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Blunting Stress Response During Intubation in Hypertensive Patients; A Comparison Between Lidocaine and Magnesium Sulphate

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ABSTRACT

Objective: To compare blunting of hemodynamic stress response to intubation using Magnesium Sulphate versus Lidocaine in hypertensive patients.

Study Design: Prospective comparative study.

Place and Duration of Study: Anaesthesia Department Combined Military Hospital, Lahore Pakistan, from Jan to Jun 2019.

***Methodology*:** A total of 232 hypertensive patients of the ASA status II, undergoing elective surgical procedures requiring intubation, were randomly divided into two groups, Group-L (Lidocaine) and Group-M (Magnesium Sulphate). Lidocaine 1.5mg/kg was given to Group-L 90 seconds before laryngoscopy, whereas Magnesium Sulphate 30mg/kg was given over ten minutes to Group-M before laryngoscopy. Baseline means arterial pressure was recorded. Mean arterial pressure was subsequently recorded each minute after intubation for five minutes.

Results: Both groups were similar with regard to demographic data. After intubation, both groups had an increase in mean arterial pressures. Blunting of stress response was observed in 78 patients (67.2%) in Group-L and 55 patients (47.4%) in Group-M. Two groups showed a significant statistical difference (p=0.003).

Conclusion: Both drugs are effective in blunting hemodynamic stress response to intubation in hypertensive patients, but Lidocaine is more effective than Magnesium Sulphate.

Keywords: Hemodynamic stability, Hypertensive patients, Lidocaine, Magnesium Sulphate, Stress response, Tracheal intubation.

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INTRODUCTION

Anaesthesia has evolved by leaps and bounds in the past few decades and has become safer than ever. Despite all the advancements in the field of anaesthesiology, it is not complication free. Cardiovascular complications are among the major causes anaesthesia-related morbidity and mortality.[1]

Many drugs have been tried to blunt the stress response produced during laryngoscopy and intubation. These include Lidocaine, Esmolol, Magnesium Sulphate, Clonidine, Dexmedetomidine, Pregabalin and many others.[2,3] Magnesium Sulphate has depressing effects on the central nervous system. It blocks peripheral neuromuscular transmission and reduces the release of acetylcholine by the motor end plate. In the myocardium, it slows down the impulse rate of the sinoauricular node, which prolongs the conduction time.[4] It also alters the movement of different ions in and out of the cells, including sodium, calcium and potassium. This action stabilizes membrane excitability.[5] It attenuates the stress response by inhibiting the release of catecholamines from the adrenal medulla. It also decreases the raised circulating norepinephrine.[6] Magnesium Sulphate also antagonizes the calcium ions in vascular smooth muscles, resulting in coronary and systemic vasodilation.[7]

Lidocaine is a sodium channel blocker and belongs to the amide group of local anaesthetics. It is the most commonly used local anaesthetic. It also has antiarrhythmic properties and is classified as a class Ib group of antiarrhythmic drugs. Once given in proximity to neural tissue, transiently can produce loss of motor, sensory, and autonomic functions. Therefore, Lidocaine infusion has been used for supplementation of general anaesthesia. Up to 40% reduction in the minimum alveolar concentration of volatile anaesthetics has been reported with lignocaine infusion. Lignocaine infusion is also used for postoperative and chronic pain relief.[8] Lidocaine, when used intravenously, has antagonistic action on sodium channels and N-methyl-d-aspartate (NMDA) receptors, reduces the release of substance P8 and has glycinergic action, which decreases the airway reactivity.[9]

The rationale of this study was to compare the blunting of stress response to intubation with

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Lidocaine versus Magnesium Sulphate in hypertensive patients undergoing elective surgeries. Literature has reported that laryngoscopy and intubation may develop hemodynamic fluctuations, and hemodynamic instability may lead to the sudden death of a patient, which may be controlled by administering Lidocaine or Magnesium Sulphate. Locally both drugs are in the current practice of anaesthesiologists, but unfortunately, no comparative studies have been carried out regarding blunting response of both of these drugs. This study aimed to compare the results of Magnesium Sulphate and Lidocaine on mean arterial pressure during intubation in hypertensive patients.

