

ORIGINAL RESEARCH

**A DESCRIPTIVE STUDY OF EFFECT OF MAGNESIUM
SULPHATE IN ATTENUATING ARTERIAL BLOOD
PRESSURE IN ELECTIVE LAPAROSCOPIC SURGERIES:
AN ORIGINAL RESEARCH**

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ABSTRACT

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

Methodology: 200 patients who underwent laparoscopic abdominal surgery were randomly divided in to two groups, group A and group B. Group A received magnesium sulphate 50 mg/kg diluted in normal saline to total volume of 20 ml at 240 ml/hour over 5 minutes. The control group (group B) received same amount of normal saline (20 ml).

Results: The baseline characteristics of the magnesium sulphate and Control groups were comparable and there was no significant difference between the groups. Systolic and Diastolic BP were higher in Control group than magnesium group. There was no significant difference in sedation levels in both groups.

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.

Keywords: magnesium sulphate, normal saline, Blood pressure.

INTRODUCTION

Opioids have been used as analgesic components of anesthesia,¹ especially after the development of fentanyl in 1959.² Subsequently, other synthetic opioids, such as alfentanil, sufentanil and remifentanil, were launched with the expansion of the group.³ Over time, several side effects related to opioids have been added, such as hyperalgesia⁴ and delayed

return of bowel motility, in addition to suspicion of facilitating growth and spread of tumor cells.⁵ These drawbacks stimulated the investigation of new options for perioperative analgesics.⁶ Magnesium sulphate has been reported as a valuable adjunct agent in anesthesia, improving the intraoperative analgesic profile, reducing postoperative hyperalgesia, nausea, vomiting, and the consumption of perioperative analgesics.⁷ Laparoscopic cholecystectomy was first performed by Phillippe Mouret in 1987.⁸ Since then, this procedure has become prevalent worldwide because of its benefits compared to open cholecystectomy that includes reduced tissue trauma, reduced postoperative morbidity, reduced hospital stay and thereby reduced healthcare costs. For laparoscopic cholecystectomy, carbon dioxide is commonly used to create pneumoperitoneum.⁹ Both carbon dioxide and pneumoperitoneum cause adverse cardiovascular effects characterized by abrupt elevation of arterial pressure, systemic vascular resistance, and decreased cardiac output.¹⁰ These vasopressor responses are mainly due to increased release of catecholamines, vasopressin, or both.¹¹ Adverse cardiovascular response is also secondary to decreased venous return caused by reverse trendelenberg position, which is used in laparoscopic cholecystectomy.¹² Moreover, severe haemodynamic changes can put patients at risk, especially for patients with compromised cardiac function.¹³ Hence, various drugs are tried to attenuate the adverse cardiovascular response during pneumoperitoneum, namely, opioids vasodilators, beta blocking agents, and alpha-2adrenergic agonists but all have their own side effects and drawbacks.¹⁴ Recently magnesium sulphate has gained attention for the same although there is not much study done yet using magnesium sulphate only. Magnesium has the ability to block the release of catecholamines from both the adrenal gland and the adrenergic nerve terminals.¹⁵ Apart from that, magnesium can produce vasodilatation by acting directly on blood vessels and is also capable of attenuating vasopressin stimulated vasoconstriction.¹⁶ Intravenously administered magnesium sulphate is capable of attenuating the adverse hemodynamic responses associated with endotracheal intubation also.¹⁷

AIM OF THE PRESENT STUDY

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

METHODOLOGY

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 ondansetron 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. Qualitative data is presented with the help of Frequency and Percentage table, association among study group is assessed with the help of Chi-Square test. p-value less than 0.05 is taken as significant level.

RESULTS

Two groups of 100 each were labelled as Group A (magnesium sulphate 50 mg/kg)- Intervention group and Group B (Normal Saline 20 mL)- Control group. (Table 1)

Table 1- Patient demographic characteristics

Parameter	Group A	Group B	P value
Age (years)	36.97 ± 10.66	37.16 ± 8.41	0.1803
Weight (Kgs)	59.10 ± 7.59	61.33 ± 8.10	0.2234
Height (cms)	156.68 ± 6.59	160.68 ± 7.24	0.1741

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. (Table 2)

