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Original Research Article.

A Hospital Based Prospective Study to Evaluate the Effect of a Single Dose of Intravenous Magnesium Sulphate on the Degree and Duration of Postoperative Pain After Lower Abdominal Surgery

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ABSTRACT

Background: Appropriate pain relief begins with an understanding of correct drug, route of administration and mode of action. Severe post-operative pain has a well-known morbidity and causes distress to patients. The aim of this study to assessed the degree and duration of postoperative pain and requirements of rescue analgesia after Intravenous use of magnesium sulphate preoperatively in lower abdominal surgery.

Materials & Methods: A hospital based prospective study done on 40 patients admitted in surgery dept. for lower abdominal surgery with mean duration of about 1-1.5 hrs at Jawahar lal Nehru Medical college, Ajmer, Rajasthan. The total 40 patients divided in two groups, Study group (patients was given 50 mg /kg magnesium sulphate in 250 ml. of isotonic sodium chloride solution IV) and control group (Patients was given 250 ml. of isotonic sodium chloride solution IV). During first 4 hrs. patient was kept in recovery room and rescue analgesia was given at VAS ≥ 4 in the form of inj. Diclofenac sodium 75mg. IV. The timing and dosage of rescue analgesia and total consumption of inj. Diclofenac sodium during first 24 hrs. after operation was noted.

Results: Our study showed that the mean age of patients was 35.58±10.31 years in MgSO4 group and 33.28±10.02 years in C group. There was no significant difference in mean age of patients between two groups (P > 0.05). Rescue analgesic consumption was seen during the first 24 hours of postoperative period especially in the immediate post-operative period. In control group, the mean duration of post-operative analgesia was 25 minutes and in MgSO4 Group the mean duration of post-operative analgesia was 187 minutes.

Conclusion: We concluded that administration of intravenous Magnesium sulphate 50 mg/kg preoperatively significantly reduces postoperative pain in patients undergoing lower abdominal surgery.

Keywords: Pain, Sedation, Magnesium Sulphate, Analgesic.

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INTRODUCTION

The World Health Organization (WHO) defines pain as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage". There are specific nerve pathways for conducting pain sensation. Pain receptors in the skin and other tissues are nerve terminals which lack any special characteristics and they are probably triggered by a chemical stimulus when potential tissue damage occurs. The A-delta fibers are larger and transmit the "fast pain". The smaller C- fibers transmit a secondary dull continuous pain. These nerve fibers enter the spinal cord through the dorsal root of the spinal cord.[1]

Severe post-operative pain has a well-known morbidity and causes distress to patients. It is the most common and the most distressing complication of surgery. Although surgical pain is well controlled, the post-operative pain is still poorly treated. Despite the introduction of new analgesics for pain relief, the advances of post-operative pain relief still depend on the improvement in the delivery of existing drugs to the patients.[1]

The transmission of nociceptive stimuli from the periphery to the CNS results in neuro-endocrine stress response resulting in increased sympathetic tone, increased catecholamine levels and catabolic hormone secretion.[1]

The effects include sodium and water retention, hyper metabolic state, hypercoagulability, hyperglycemia (and therefore poor wound healing and depression of immune function), paralytic ileus, shallow respiration and inadequate cough due to pain, resulting in post-operative pulmonary complications. In patients with underlying cardiac disease, severe post-operative pain may

cause sympathetic stimulation, increasing cardiac work and also causes constriction of the coronary vessels, leading to myocardial ischemia and infarction. Control of these pathophysiologic processes by administering adequate post-operative analgesia may lead to improvement in morbidity and patient satisfaction. Thus, the effective relief of surgical pain is to be achieved not only for humanitarian reasons but also for physiological benefits of the patient and thus, improvement in morbidity.[2]

Transmission of pain signals evoked by tissue damage leads to sensitization of the peripheral and central pain pathways. Pre-emptive analgesia is a treatment that is initiated before the surgical procedure in order to reduce this sensitization. Owing to this 'protective' effect on the nociceptive system, pre-emptive analgesia has the potential to be more effective than a similar analgesic treatment initiated after surgery.

Theoretically, immediate postoperative pain may be reduced and the development of chronic pain may be prevented. The only way to prevent sensitization of the nociceptive system might be to block completely any pain signal originating from the surgical wound from the time of incision until final wound healing.

Appropriate pain relief begins with an understanding of correct drug, route of administration and mode of action. Early administration will achieve effective analgesic concentration and make it easier to maintain the therapeutic levels of drug in blood. Once a satisfactory level of pain relief has been achieved, this can be sustained by regular administration of drugs.[3] Therapies that have been tested in pre-emptive trials includes NSAIDS, intravenous opioids, intravenous ketamine, peripheral local anaesthetics, caudal and epidural analgesia, dextromethorphan and gabapentin. Relief from severe pain arising from deep or visceral structures, as happens in surgical procedures, requires the use of opioids. Commonly used opioids are Morphine, Fentanyl, Pethidine etc. Opioids offer the benefit to relieve strong pain and many options are available if one is causing significant side effects. Side effects of opioids include sedation, nausea, vomiting, vasodilatation and myocardial depression, pruritus, delayed gastric emptying, constipation, urinary retention and prolonged respiratory depression.[2]

Other than opioids Magnesium sulfate is also used as pre-emptive analgesic due to its antagonistic effect on NMDA (N- Methyl, D-Aspartate) receptors and Calcium ion channels. Magnesium sulphate inhibits catecholamine release from adrenergic nerve terminals and adrenal medulla during laryngoscopy and endotracheal intubation.[3] The aim of this study to assessed the degree and duration of postoperative pain and requirements of rescue analgesia after Intravenous use of magnesium sulphate preoperatively in lower abdominal surgery.

