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Analgesic Effects of Magnesium Sulphate In Patients Undergoing Laparoscopic Cholecystectomy

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ABSTRACT

Objective: To assess the effectiveness of intraoperative administration of MgSO4 in achieving satisfactory postoperative pain relief following laparoscopic surgery.
Study Design: Quasi-experimental research.
Place and Duration of Study: Combined Military Hospital, Rawalpindi Pakistan, Apr to Sep 2021.
Methodology: A total of 200 patients gave their informed consent before being split into two groups of 100. Patients were given Tablet Alprazolam 0.25mg and Omeprazole 20mg the night before surgery and again on the morning of surgery, and were asked for NPO for 8 hours before to surgery. Group 1 got 50 mg/kg of magnesium sulphate diluted in 250 ml of isotonic 0.9% normal saline intravenously during surgery, while Group 2 received the same volume of isotonic 0.9% normal saline.
Results: Administering intravenous magnesium sulphate at an intravenous dose of 50 milligrams per kilogram of body weight before laryngoscopy and intubation significantly reduces the need for post-operative pain medication by reducing post-operative pain and delaying its onset. Additionally, it reduces the amount of pain medication required after surgery. Therefore, overall, pretreatment with magnesium sulphate has a significant impact on post-operative pain management.
Conclusion: Magnesium sulphate is an excellent analgesic for people undergoing laparoscopic cholecystectomy.

Keywords: Gallbladder surgery, Laparoscopic cholecystectomy, Magnesium sulphate

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INTRODUCTION

Pain, along with drowsiness and nausea/vomiting, is a common cause of delayed discharge after ambulatory surgery. Ineffective postoperative pain management can result in negative clinical outcomes for patients, leading to unpleasant experiences and potential prolongation of hospital stay with associated economic and medical implications.1,2 To deal with the fact that post-injury hypersensitivity occurs via a central mechanism, the concept of pre-emptive analgesia was established.[3] As an antagonist of N-methyl-D-aspartate (NMDA) receptors and related ion channels, magnesium sulphate shows promise in lowering the need for anaesthetic and analgesic medicines during surgery and avoiding the onset of postoperative pain.[4] Preoperative treatment of magnesium sulphate has been shown to decrease anaesthetic requirements and improve postoperative pain management in a number of prior studies that looked into its use as an adjuvant for intra and postoperative analgesia.[5,6] Magnesium sulphate used intravenously (IV) during spinal anaesthesia has been demonstrated to enhance postoperative pain relief.[7] Requirements for propofol and neuromuscular blocking drugs, as well as postoperative pain and painkiller intake, have been significantly reduced due to the infusion of magnesium sulphate during surgery.[8] Total intravenous anaesthesia with magnesium sulphate has been found to have beneficial effects on the quality of postoperative analgesia. Adequate pain relief is crucial for patient comfort and optimal postoperative recovery.[9]

Considering the potential of magnesium sulphate in preventing postoperative pain, the present study aims to investigate its effect on analgesic requirement in patients undergoing laparoscopic cholecystectomy.

METHODOLOGY

Following approval from the Institutional Ethical Committee (IERB Certificate Number: 365), the quasi-experimental study was conducted between April to Sep 2021. The sample size was determined with the use of the World Health Organization's online tool.[10]

Inclusion Criteria: Men and women between the ages of 18 and 65 who were undergoing laparoscopic

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cholecystectomy under general anaesthesia and endotracheal intubation were included in the study.

Exclusion Criteria: Patients with a body mass index (BMI) greater than 35 kg/m2 were not included in the study, nor were those with a history of drug or alcohol abuse, a history of cardiovascular disease, significant respiratory, renal, or hepatic disorders, or treatment with calcium channel blockers or magnesium.

Two hundred participants were included in the study; these were split evenly between two groups of 100 patients each. Patients were given Tablet Alprazolam 0.25mg and Omeprazole 20mg the night before surgery and on the morning of surgery, respectively, in addition to an 8-hour preoperative fast. Patients gave their informed consent, and then a computer-generated Microsoft Excel programme randomly assigned them to Group-I or Group-II. Patients in both groups were subjected to preoperative monitoring of vital signs (including heart rate, non-invasive blood pressure, oxygen saturation, and electrocardiogram) in the operating room. The patient's heart rate, blood pressure, and oxygen levels were all tracked as they were given preoperative drugs. Patients were immediately moved to the operating room with continuous vital monitoring after an intravenous 18G or 20G cannula was placed into a peripheral vein and a 10ml/kg Ringer lactate infusion was initiated.

