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A DESCRIPTIVE STUDY OF EFFECT OF MAGNESIUM SULFATE IN ATTENUATING ARTIRIAL BLOOD PRESSURE IN ELECTIVE LAPAROSCOPIC SURGERIES

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Abstract

Introduction: Laparoscopic surgery has become the standard procedure for many surgical pathologies. However, the physiological effects of pneumoperitoneum are of concern. The creation of pneumoperitoneum with carbon dioxide (CO2) produces unique haemodynamic challenge for the anaesthetic management of patients. The increased intra-abdominal pressure during pneumoperitoneum together with the head-up tilt leads to alterations in cardiovascular, respiratory, stress response and acid base physiology. The changes in cardiovascular system associated with pneumoperitoneum includes an increase in mean arterial pressure, decrease in cardiac output and increase in systemic vascular resistance which can lead to altered tissue perfusion.

Materials and Methods: 200 ASA I or II patients undergoing laparoscopic abdominal surgery were enrolled into the study carried out by department of Anaesthesiology with exclusion criteria's like known allergies, patients having cardiovascular, asthma, kidney diseases, higher BMI etc. Patients were randomly divided into two groups according to computer generated randomization table. A patient received one of these solutions as a bolus intravenously 5 minutes after intubation but before pneumoperitoneum was created**.**

Results: The mean of patients' age, weight and height were calculated between the two groups andwere tabulated as shown below. Thus, it was concluded on the basis of the p value that thedistribution of age, weight and height among the two groups were comparable and thesefactors did not have any influence on outcome.There was no significant difference in the base line pulse rate, systolic, diastolic and mean arterial pressure.

Conclusion: In our study, we conclude that IV magnesium sulphate, when given before pneumoperitoneum attenuates arterial pressure increase during elective laparoscopic abdominal surgeries. This attenuation is apparently related to reductions in the release of catecholamine, vasopressin or both by magnesium sulphate.

Key Words: Laparoscopic surgery, magnesium sulphate, carbon dioxide, asthma, kidney diseases.

INTRODUCTION

For many surgical diseases, laparoscopic surgery has become the conventional treatment. The physiological repercussions of pneumoperitoneum, on the other hand, are cause for concern. The formation of pneumoperitoneum with carbon dioxide (CO2) presents a unique haemodynamic problem for patient anaesthesia management. The increased intra-abdominal pressure caused by pneumoperitoneum, combined with the head-up tilt, causes changes in cardiovascular, respiratory, stress, and acid-base physiology. Pneumoperitoneum causes alterations in the cardiovascular system such as an increase in mean arterial pressure, a decrease in cardiac output, and an increase in systemic vascular resistance, which can lead to altered tissue perfusion.

Magnesium inhibits catecholamine release from both adrenergic nerve terminals and the adrenal gland. Furthermore, magnesium causes vasodilation by acting directly on blood vessels, and high dose magnesium has been shown to reduce vasopressin-stimulated vasoconstriction and normalise vasopressin sensitivity.

The reverse trendelenberg position, which is employed in laparoscopic cholecystectomy, also causes reduced venous return, which causes adverse cardiovascular reaction. Furthermore, substantial haemodynamic alterations can endanger patients, especially those with reduced heart function. As a result, many medicines are explored to reduce the deleterious cardiovascular response during pneumoperitoneum, including opioid vasodilators, beta blocking agents, and alpha-2adrenergic agonists, but each has its own set of side effects and disadvantages. Although there has not been much research done utilising magnesium sulphate alone, magnesium sulphate has recently attracted attention for the same. Magnesium has the ability to inhibit catecholamine release from both the adrenal gland and adrenergic nerve terminals. Apart from that, magnesium can produce vasodilatation by acting directly on blood vessels and is also capable of attenuating vasopressin stimulated vasoconstriction. Intravenously administered magnesium sulphate is capable of attenuating the adverse hemodynamic responses associated with endotracheal intubation also.

The purpose of the present research was evaluating the effects of magnesium sulphate on arterial blood pressure in cases of elective laparoscopic surgeries.

MATERIALS AND METHODS

Study Design: A Descriptive study.

Study location: Department of Anaesthesia, Balaji Medical College, Chennai.

Study duration: June 2013 to November 2013.

200 ASA I or II patients undergoing laparoscopic abdominal surgery were enrolled into the study carried out by department of Anaesthesiology with exclusion criteria’s like known allergies,

patients having cardiovascular, asthma, kidney diseases, higher BMI etc. Patients were randomly divided into two groups according to computer generated randomization table. A patient received one of these solutions as a bolus intravenously 5 minutes after intubation but before pneumoperitoneum was created**.**

Group A: (Magnesium group) received magnesium sulphate 50 mg/kg 5 minutes after intubation over a period of 5 minutes diluted in normal saline to total volume 20ml @ 240 ml/hr through infusion pump but before pneumoperitoneum was created.

Group B: (control group) received 20 ml of normal saline @ 240 ml/hr through infusion pump 5 minutes after intubation over a period of 5 minutes but before pneumoperitoneum was created.