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

Parameter	Group A (Mean ±SD)	Group B (Mean ±SD)	P value
Pre induction HR	73.17±6.37	72.16±5.28	0.7651
Post induction HR	73.28±6.50	74.10±6.31	0.2281
HR 5 min	74.17±5.37	74.16±5.30	0.2297
HR 30 min	73.17±6.37	72.16±5.28	0.2709
Pre induction SBP	123.56±10.54	124.56±12.54	0.8365
Post induction SBP	120.46±10.34	122.46±11.34	0.8865
Systolic BP at 5 min	123.77±9.54	123.77±9.54	0.8265
Systolic BP at 20 min	123.56±13.54	127.56±13.54	0.8165
Pre induction DBP	75.36±6.38	84.36±6.38	<0.001

Post induction DBP	77.39±6.30	80.39±6.30	<0.001
DBP 5 min	72.37±6.38	79.37±6.38	<0.001
DBP 30 min	75.40±6.39	75.40±6.39	<0.001

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

DISCUSSION

Attenuation of the circulatory response to pneumoperitoneum is usually done by opioids, vasodilators, beta blocking agents, and alpha2 adrenergic agonists.¹⁰ 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.¹⁴ Apart from that, magnesium can produce vasodilatation by acting directly on blood vessels and is also capable of attenuating vasopressin stimulated vasoconstriction.^{15,16} Intravenously administered magnesium sulphate is capable of attenuating the adverse hemodynamic responses associated with endotracheal intubation also.¹⁷ New algorithms have been studied in the pursuit for a more sensitive and specific assessment of intraoperative analgesia, such as monitoring the surgical plethysmography index,¹⁸ which may be a valuable tool in future studies for more validated assessment of magnesium sulphate analgesia. In our study, we evaluate whether magnesium sulphate administration before pneumoperitoneum attenuates increases in arterial pressure during CO2 pneumoperitoneum in patients under general anaesthesia. In our study, the systolic BP measurements 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 was found that the mean systolic BP in Intervention group was lower compared to Control group after intubation, which was statistically significant. In a study by Jee et al,¹⁹ magnesium sulphate 50 mg/kg was administered over 2 - 3 mins before pneumoperitoneum in patients undergoing laparoscopic cholecystectomy was found to effectively attenuate the effects of pneumoperitoneum by decreasing the systolic BP. In that study, they compared the arterial pressure and heart rate at different time periods and found to have significant increase in systolic 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, 10 mins, 20 mins and 30 mins and it was found that the diastolic BP in Intervention group was lower compared to Control group which was statistically significant. In a study by Kalra et al,²⁰ they compared clonidine and magnesium sulphate in attenuating haemodynamic response to pneumoperitoneum. They found that both clonidine and magnesium were effective in reducing systolic BP and diastolic BP in Intervention group compared to Control group which was statistically significant. Hence, both the drugs were effective in decreasing stress response by reducing systolic and diastolic BP. In one study, Jean LJ et al.²¹ concluded that the raise in systemic vascular resistance was due to vasopressin and catecholamines, which were produced after pneumoperitoneum. They used clonidine before pneumoperitoneum and found that it reduced release and attenuated haemodynamic changes during laparoscopy. Another study by Ishizaki et al tried to evaluate the safe intra-abdominal pressure during

laparoscopic surgery. They observed significant fall in cardiac output at 16 mmHg of intra-abdominal pressure. Haemodynamic alterations were not observed at 12 mmHg of intra-abdominal pressure. Based on all these observations, the current recommendation is to monitor intra-abdominal pressure and to keep it as low as possible within 10 - 12 mmHg. In one study, Doyle²² gave antenatal magnesium sulphate therapy to women at risk of preterm birth. He established the effect of magnesium sulphate as a neuroprotective agent when given antenatally to women at risk of preterm birth. Yosry¹⁶ in one study compared magnesium sulphate and sodium nitroprusside to induce controlled hypotension and to reduce choroidal blood flow during choroidal melanoma resection. Magnesium sulphate reduces intra-operative arterial pressure and provided good surgical conditions.

CONCLUSION

In our study, we investigated whether magnesium sulphate attenuates haemodynamic stress response to pneumoperitoneum during laparoscopic abdominal surgeries. The systolic and diastolic blood pressure increased abruptly after creation of pneumoperitoneum. The increase in arterial pressure was sustained during pneumoperitoneum in Control groups.

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