Patients were preoxygenated for 3 minutes and then given an injection of Ondansetron (0.1mg/kg) and Fentanyl (0.5 g/kg) before to induction. Injection Atracurium 0.5 mg/kg and intravenous Propofol 2.0 mg/kg were used to induce anaesthesia. All patients were kept alive with a mixture of 33% oxygen, 66% nitrous oxide, 0.4% halothane, and 5mg atracurium boluses given at regular intervals during various surgical procedures.

During surgery, patients in Group-I were given an intravenous infusion of Magnesium sulphate 50 mg/kg in 250 ml of isotonic 0.9% sodium chloride solution over the course of 15-20 minutes. Group II, on the other hand, had the same volume of isotonic 0.9% sodium chloride solution infused into their veins over the course of 15 to 20 minutes. An automatic insufflation equipment was used to create a CO2 pneumo-peritoneum and keep the pressure constant at about 12-14 mm Hg during the operation. At the conclusion of surgery, patients were extubated once the residual neuromuscular blockade had been reversed with injections of Neostigmine (0.05mg/kg) and Glycopyrrolate (0.01mg/kg).

The severity of postoperative pain was rated on a visual analogue scale (VAS) from 0 (no pain) to 10 (the worst agony possible). Tramadol was administered intravenously to both groups for pain management, starting with a loading dose of 1 mg/kg and continuing with 0.5 mg/kg increments as needed, up to a maximum dose of 3 mg/kg. In the first six hours following surgery, data were collected on how long it took before the patient needed rescue analgesia and how much Tramadol they ended up taking.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were expressed as Mean±Sd and qualitative variables were expressed as frequency and percentages. Mann-Whitney U test was applied to find the median differences among the groups.The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

Two hundred participants participated in the study, with 76(38.0%) of them being male and 124(62.0%) being female. The mean age, weight, and BMI of the patients were 36.53±5.38 years, 59.16±6.23 kg, and 26.30±2.41, respectively. The average surgical time was 45.50±7.10 minutes. The demographic details of the patients are presented in Table-I.

The median VAS score for Group-I and Group-II at 0 hours was 4.70(2.15) and 6.00(3.25), respectively, with a highly significant *p*-value < 0.001. At one hour, Group-I had a median VAS score of 4.43(1.73) and Group-II had 5.53(1.23), also with *p*-value < 0.001. At two hours, the median VAS score for Group-I was 4.20(1.1) and for Group-II it was 5.10(1.90), with a *p*-value of 0.001. The median VAS score at four hours was 4.07(1.83) for Group-I and 4.93(2.10) for Group-II, with a *p*-value of 0.032. However, at six hours, the median VAS score for Group-I was 3.90(1.89) and for Group-II it was 4.09(2.01), with a *p*-value of 0.004, as shown in Table-II.

Table-I: Demographic Characteristics (n=200)

Parameters	Mean±SD
Age (Years)	36.53±5.38
Weight (Kg)	59.16±6.23
BMI	26.30±2.41
surgical time (minutes)	45.50±7.10
Gender	n (%)
Male	76(38.0%)
Female	124(62.0%)

Table-II: Vas At Different Hour Comparison Between Group I And Group II (n=200)

VAS	Study Groups Median (IQR)		*p* value
	Group-I (n=100)	Group-II (n=100)	
At 0 hour	4.70(2.15)	6.00(3.25)	< 0.001
At 1 hour	4.43(1.73)	5.53(1.23)	< 0.001
At 2 hour	4.20(1.1)	5.10(1.90)	0.001
At 4 hour	4.07(1.83)	4.93(2.10)	0.032
At 6 hour	3.90(1.89)	4.09(2.01)	0.004