METHODOLOGY

This study was a prospective comparative study conducted at the Department of Anesthesiology Combined Military Hospital, Lahore Pakistan, from January to June 2019 after taking approval from the Ethical Review Board (ERC ref no. 1325/2019/Trg/Adm). The sample size was calculated with the help of the WHO sample size calculator by keeping the confidence level at 95%, power at 80%, anticipated population proportion-1 (P1) at 54%, and population proportion-2 (P2) at 36%.[10] The sample size in each group was 116 with a total sample size of 232.

Inclusion Criteria: All patients aged 20 to 70 years with controlled hypertension undergoing elective surgeries were included in the study (controlled hypertension was taken as systolic BP<140 mmHg and diastolic BP<90 mmHg).

Exclusion Criteria: Patients with co-morbid conditions (coronary artery disease, cardiac arrhythmias, cerebrovascular accident, chronic renal failure with serum creatinine >1.5mg/dL), patients with anticipated difficult airway and cases in which laryngoscopy had taken over 15 seconds or not succeeded the first time were excluded from this study.

Non-probability consecutive sampling technique was used to select the patients for this study. Patients were randomly segregated into two groups following the lottery method. Informed consent for participation in this study was taken from each patient.

Demographic information was obtained, including name, age, gender, height and weight. Patients were divided into two groups using the lottery method, with 116 patients in each group. All patients had their routine antihypertensive medication continued till surgery. Intraoperative monitoring of patients included heart rate, non-invasive blood pressure, temperature, pulse-oximetry and electrocardiography. An intravenous (IV) line was secured, and the patients were administered Ringer's lactate intravenously. In addition, IV Midazolam 2 mg and IV Nalbuphine 0.1mg/kg were administered. Baseline mean arterial pressure (non-invasive) and oxygen saturation were measured after premedication.

The general anaesthesia technique was standardized for both groups. In Group-M patients were given IV Magnesium Sulphate 30mg/kg as an infusion over ten minutes before the anaesthetic induction. Next, patients were induced with IV Propofol 2mg/kg, and after the loss of consciousness; IV Atracurium 0.5 mg/kg was given. Group-L patients were administered IV 2% Lidocaine 1.5 mg/kg 90 seconds before laryngoscopy. Following laryngoscopy and endotracheal intubation, MAP was recorded non-invasively every minute during the first five successive minutes.

Anaesthesia was maintained with Isoflurane and Oxygen. Muscle relaxation was maintained with IV atracurium 0.1 mg/kg. After surgery, the effect of muscle relaxation was reversed with IV Neostigmine 0.04-0.05 mg/kg and IV Glycopyrrolate 0.01 mg/kg. After adequate recovery, patients were shifted to the post-anaesthesia care unit and monitored before shifting to the ward. The results were analyzed at the end of the study. Blunting of stress response was taken to prevent an increase baseline MAP by more than 20%.

Statistical Package for Social Sciences (SPSS) version 20.0 was used for the data analysis. Quantitative variables like age, BMI and duration of hypertension were measured in the form of mean±SD. Qualitative variables like gender and blunting of stress response were measured in the form of frequency and percentages. Chi-square test was applied to find out the association. The *p*-value of ≤0.05 was set as the cut-off value for significance.

RESULTS

A total of 232 patients were evaluated. Both groups were similar with regard to demographic data. A detailed comparison of the demographic and clinical data of both groups was shown in Table-I.

After intubation, both groups had an increase in mean arterial pressures. Blunting of stress response was observed in 78 patients (67.2%) of Group-L and 55 patients (47.4%) of Group-M. Statistically significant difference was seen between the two groups (p=0.003) (Table-II).

