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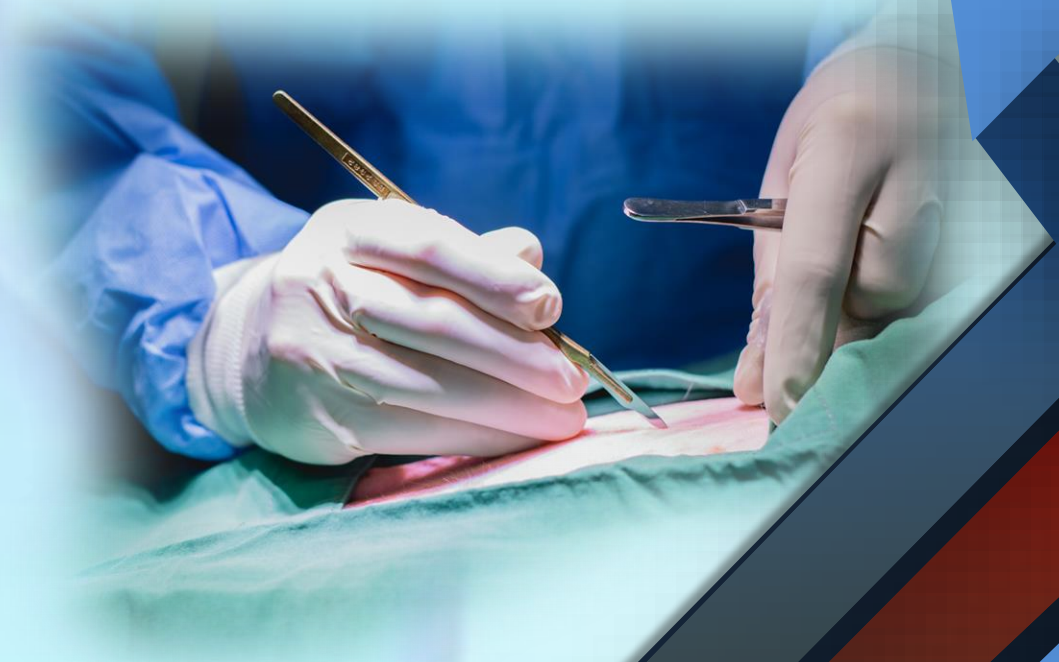

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Original article

The Beneficial Effects of Adding Magnesium Sulphate to General Anesthesia for Laparoscopic Sleeve Gastrectomy

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ABSTRACT

Background: Obesity is a significant health issue. It was estimated that about 700 million were obese. Some call this trend the "New World Syndrome".

Aim of the work: The study aims to compare between intravenous injections of one to two grams of magnesium sulfate [$MgSO_4$] in patients scheduled for elective laparoscopic sleeve gastrectomy.

Patients and methods: It is a multicenter study, which included 800 patients who were scheduled for elective laparoscopic sleeve gastrectomy under general anesthesia; all patients were randomly grouped into two equal groups [n = 400]. The first group for one gram and the second group for two grams of $MgSO_4$ over 10 minutes immediately after induction of anesthesia and before starting surgery. Then, all were assessed postoperatively for different variables.

Results: The duration of full recovery was significantly shorter, intensive care unit admission and postoperative pain immediately after recovery till the end of the first 18 hours was lower in M2 when compared to the M1 group. Postoperative respiratory depression, nausea, and vomiting were significantly decreased. The number of early ambulation was significantly increased, while the length of stay was significantly reduced in the M2 group. Intraoperative bleeding and pain after 18 hours showed a non-significant difference between both groups. Postoperative bleeding was reported in two patients in the M2 group and returning to the operating room again within 6 hours and managed by blood transfusion and surgical laparoscopy. No patients suffered from deep vein thrombosis or any other complications.

Conclusion: Adding $MgSO_4$ to general anesthesia in laparoscopic sleeve gastrectomy had beneficial effects, which increased by increasing the dose from one to two grams.

Keywords: General Anesthesia; Obesity; Magnesium sulfate; Laparoscopic; Sleeve gastrectomy.

