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Assessment of magnesium sulphate on decreasing hemodynamic stress responses during laparoscopic abdominal surgeries

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Abstract
Anaesthesia and surgery induced stress response can be modulated by premedication drugs. Magnesium blocks release of catecholamine from both adrenergic nerve terminals and adrenal gland. Intravenous magnesium sulphate inhibits catecholamine release associated with intubation. Magnesium also produces vasodilatation by acting directly on blood vessels, and in high doses, attenuates vasopressin mediated vasoconstriction. The objective of this study is to compare the influence of magnesium sulphate premedication on stress attenuation during laparoscopic abdominal surgery.
The study is conducted in HIMS in Department of Anaesthesia. Total 50 patients having are group of 40-58 year were enrolled in to the study. As per the classification of the American Society of Anesthesiologists I and II physical conditions posted for lower abdominal surgeries were enrolled on to the study. The enrolled 50 patients were divided in 2 groups. The Group-A patients includes the 25 patients & Group- B patients includes the 25 patients. The patients in group A received magnesium sulphate while those in group B received normal saline.
In the group a administered with the magnesium sulphate had same pulse rate as compared to normal saline administered patients. The Systolic Blood Pressure, Diastolic Blood Pressure and Mean Arterial Pressure was found to lower in group A administered with the magnesium sulphate.
The magnesium sulphate attenuated hemodynamic and Neuro endocrine stress response of General anaesthesia. The magnesium sulphate administered group showed better intra operative stability and blood glucose control on comparison to saline administered group. During laparoscopic abdominal surgeries magnesium sulphate have effectively modulated Neuro endocrine stress response of general anaesthesia as analysed by blood pressure parameters.

Keywords: magnesium sulphate, hemodynamic responses, anaesthesia, laparoscopy, abdominal surgeries etc.

Introduction

Laparoscopy is an operation performed in the abdomen or pelvis through small incisions (usually 0.5–1.5 cm) with the aid of a camera. The laparoscope aids diagnosis or therapeutic interventions with a few small cuts in the abdomen [1]. There are a number of advantages to the patient with laparoscopic surgery versus an open procedure. These include reduced pain due to smaller incisions and hemorrhaging, and shorter recovery time.

Laparoscopic surgery, also called minimally invasive surgery (MIS), bandaid surgery, or keyhole surgery, is a modern surgical technique in which operations are performed through small incisions (usually 0.5–1.5 cm) elsewhere in the body.

There are a number of advantages to the patient with laparoscopic surgery versus the more common, open procedure. Pain and hemorrhaging are reduced due to smaller incisions and recovery times are shorter. The key element in laparoscopic surgery is the use of a laparoscope, a long fiber optic cable system which allows viewing of the affected area by snaking the cable from a more distant, but more easily accessible location.

Laparoscopic surgery includes operations within the abdominal or pelvic cavities, whereas keyhole surgery performed on the thoracic or chest cavity is called thoracoscopic surgery. Specific surgical instruments used in a laparoscopic surgery include: forceps, scissors, probes, dissectors, hooks, retractors and more. Laparoscopic and thoracoscopic surgery belong to the broader field of endoscopy.

In certain advanced laparoscopic procedures, where the size of the specimen being removed would be too large to pull out through a trocar site (as would be done with a gallbladder), an incision larger than 10 mm must be made. The most common of these procedures are removal of all or part of the colon (colectomy), or removal of the kidney (nephrectomy). Some surgeons perform these procedures completely laparoscopically, making the larger incision toward the end of the procedure for specimen removal, or, in the case of a colectomy, to also prepare the remaining healthy bowel to be reconnected (create an anastomosis). Many other surgeons feel that since they will have to make a larger incision for specimen removal anyway, they might as well use this incision to have their hand in the operative field during the procedure to aid as a retractor, dissector, and to be able to feel differing tissue densities (palpate), as they would in open surgery. This technique is called hand-assist laparoscopy. Since they will still be working with scopes and other laparoscopic instruments, CO_2 will have to be maintained in the patient's abdomen, so a device known as a hand access port (a sleeve with a seal that allows passage of the hand) must be used. Surgeons who choose this hand-assist technique feel it reduces operative time significantly versus the straight laparoscopic approach. It also gives them more options in dealing with unexpected adverse events (e.g. uncontrolled bleeding) that may otherwise require creating a much larger incision and converting to a fully open surgical procedure.

There are two types of laparoscope [2].

- a telescopic rod lens system, usually connected to a video camera (single chip or three chip)
- a digital laparoscope where a miniature digital video camera is placed at the end of the laparoscope, eliminating the rod lens system

The mechanism mentioned in the second type is mainly used to improve the image quality of flexible endoscopes, replacing traditional fiberscopes. Nevertheless, laparoscopes are rigid endoscopes. The rigidity is required in clinical practice. The rod-lens based laparoscopes dominate overwhelmingly in practice, due to their fine optical resolution (50 µm typically, dependant on the aperture size used in the objective lens), and the image quality can be better than that of the digital camera if necessary. The second type of laparoscope is very rare in the laparoscope market and in hospitals.