Table-I: Demographic and Clinical Characteristics of Patients (n=232)

Parameters	Group- L (Lidocaine) (n=116)	Group-M (Magnesium Sulphate) (n=116)	*p*-value
Age (Years)	50.60±7.96	49.45±8.94	0.303
Gender			
Male Female	64 (55.2%) 52 (44.8%)	56 (48.3%) 60 (51.7%)	0.360
Body Mass Index (Kg/m2)	24.57±2.85	25.16±3.43	0.154
Duration of hypertension (Years)	2.96±1.97	2.65±1.73	0.205
Baseline Mean arterial pressure (mmHg)	96.01±11.87	98.98±12.25	0.062

Table-II: Comparison for Blunting of Stress Response (n=232)

Blunting of Stress Response	Group-L (Lidocaine) n(%)	Group-M (Magnesium Sulphate) n(%)	*p*-value
Yes	78(67.3%)	55(47.5%)	0.003
No	38(32.7%)	61(52.5%)	
Total	116(100%)	116(100%)	

DISCUSSION

Lidocaine and Magnesium Sulphate has been successfully used for blunting stress response provoked by laryngoscopy and intubation. In this study, both drugs showed the blunting of the stress response; however, Lidocaine proved superior to Magnesium Sulphate in hemodynamic stability in patients with hypertension. Reid and Brace first described the hemodynamic changes secondary to laryngoscopy and intubation.[11] On average, there is about a 40% to 50% rise in blood pressure and about a 20% increase in heart rate due to a sympathetic outburst during laryngoscopy. The hemodynamic response is produced within seconds of laryngoscopy and increases with the passage of the endotracheal tube and usually peaks in two minutes and returns to baseline in five minutes. These changes are usually short-lived and well-tolerated by normal patients. However, in patients with cardiovascular disease, it can produce detrimental effects such as myocardial ischemia, ventricular arrhythmias, ventricular failure and pulmonary oedema. It can also lead to cerebrovascular accidents in hypertensive patients with cerebrovascular disease.[12] Various drug including β-blockers such as Labetalol,[13] and Esmolol,[14] Opioids, Lidocaine,[15,16] Nitroglycerine, alpha adrenergic agonists such as Clonidine,[17] and dexmedetomidine,[17] calcium channel blockers such as Diltiazem,[18] and have been used for obtunding the stress response. Lidocaine, whether given intravenously or through an endotracheal tube, successfully prevents the rise in blood pressure but fails to prevent the rise in heart rate. According to a study done by Mahajan *et al*.[19] Magnesium Sulphate and Dexmedetomidine significantly decreased hemodynamics rather than maintaining stability. However, this was studied in normotensive patients only. Magnesium Sulphate also obtunds hemodynamic response to pneumoperitoneum.[20,21]

The results of our study were similar to a local study done by Waseem SHM *et al*. which concluded that Lidocaine was more effective in controlling stress response to intubation than Magnesium Sulphate.[10] Contrary to this, Hossain *et al*.[22] and Batata *et al*,[23] concluded that Magnesium Sulphate was superior to Lidocaine with respect to MAP control.

A study conducted by Puri *et al*,[24] observed the effects of Lidocaine and magnesium sulfate in coronary artery disease patients undergoing coronary artery bypass grafting (CABG) and found better stability with Magnesium Sulphate. Padmawar *et al*. again showed that Magnesium Sulphate was superior in controlling blood pressure but resulted in increased heart rate.[25] These varying results can be related to lower doses of Magnesium Sulphate where it produced a favourable response. Puri *et al*. used Magnesium Sulphate 50 mg/kg, and Padmawar et al. used 40 mg/kg. Panda *et al*. studied three doses of 30, 40, and 50 mg/kg of Magnesium Sulphate in hypertensive patients and concluded that 30mg/kg was the optimal dose. Higher doses produced significant episodes of hypotension requiring intervention. We used 30mg/kg in our study since there is added risk of hypotension in patients taking antihypertensive medications.

CONCLUSION

Both drugs are effective in blunting hemodynamic stress response to intubation in hypertensive patients, but Lidocaine is more effective than Magnesium Sulphate.

Conflict of Interest: None.

Author's Contribution

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

RF: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

AH: Conception, Study design, drafting the manuscript, approval of the final version to be published.

MN: Data interpretation, 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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