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* Main subject and any subcategories have been classified according to the research topic.

INTRODUCTION

Obesity in North Africa and the Middle East is a notable health issue. It was estimated that in 2015, 2.3 billion people were overweight, and 700 million were obese[1]. The lifestyle changes associated with the discovery of oil and the subsequent increase in wealth are contributing factors. The overweight or obesity is defined as "Excessive fat accumulation that may impair health"[2].

It is estimated by calculation of the Body Mass Index [BMI]. BMI is defined as the sum of dividing a person's weight [kilograms] by the subject's square of height in meters. BMI from 25 to 29 kg/m^2 is assigned for overweight, while BMI ≥ 30 kg/m^2 indicating obesity. Increased BMI is associated with an increased risk of medical diseases as a result of obesity. These chronic disease comorbidities include gastrointestinal [GIT] problems[3], cardiovascular [CV] diseases[4], diabetes[5], musculoskeletal disorders, cancer, and premature death[6].

During the past years, innovations in surgical techniques, such as laparoscopic sleeve gastrectomy, had allowed a large population the opportunity to receive treatment for their disease[3]. However, it remains a highly challenging task for the anesthesiologist because of the anatomic and physiological implications and pharmacological alterations associated with obesity. These stresses reflected the importance of anesthesia, anesthetic technique, and of postoperative [PO] analgesia to permit early ambulation and the ability to restore normal breathing. In such cases, anesthesia is usually described as beneficial or not; however, several subjects and techniques must be discussed and investigated to increase anesthetic interventions' effectiveness and provide optimal perioperative care[7-8].

Using adjuvants could provide such benefits. However, its type and dose are crucial to achieving a high benefit with low side effects.

AIM OF THE WORK

To compare between intravenous injections of one to two grams of magnesium sulfate [$MgSO_4$] in patients scheduled for elective laparoscopic sleeve gastrectomy

PATIENTS AND METHODS

This study included 800 patients of ASA I–II classes, aged between 20 and 60, with BMI ranging between 40-70kg/m^2 assigned for elective laparoscopic sleeve gastrectomy. They were selected from Al-Ansar Hospital [Kingdom of Saudi Arabia] [400 patients], Al-Azhar University Hospital [Damietta] [160 patients], and Dar-Al-Hyah Private Hospital [Damietta] [240]. They were enrolled in the study between January 2016 and January 2020

Exclusion criteria were allergy to $MgSO_4$ or any other study drug, renal, hepatic, CV dysfunction, neurological disorders, atrioventricular conductance disorders, analgesic or opioid abuse. Also, any patient under treatment with calcium channel blockers was excluded.

Ethical Considerations: The study protocol was approved by the ethical research committee of Al-Ansar Hospital [KSA]**,** and written informed consent was obtained from all patients.

Surgery was performed by the same surgical and same anesthesia teams under general anesthesia for all patients. All patients were randomly [by closed envelope method] grouped into two equal groups [n = 400]. **In the M1 group**, all patients received intravenous [IV] one-gram of magnesium sulfate [MGSO4] in 100 ml of isotonic saline over 10 minutes immediately after induction of anesthesia before starting surgery; while patients in the **M2 group** received IV two grams of MGSO4 in 100 ml of isotonic saline over 10 minutes immediately after induction and before starting surgery.

The pre-anesthetic evaluation was performed up to one week before surgery, and fitness for anesthesia was given with further instructions regarding medication. On the day of surgery, patients were wheeled into the operation theatre, and IV access was obtained with 18 or 16-gauge intravenous cannula. Electrocardiogram [ECG] and noninvasive arterial pressure [using large size blood pressure [BP] cuff, which encircled ¾ of the upper arm], pulse oximetry monitoring was established. Electrodes were placed on the forehead to monitor bispectral index [BIS] [A-2000 BIS TM monitor, Aspectw Medical Systems Inc., Natick, MA, USA], and the neuromuscular block was monitored at the wrist using a peripheral nerve stimulator [TOF

Watch SXw, Organon Ltd, Dublin, Ireland] for intra-operative monitoring.