Also attached is a fiber optic cable system connected to a "cold" light source (halogen or xenon), to illuminate the operative field, which is inserted through a 5 mm or 10 mm cannula or trocar. The abdomen is usually in sufflated with carbon dioxide gas. This elevates the abdominal wall above the internal organs to create a working and viewing space. CO_2 is used because it is common to the human body and can be absorbed by tissue and removed by the respiratory system. It is also non-flammable, which is important because electrosurgical devices are commonly used in laparoscopic procedures [3].

Stress attenuation is of high relevance to anaesthesiologist. Stress response can be attenuated by various premedications and anaesthetic techniques. Pharmacological agents are used to improve outcome and decrease surgical stress.

Anaesthesia and surgery induced stress response can be modulated by premedication drugs. Magnesium blocks release of catecholamine from both adrenergic nerve terminals and adrenal gland. Intravenous magnesium sulphate inhibits catecholamine release associated with intubation. Magnesium also produces vasodilatation by acting directly on blood vessels, and in high doses, attenuates vasopressin mediated vasoconstriction.

The objective of this study is to compare the influence of magnesium sulphate premedication on stress attenuation during laparoscopic abdominal surgery.

Methodology

The study is conducted in HIMS in Department of Anaesthesia. Total 50 patients having are group of 40-58 year were enrolled in to the study. As per the classification of the American Society of Anaesthesiologists I and II physical conditions posted for lower abdominal surgeries were enrolled on to the study. All the patients are informed consents. All the patient's clinical history was collected.

The enrolled 50 patients were divided in 2 groups. The Group-A patients includes the 25 patients & Group-B patients includes the 25 patients. The patients ingroup A received magnesium sulphate while those in group B received normal saline.

Anaesthesia machine monitors and resuscitation equipment's were checked. ECG, NIBP and pulse oximeter were applied and baseline readings of parameters like HR, SBP, DBP, MAP and SpO_2 were noted. Capnometer ($ETCO_2$) was attached after intubation.

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% O_2 for 3 minutes before induction. Induction was done with Inj. Propofol 2 mg/kg body weight i.v in both the groups and injection Rocuronium 0.8 mg/kg iv to facilitate endotracheal intubation.

Anaesthesia 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.

Results & discussion

The data from the enrolled 50 patients were collected and presented below. The Group-A patients includes the 25 patients & Group- B patients includes the 25 patients. The patients in group A received magnesium sulphate while those in group B received normal saline.

Table 1: Shows the age, sex and weight of the patients.

	Group A: Magnesium Sulphate	Group B: Normal Saline
Age (years)	42-56	45-54
Weight Kg	47-58	46 - 59
BMI (kg/m2)	26-28	24-29
ASA I	23	22
ASA II	2	3

Table 2

	Group A: Magnesium Sulphate	Group B: Normal Saline
Pulse Rate	74 - 108	75-102
Systolic Blood Pressure	105 – 138	109 - 145
Diastolic Blood Pressure	55 – 101	64 - 84
Mean Arterial Pressure	76 – 96	75- 98

In the group A administered with the magnesium sulphate had same pulse rate as compared to normal saline administered patients. The Systolic Blood Pressure, Diastolic Blood Pressure and Mean Arterial Pressure was found to lower in group A administered with the magnesium sulphate.

Diamant *et al.* [4] reported 35% decrease in cardiac output in dog with a raised intra-abdominal pressure of 40mmHg. Ishizaki *et al.* [5]. Tried to evaluate the safe intra-abdominal pressure during laparoscopic surgery. They observed significant fall in cardiac output at 16 mm Hg of intra-abdominal pressure and hemodynamic alterations.

So we kept intra-abdominal in our study between 12-14 mm Hg and decided to use magnesium sulphate to attenuate hemodynamic changes during laparoscopic surgeries. Study by Joris JL *et al.* [6]. Concluded that vasopressin and catecholamines probably mediate the increase in systemic vascular resistance observed during pneumoperitoneum. Magnesium sulphate is effective in blocking the release of catecholamines from both adrenergic nerve terminals and the adrenal gland. Besides, magnesium produces vasodilatation by acting directly on blood vessels.

Magnesium also attenuate vasopressin stimulated vasoconstriction. Because of the ability of magnesium sulphate to attenuate adverse hemodynamic response, we have administered 50 mg/kg magnesium sulphate as an infusion over 5 minutes. He same dosage has been used by Nand Kishore Kalra *et al*. [19], Decoke Lee *et al*., [20] and D Jee *et al*. [21] in their studies.

Conclusion

The magnesium sulphate attenuated hemodynamic and neuroendocrine stress response of general anaesthesia. The magnesium sulphate administered group showed better intraoperative stability and blood glucose control on comparison to saline administered group. During laparoscopic abdominal surgeries magnesium sulphate have effectively modulated neuroendocrine stress response of general anaesthesia as analysed by blood pressure parameters.

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