63.64%)
Diagnosis		
Thyroid	13(23.64%)	11(20%)
Laparotomy	25(45.45%)	26(47.27%)
Cholecystectomy	17(30.91%)	18(37.73%)
American Society of Anesthesiologists Status		
I	25(45.45%)	23(41.82%)
II	30(54.55%)	32(58.18%)
Systolic Blood Pressure (mmHg)		
≤150	31(67.27%)	31(67.27%)
>150	24(32.73%)	24(32.73%)

Table -II: Efficacy of Intravenous Magnesium Sulphate Compared with Placebo (n=110)

		Group A (n=55)	Group B (n=55)	*p*-value
EFFICACY	Yes	16(29.09%)	04(7.27%)	0.03
	No	39(70.91%)	51(92.73%)	

pressure from baseline was significantly raised in controls 2 minutes after laryngoscopy and intubation (28.44% change in Control Group vs 7.72% change in Magnesium Sulphate Group). James *et al*.[14] studied effects of pre-treatment with intravenous Magnesium Sulphate 60 mg/kg body weight, compared to normal saline on hemodynamic responses and catecholamine release associated with endotracheal intubation, reported significant increase in SBP (106.4±3.1 to 145.1±5.6 mmHg) after intubation in Control Group but not in Magnesium Group (from 106.8±3.1 to 110.0±4.4 mmHg). Another study also reported similar observation with the changes in mean arterial pressure (MAP), [15] which decreased significantly (P<0.001) from 91.7±14.5 to 76.2±15.6 mm Hg after administering the study drug in the Magnesium Group in comparison to Control Group (from 92.6±8.7 to 91.5±7.8 mmHg). MAP rise after intubation was observed in both groups, but it was significantly higher (p<0.001) than the baseline in controls (92.6±8.7 mmHg to 109.7±19.6 mmHg) immediately after intubation and (92.6±8.7 mmHg to 104.8±16.6 mmHg) at 3 minutes after intubation as compared to Magnesium Group where the levels were just near baseline (91.7±14.5 mmHg to 92.2±16.5 mmHg) after intubation.

Preoperative administration of magnesium sulfate has demonstrated efficacy in attenuating the hemodynamic response associated with endotracheal intubation and facilitating controlled hypotension during anesthesia, furthermore, this intervention has been observed to reduce the requisite dosages of anesthetic agents, analgesics, and neuromuscular blocking drugs in the intraoperative period.[16] Abbady [17] similarly found a significant rise in heart rate and mean arterial blood pressure value in the placebo batch following laryngoscopy and intubation in comparison to the group which received 50 mg/kg Magnesium Sulfate (P<0.01). Sharma *et al*.[18] recorded similar response of Magnesium Sulfate and Esmolol on mean arterial pressures during tracheal intubation in controlled hypertensive patients (p>0.05). However, they concluded greater increase in heart rate after intubation in Magnesium Sulfate Group, contrary to this study.

Table-III: Association of Efficacy with Duration of Disease and Smoking Between Groups (n=110)

Duration (months)	Group A Efficacy		Group B Efficacy		*p*-value
	Yes	No	Yes	No	
≤5	12(21.81%)	25(45.45%)	02(3.63%)	36(65.45%)	0.003
>5	04(7.27%)	14(25.45%)	02(3.63%)	15(27.27%)	0.412
Smoking					
Yes	07(12.72%)	14(25.45%)	01(1.81%)	19(34.54%)	0.022
No	09(16.36%)	25(45.45%)	03(5.45%)	32(58.18%)	0.050

Based on the observed outcomes, we propose the routine administration of intravenous magnesium sulfate as a prophylactic measure for hypertensive patients undergoing laryngoscopy and endotracheal intubation. This intervention is recommended to mitigate the risk of post-anesthetic complications associated with these procedures.

CONCLUSION

Intravenous Magnesium sulphate is efficacious in reducing the hemodynamic response to laryngoscopy and intubation in hypertensive patients.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

MRH & SAJ: Conception, drafting the manuscript, approval of the final version to be published.

LA & SA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

US & UA: Study design, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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