Patients were pre-medicated with intravenous Ondansetron [8 mg], low molecular weight heparin [LMWH] [clexan 40 IU] subcutaneous below the umbilicus, intravenous paracetamol two grams, 10 minutes before induction. Bolus injection of Fentanyl [1 µg/kg of total body weight [TBW]] and preoxygenation with 100% oxygen had been carried out for five minutes. Anesthesia was induced with injection Propofol [1.5-2 mg/kg of TBW], tracheal intubation after administration cis-atracurium [0.1 mg/kg of TBW]. After intubation, all pressure points were adequately padded. The surgery was performed in anti-Trendelenburg position; patients were restrained properly to prevent slipping from the operation table. Volume-controlled ventilation was applied with FiO_2 of 50% of 0.6-1.0 liter flow with positive end-expiratory pressure [PEEP] of 3- 5 cm H_2O [low flow 0.6 to one LO_2 50% + N_2O 50% + sevoflurane].

Intraabdominal pressure maintained between 12 to 15 mmHg. In addition, deep venous thrombosis [DVT] prophylaxis with DVT pump machine was applied to both legs. End-tidal carbon dioxide [$EtCO_2$] was maintained between 35-40 mmHg and arterial oxygen saturation [SpO_2] between 95%-100%. Both blood pressure and heart rate were maintained at 20% of the baseline value.

Intra-operatively, a gastric boogie was pushed into the stomach at the time of sleeve resection. At the end of the procedure, residual neuromuscular block was reversed with an injection of neostigmine 0.04 mg/kg and atropine sulfate 0.01 mg/kg. Tracheal extubation [BIS value of 70] was performed when the patients showed adequate clinical signs of reversal of neuromuscular block. After the operation, the patients were transferred to the recovery room in semi-sitting positions with oxygen mask ventilation and full monitoring. The consciousness score was evaluated every five minutes by the modified Aldrete score [0: not responding, 1: arousable with minimal stimulation, and 2: fully awake][9] until ready for discharge from the recovery room to the surgical ward or post-anesthetic care unit [PACU].

Postoperative pain relief was provided with local anesthetic wound infiltration of the port site with 0.125% bupivacaine hydrochloride and intravenous paracetamol [Perphalgan; 1 gm/8 hour]. Oral fluids were started on the next day. DVT prophylaxis with LMWH was continued for the first 48 hours after surgery and provided till the patient was discharged from the hospital.

Early postoperative recovery and incidence of intensive care unit [ICU] admission were recorded. Besides, the intensity of pain after full recovery in the recovery room assessed by using a visual analog scale [VAS- scoring range 0 to 10] every 6 hours in the next 24 hours, the incidence of any intraoperative or postoperative complication [like postoperative respiratory depression, postoperative nausea, and vomiting [PONV], intraoperative or postoperative bleeding or DVT]. Besides, early ambulation [unassisted mobility within 8 hours postoperatively] and length of hospital stay [LOS] were recorded. Lastly, the surgeon and patients' global satisfaction levels regarding comfort and quality of pain control were assessed using a five-point Likert scale [one: very unsatisfactory, and five: excellent].

All these data and the patients' demographic characteristics were analyzed using statistical package for social science [SPSS] software, version 20 [IBM®SPSS® statistics, One-New Orchard Road Armonk, New York 10504-1722]. For comparison between groups, the independent samples student "t" test was used, while Chi square was used to compare qualitative groups. Repeated measures [ANOVA test] were used to test variability over time. Values were expressed as counts, percentages [for qualitative data], arithmetic mean, and standard deviation [SD] for numerical data. P-value <0.05 was considered statistically significant.