All patients received premedication injection midazolam 0.02 mg/kg, injection fentanyl 2 μg/kg, and injection Glycopyrolate 4 μg/kg body weight intravenous. Patients were pre-oxygenated with 100% O2 for 3 minutes before induction. Induction was done with Inj.Propofol 2 mg/kg body weight i.v in both the groups and injection. Anesthesia was maintained with oxygen and nitrous oxide mixture 50:50, sevoflurane end- tidal 1.5 to 2.5% and rocuronium 0.2 mg/kg intermittent boluses. During surgery ringer lactate was infused in accordance with deficit, maintenance and blood loss. CO2 pneumoperitoneum was created and intra-abdominal pressure maintained between 12-14 mm Hg. Patients were ventilated mechanically. Tidal volume and respiratory rate were adjusted to maintain end-tidal CO2 between 35-45mm Hg. Monitoring of HR, SBP, DBP, MBP, SpO2, ETCO2 and TOF was done on a multichannel monitor and TOF monitor. All patients were given injection ondanseteron 4mg, injection diclofenac sodium 75mg intravenous towards the end of surgery.

Data analysis was done with the help of SPSS Software 25.0. Quantitative data is presented with the help of Mean, Std Dev, Median and IQR, comparison between study groups is done with the help of Unpaired t-test or Mann-Whitney test as per results of Normality test. P-value less than 0.05 is taken as significant level.

RESULTS

Parameter	Group A	Group B	P Value
Age (years)	36.90 ± 10.26	37.16 ± 8.41	0.182
Weight (Kgs)	58.15 ± 7.50	60.30 ± 8.02	0.224
Height (cms)	155.60 ± 6.50	161.60 ± 7.20	0.175

Table 1: Patient demographic characteristics

The mean of patients' age, weight and height were calculated between the two groups and were tabulated as shown below. Thus, it was concluded on the basis of the p value that the distribution of age, weight and height among the two groups were comparable and these factors did not have any influence on outcome.

Parameter	Group A (Mean ±SD)	Group B (Mean ±SD)	P value
Pre induction HR	72.10±6.30	72.10±5.20	0.7651
Post induction HR	73.15±6.31	74.00±6.25	0.2281
HR 5 min	73.10±5.20	74.10±5.20	0.2297
HR 30 min	73.10±6.21	72.12±5.13	0.2709
Pre induction SBP	123.12±10.10	123.10±11.15	0.8365
Post induction SBP	120.10±10.14	122.12±11.12	0.8865
Systolic BP at 5 min	123.00±9.12	122.10±9.30	0.8265
Systolic BP at 20 min	123.13±13.15	127.23±13.35	0.8165
Pre induction DBP	75.10±6.14	84.14±6.10	<0.001
Post induction DBP	77.12±5.10	80.00±6.00	<0.001
DBP 5 min	72.02±6.03	79.02±6.12	<0.001
DBP 30 min	75.10±6.10	75.20±6.10	<0.001

Table 2: Comparison of heart rate, systolic blood pressure, diastolic blood pressure at different points of time between group A and Group B.

There was no significant difference in the base line pulse rate, systolic, diastolic and mean arterial pressure.

DISCUSSION

Several drugs and regimes are often used to attenuate the hemodynamic stress response to pneumoperitoneum in laparoscopic surgery but there was not much study done yet using magnesium sulphate alone.

Magnesium has the ability to block the release of catecholamines from both the adrenal gland and adrenergic nerve terminals. Apart from that, magnesium can produce vasodilatation by acting directly on blood vessels and is also capable of attenuating vasopressin stimulated vasoconstriction. Intravenously administered magnesium sulphate is capable ofattenuating the adverse hemodynamic responses associated with endotracheal intubation also. New algorithms have been studied in the pursuit for a more sensitive and specificassessment of intraoperative analgesia, such as monitoring the surgical plethysmography index, which may be a valuable tool in future studies for more validated assessment ofmagnesium sulphate analgesia.

In our study, we evaluate whether magnesium sulphateadministration before pneumoperitoneum attenuates increases in arterial pressure during CO2pneumoperitoneum in patients under general anaesthesia. In our study, the systolic BPmeasurements were compared between Intervention groups and Control groups at pre-induction, post-induction at 5 mins, 10 mins, 20 mins and 30 mins post-induction.

It wasfound that the mean systolic BP in Intervention group was lower compared to Control groupafter intubation, which was statistically significant. In a study by Jee et al, magnesium

sulphate 50 mg/kg was administered over 2-3 mins before pneumoperitoneum in patientsundergoing laparoscopic cholecystectomy was found to effectively attenuate the effects ofpneumoperitoneum by decreasing the systolic BP. In that study, they compared the arterialpressure and heart rate at different time periods and found to have significant increase insystolic BP and diastolic BP in Control group compared to Intervention group.

In our study,the diastolic BP was also compared between Intervention and Control groups at 5 mins, 10mins, 20 mins and 30 mins and it was found that the diastolic BP in Intervention group waslower compared to Control group which was statistically significant. In a study by Kalra et al, they compared clonidine and magnesium sulphate in attenuating haemodynamic responseto pneumoperitoneum. They found that both clonidine and magnesium were effective inreducing systolic BP and diastolic BP in Intervention group compared to Control groupwhich was statistically significant. Hence, both the drugs were effective in decreasing stressresponse by reducing systolic and diastolic BP.

CONCLUSION

According to our findings, IV magnesium sulphate given before to pneumoperitoneum reduces arterial pressure increase during elective laparoscopic abdominal procedures. This attenuation appears to be connected to magnesium sulphate-induced decreases in catecholamine, vasopressin, or both.

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