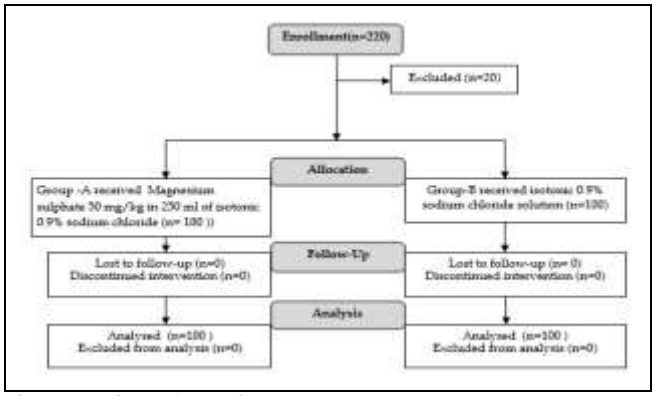

Figure: Patient Flow Diagram

DISCUSSION:

There has been a lot of research done on preventive analgesia, also called pre-emptive analgesia, as a means of dealing with pain. Preemptive analgesia is the practise of giving a dose of painkillers before a painful stimulus is experienced, with the intention of protecting the central nervous system from becoming overly sensitive to pain. The effect of magnesium on perioperative analgesic requirements was evaluated in patients who underwent identical levels of surgical stimulation.[11] In our trial, 200 patients were split into two groups according to their ASA pain rating, and each group received a loading dose of magnesium sulphate 15 minutes before induction. Postoperative VAS readings were taken at 1, 2, 4, and 6 hours after extubation.

The VAS scores at 0, 1, 2, and 4 hours indicated statistically significant differences between the two groups, with greater values in Group II compared to Group I; however, the VAS scores at 6 hours showed limited fluctuation and were not statistically significant. Consistent with the prior study, this suggests that the Magnesium Group had superior pain control.[12] Total tramadol intake also differed significantly between the two groups, with Group II (Control Group) consuming 106.83 20.98 mg and Group I consuming 79.70 24.[14] mg, respectively. This finding implies that the Magnesium Group needed less rescue analgesia (tramadol) than the Control Group. There was also a difference in the time it took for people in Group II to take their first dosage of tramadol as a rescue analgesic (49.33 93.33 minutes) compared to those in Group I (131.72 140.11 minutes).

Other studies have also shown that magnesium administration during surgery can result in lower postoperative opioid consumption, improved pain relief, and better recovery outcomes.[13,14] One study found that patients in the magnesium group who had undergone major lumbar surgery reported less pain and opiate use postoperatively, in addition to better sleep and overall happiness. Patients undergoing open cholecystectomy who were given magnesium sulphate intraoperatively reported greater pain alleviation and comfort in the immediate postoperative period, as well as enhanced sleep quality in the postoperative phase and no serious adverse effects. The use of magnesium sulphate as an adjunct for postoperative analgesia following abdominal surgery has also been supported by a small number of studies.[15,16]

Other routes of magnesium administration, such as epidural and intrathecal, have also been shown to reduce postoperative analgesic requirements in various surgeries, including gynecological surgeries under total intravenous anesthesia. No evidence of adverse effects related to magnesium sulfate has been reported, and favorable results in terms of recovery and postoperative analgesia have been observed in laparoscopic cholecystectomy and thoracotomies with magnesium sulfate use. Intraoperative magnesium sulfate infusion has also shown encouraging results with minimal side effects in reduced discomfort and quicker healing times following laparoscopic procedures.[17,18]

STUDY LIMITATIONS

Due to its small sample size and single-center design, our study has limitations. In the future, larger sample sizes and longer-term follow-up in subsequent studies may provide more robust results that could serve as local guidelines.

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CONCLUSION

The intravenous magnesium sulphate, at a low dose of 50 mg/kg in 250 ml of isotonic 0.9% sodium chloride solution, greatly reduces postoperative pain during the first day after

laparoscopic cholecystectomy*:* Magnesium sulphate is an excellent analgesic for people undergoing laparoscopic cholecystectomy

Conflict of Interest: None.

Authors' Contribution

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

TY & SAMR: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

KM & UEM: Data acquisition, data analysis, approval of the final version to be published.

MA & AK: Critical review, concept, drafting the manuscript, 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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