RESULTS

The analyses showed that there were no significant differences between both groups regarding age, sex, BMI, or duration of operation **[Table 1].** The duration of full recovery was significantly short in M 2 group [15±5 minutes], while in M 1 group, it was [32 ±7 minutes]. Also, the incidence of intensive care unit [ICU] admission was significantly reduced in M 2 group [8 patients, 2%], while in M 1 group, it was 33 patients [8.25%] **[Table 2].**

The mean value of pain immediately after

recovery in M 2 and M 1 groups was 2±1 and 5±2, respectively [P < 0.001]. After 6 hours, it was 3±1 an in M 2 group and 6 ± 1 in the M 1 group [P < 0.001]. After 12 hours, it was 4±2 in the M 2 group and 4±2 in the M 1 group [P < 0.001], while at 18 hours postoperatively, it was 3±1 in M 2 group and 3±2 in M 1 group with no significant difference. In 24 hours, it was 1±1 in M 2 group and 2±1 in the M1 group, with no significant difference **[Table 3].** Intra- and postoperative complications revealed no significant difference between groups regarding intraoperative bleeding [2.5% vs. 1.5% in M2 vs. M1, respectively]. However, there was a significant reduction in postoperative respiratory depression in M2 compared to the M1 group [2% vs. 10.0% respectively]. Also, there was a significant reduction in postoperative nausea and vomiting [PONV] in M2 than the M1 group [5% vs. 37.5% respectively]. Postoperative bleeding was reported in two patients in the [M2] group, and managed by returning to the operating room within six hours, had a blood transfusion and surgical laparoscopy. No patient suffers from deep vein thrombosis [DVT] or any other complication **[Table 4]**.

Early ambulation and length of stay [LOS] revealed that early ambulation was significantly higher in M2 than in the M1 group [87.5% vs. 35.0% respectively]. Also, LOS was significantly shortened in M2 compared to the M1 group [1.0±0.5 vs. 2.3±1.0 days, respectively] **[Table 5]**.

The level of surgeon and patient satisfaction was high in M2 compared to the M1 group **[Figure 1].**

Table [1]: Comparison of age, sex, BMI, and duration of operation between the two groups

		M 1	M 2	Test	P-value
Age [years]Mean ± SD		42.60±12.4	41±12.3	1.74	0.08
Gender	**Male**	170 [42.5%]	159[39.5%]	0.62	0.42
	Female	230 [47.5%]	241[60.5%]		
BMI [kg/m²]		52±8	51±12	1.23	0.21
Operation time [minutes]		72±15	71±17	0.34	0.66

Table [2]: Comparison of Duration of full recovery and Incidence of ICU admission between the two groups

	M 1	M 2	Test	P-value
Duration of full recovery, [min.]	32 ±7	15±5	40.91	<0.001
Incidence of ICU admission	33[8.25%]	8[2%]	16.06	<0.001

Table [3]: Comparison mean value of pain between the two groups

	M 1	M 2	P-value
Immediately after recovery	5 ± 2	2 ± 1	< 0.001
After 6 H	6 ± 1	3 ± 1	< 0.001
After 12 H	4 ± 2	3 ± 2	< 0.001
After 18 H	3 ±2	3 ± 1	> 0.05
After 24 H	2± 1	1 ± 1	> 0.05

Table [4]: Incidence of intraoperative or postoperative complication

	M 1	M 2	P-value
Intraoperative bleeding	6/400[1.5%]	10/400 [2.5%]	> 0.05
PO respiratory depression	40/400[10%]	8/400 [2%]	< 0.0001*
PON&V	150/400 [37.5%]	20/400 [5%]	< 0.0001*
PO bleeding	0/400 [0%]	2/400 [0.5%]	>0.05
PO DVT	0/400 [0%]	0/400 [0%]	-

Table [5]: Early ambulation and length of hospital stay

	M 1	M 2	P-value
Early post operative ambulation [no, %]	170/400[35%]	350/400[87.5%]	< 0.0001
length of hospital stay[days] mean± SD]	2.3±1.0	1.0 ±0.5	< 0.001

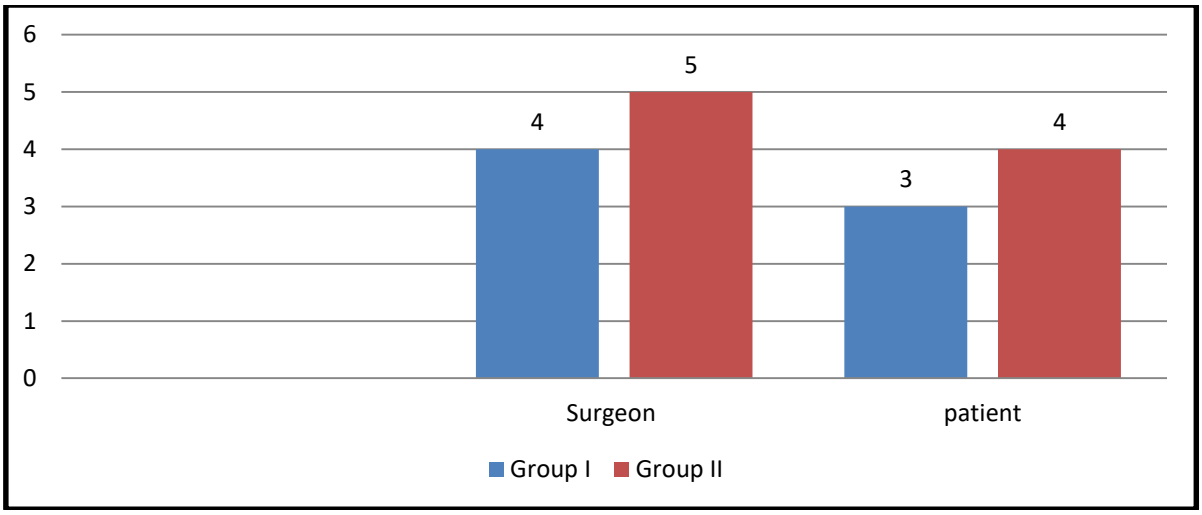

Figure [1]: Surgeon and patient satisfaction

DISCUSSION

Results of the current work, the duration of full recovery was significantly short in the M2 group than in the M1 group. The higher dose of $MgSO_4$ causes bronchodilatation, reverse cerebral vasospasm, and causes reduced excitability of nerves to reduce the sense of pain[10]. So, the recovery was early when we give two grams of $MgSO_4$ compared to the dose of one gram, and there was a trend to use an increased dose of $MgSO_4$ for treatment of acute[11] and chronic pain[12]**.** The incidence of ICU admission was significantly low in M2 than in the M1 group, as the higher dose of $MgSO_4$ is associated with early recovery, less pain, and less PONV[13].

The mean value of pain is significantly lower with a high dose of $MgSO_4$. It is attributed to Mg's role in NMDA receptors in pain perception[11-12].

Narcotic-based analgesia may be challenging because of the increased risk of hypoventilation and hypoxemia in obese patients. Mg and non-steroidal anti-inflammatory drugs should be part of multi-modal opioid-sparing postoperative analgesia[14]. Magnesium is NMDA receptor antagonist with anti-nociceptive effects[15] and has been previously investigated as a possible adjuvant for intra- and postoperative analgesia. The majority of these studies suggest that preoperative $MgSO_4$ reduces anesthetic requirements and improves postoperative analgesia[16]**.** However, two reports have suggested that $MgSO_4$ infusion has been reported to reduce remifentanil requirements and have no effect on propofol requirements in patients undergoing vitrectomy[17]**.** Also, **Ryu et al.[18]** conclude that magnesium sulfate to patients receiving total intravenous anesthesia does not reduce pain severity after surgery.

The incidence of intraoperative or postoperative bleeding is increased with the M2 group. It could be attributed to the effect of magnesium in the reduction of platelet activity, leading to prolongation of bleeding time, especially with a preoperative dose of Clexan[19]

Postoperative respiratory depression was markedly decreased in the M2 group, as magnesium sulfate is an effective bronchodilator but does not affect respiratory drive[10]**.**

In the present study, patients in the M2 group showed less postoperative shivering and PONV, as mentioned by **Ryu et al.[18]**, and **Xie et al.[20].**

No DVT group had been reported in the current work. It could be due to preemptive analgesia, MgSO4, Clexan, and intraoperative preventive DVT pump machine. Early ambulation significantly increased in the M2 group and attributed to reduced respiratory depression, low pain, and significantly low PONV[21]**.**

Sherif et al.[22] reported shorted LOS in the high dose group, as in the current study. **Mannaerts et**

al.[23] reported that the implementation of enhanced recovery after bariatric sugary [ERABS] can lead to shorter procedure duration and LOS, which may lead to more efficient and cost-effective care

Lastly, the surgeon's and patient's satisfaction was significantly higher in the M2 group. One of the explanations is the increased discomfort and aggravates postoperative pain by shivering [21]**.** Besides, the prevention of shivering and low PONV may attenuate postoperative pain and enhance patients' satisfaction[24].

In conclusion, the beneficial actions achieved by magnesium sulfate addition to general anesthesia for laparoscopic sleeve gastrectomy was improved by increasing the dose from one to two grams, and these effects were clear in the reduction of the recovery duration, reduction of admission to ICU, reducing PO pain, low complication, early ambulation, shortening of LOS and higher patient's and surgeon's satisfaction.

Financial and Non-financial Relationships and Activities of Interest

None

REFERENCES

1. **Rosengren A, Teo K, Rangarajan S, Kabali C, Khumalo I, Kutty VR, et al.** Psychosocial factors and obesity in 17 high-, middle- and low-income countries: the Prospective Urban Rural Epidemiologic study. Int J Obes [Lond]. **2015** Aug; 39 [8]: 1217-23. doi: 10.1038/ ijo.2015.48.
2. **Engin A.** The Definition and Prevalence of Obesity and Metabolic Syndrome. Adv Exp Med Biol. **2017**; 960:1-17. doi: 10.1007/978-3-319-48382-5_1.
3. **Orouk AE, Sayyouh AS, Salem NA.** Incidence of Esophageal Reflux after Laparoscopic Sleeve Gastrectomy for Morbid Obesity. IJMA **2020**; 2[3]: 493-502. doi: 10.21608/ijma.2020.26707.1112
4. **Csige I, Ujvárosy D, Szabó Z, Lőrincz I, Paragh G, Harangi M, Somodi S.** The Impact of Obesity on the Cardiovascular System. J Diabetes Res. **2018** Nov 4; 2018:3407306. doi: 10.1155/2018/3407306.
5. **Chobot A, Górowska-Kowolik K, Sokołowska M, Jarosz-Chobot P.** Obesity and diabetes-Not only a simple link between two epidemics. Diabetes Metab Res Rev. **2018**; 34[7]:e3042. doi:10.1002/ dmrr. 3042.
6. **Meldrum DR, Morris MA, Gambone JC.** Obesity pandemic: causes, consequences, and solutions-but do we have the will? Fertil Steril. **2017** Apr;107[4]:833-839. doi: 10.1016/j.fertnstert.2017.02.104.
7. **Brodsky JB.** Recent advances in anesthesia of the obese patient. F1000Res. **2018** Aug 6;7:F1000 Faculty Rev-1195. doi: 10.12688/f1000research.15093.1.
8. **Lindauer B, Steurer MP, Müller MK, Dullenkopf A.** Anesthetic management of patients undergoing bariatric surgery: two year experience in a single institution in Switzerland. BMC Anesthesiol. **2014** Dec 18; 14:125. doi: 10.1186/1471-2253-14-125.
9. **Kaur A, Jain AK, Sehgal R, Sood J.** Hemodynamics and early recovery characteristics of desflurane versus sevoflurane in bariatric surgery. J Anaesthesiol Clin Pharmacol. **2013** Jan; 29[1]:36-40. doi: 10.4103/ 0970-9185.105792.
10. **Farouk S.** Pre-incisional epidural magnesium provides pre-emptive and preventive analgesia in patients undergoing abdominal hysterectomy. Br J Anaesth. **2008** Nov; 101[5]:694-9. doi: 10.1093/bja/aen274.
11. **James MF.** Magnesium: an emerging drug in anaesthesia. Br J Anaesth. **2009** Oct; 103[4]:465-7. doi: 10.1093/ bja/aep242.
12. **Eizaga Rebollar R, García Palacios MV, Morales Guerrero J, Torres LM.** Magnesium sulfate in pediatric anesthesia: the Super Adjuvant. Paediatr Anaesth. **2017** May;27[5]:480-489. doi: 10.1111/pan. 13129.
13. **Do SH.** Magnesium: a versatile drug for anesthesiologists. Korean J Anesthesiol. **2013** Jul;65[1]:4-8. doi: 10. 4097/ kjae. 2013.65.1.4.
14. **Flegal KM, Carroll MD, Ogden CL, Curtin LR.** Prevalence and trends in obesity among US adults, 1999-2008. JAMA. **2010** Jan 20; 303[3]:235-41. doi: 10.1001/jama.2009.2014.
15. **Messeha MM, Boshra V.** Comparison of the antinociceptive effect of systemic versus intrathecal magnesium sulphate on spinal morphine analgesia. Magnes Res. **2016** Mar 1; 29 [1]: 22-33. doi: 10.1684/mrh.2016. 0396.
16. **Olgun B, Oğuz G, Kaya M, Savlı S, Eskiçırak HE, Güney İ, Kadıoğulları N.** The effects of magnesium sulphate on desflurane requirement, early recovery and postoperative analgesia in laparoscopic cholecystectomy. Magnes Res. **2012** Jul; 25 [2]:72-8. doi: 10.1684/ mrh.2012.0315.
17. **Schulz-Stübner S, Wettmann G,** Reyle-Hahn SM, Rossaint R. Magnesium as part of balanced general anaesthesia with propofol, remifentanil and mivacurium: a double-blind, randomized prospective study in 50 patients. Eur J Anaesthesiol. **2001** Nov; 18

[11]: 723-9. doi: 10.1046/j.1365-2346. 2001.00921.x.

18. **Ryu JH, Kang MH, Park KS, Do SH.** Effects of magnesium sulphate on intraoperative anaesthetic requirements and postoperative analgesia in gynaecology patients receiving total intravenous anaesthesia. Br J Anaesth. **2008** Mar; 100 [3]: 397-403. doi: 10.1093/bja/aem407.

19. **Haryalchi K, Abedinzade M, Khanaki K, Mansour Ghanaie M, Mohammad Zadeh F.** Whether preventive low dose magnesium sulphate infusion has an influence on postoperative pain perception and the level of serum beta-endorphin throughout the total abdominal hysterectomy. Rev Esp Anestesiol Reanim. **2017** Aug-Sep; 64 [7]:384-390. doi: 10.1016/ j.redar.2016.11.009.

20. **Xie M, Li XK, Chen J.** [Effect of magnesium sulphate infusion on emergence agitation in patients undergoing esophageal carcinoma with general anesthesia: a randomized, double-blind, controlled trial]. Nan Fang Yi Ke Da Xue Xue Bao. **2016** Dec 20; 36[12]:1650-1654. Chinese [English abstract].

21. **Nadri S, Mahmoudvand H, Vahabi S.** Effect of magnesium sulfate on morphine activity retention to control pain after herniorrhaphy. Pain Manag. **2017** Mar; 7[2]:119-125. doi: 10.2217/pmt-2016-0038.

22. **Awad S, Carter S, Purkayastha S, Hakky S, Moorthy K, Cousins J, Ahmed AR.** Enhanced recovery after bariatric surgery [ERABS]: clinical outcomes from a tertiary referral bariatric centre. Obes Surg. **2014** May; 24 [5]:753-8. doi: 10.1007/s11695-013-1151-4.

23. **Mannaerts GH, van Mil SR, Stepaniak PS, Dunkelgrün M, de Quelerij M, Verbrugge SJ, Zengerink HF, Biter LU.** Results of Implementing an Enhanced Recovery after Bariatric Surgery [ERABS] Protocol. Obes Surg. **2016** Feb; 26 [2]: 303-12. doi: 10.1007/ s11695-015-1742-3.

24. **Sousa AM, Rosado GM, Neto Jde S, Guimarães GM, Ashmawi HA.** Magnesium sulfate improves postoperative analgesia in laparoscopic gynecologic surgeries: a double-blind randomized controlled trial. J Clin Anesth. **2016** Nov; 34:379-84. doi: 10.1016/ j.jclinane.2016.05.006.

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