MATERIALS & METHODS

A hospital based prospective study done on 40 patients admitted in surgery dept. for lower abdominal surgery with mean duration of about 1-1.5 hrs at Jawahar lal Nehru Medical college, Ajmer, Rajasthan. Total 40 patients divided in two groups, Study group (patients was given 50 mg/kg magnesium sulphate in 250 ml. of isotonic sodium chloride solution IV) and control group (Patients was given 250 ml. of isotonic sodium chloride solution IV).

Inclusion Criteria

- Male/Female patients aged 15-50 yrs
- ASA grade 1-2

Exclusion Criteria

- History of chronic disease like hypertension, varying degree of heart blocks, diabetes mellitus, respiratory disease, myopathy, neurological disorders, drugs or alcohol abuse.
- Pregnant women, obese patients (body mass index more than 30 kg./m.)
- Patients treated with calcium channel blockers or magnesium
- Patients with impaired renal or hepatic function
- Any absolute or relative contraindication to study drug.

Preanaesthetic Checkup

All patients were visited on the day prior to surgery and explained about the anaesthetic technique and perioperative course. Each patient had a pre anaesthetic checkup.

Procedure

After taking informed consent and confirming overnight fasting, patient was taken on the recovery room and baseline vitals like B.P., pulse rate, respiratory rate recorded. After a 18 gauge intravenous (IV) cannula have been inserted at the forearm level, inj. Magnesium sulphate 50mg/kg mixed in 250 ml of inj. Isotonic sodium chloride and this drug was infused over 30

minute before induction of anaesthesia. Pulse rate and blood pressure monitored at 10, 20- and 30-minutes intervals during this period. Upon arrival in operating room patient was taken on the operating table and all usual monitoring was established.

General anaesthesia administered by using inj. Glycopyrolate 0.005 mg./kg., inj. Fentanyl 2 microgm./kg. IV, for induction. Inj. Thiopentone 5 mg./kg. and inj. Succinyl choline 1mg./kg. was given to facilitate intubation with appropriate size of ET tube. During surgery anaesthesia was maintained with isoflurane and nitrous oxide in oxygenandlnj. Atracurium basylate 0.1 mg./kg. SOS.

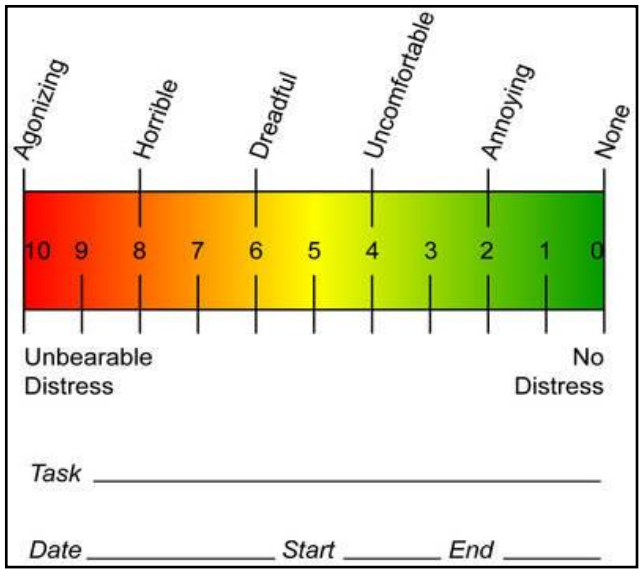
During surgery BP, PR, O_2 saturation and any fluid and drugs requirement was noted on 5, 10.20,30,40,50,60,70,80 and 90 minutes after induction of anaesthesia. Postoperatively residual neuromuscular blockade was reversed by using inj. Neostigmine 0.05mg./kg. and inj. Glycopyrolate 0.02mg./kg.

Patients at rest was evaluated by using a 0 – 10 cm. visual analogue score (VAS) or by using a 0-4 verbal rating score (VRS) at emergence from anaesthesia and1/2, 1, 2, 4, 6, 12 and 24 hrs. after surgery.

- During intraoperative period hypotension was defined as a systolic arterial blood pressure (SABP) <90 mmHg or a decrease in SABP by 30% or more from baseline values and treated by incremental doses of ephedrine 5 mg IV until the correction of SABP.
- Bradycardia Was defined as fall in heart rate below 55 beats per min and was treated with incremental doses of atropine 0.5 mg IV.
- Other adverse effects including ECG changes, O2 saturation decrease was recorded.
- Duration of complete analgesia was defined as the time from the extubation to the first feeling of pain.
- Duration of analgesia was defined as the time from extubation to the first request of analgesics.

Visual Analogue Score (VAS)

The VAS consisted of a 10 cm horizontal paper strip with two endpoints labeled "No Pain" and Worst Imaginable or" Agonizing Pain".



During first 4 hrs. patient was kept in recovery room and rescue analgesia was given at VAS ≥ 4 in the form of inj. Diclofenac sodium 75mg. IV. The timing and dosage of rescue analgesia and total consumption of inj. Diclofenac sodium during first 24 hrs. after operation was noted.

Statistical Analysis

Unpaired t-test, repeated measure Anova was used for ratio & interval scale data and for nominal data chi – square test was used. A '*P*' value of <0.05 was considered significant, <0.001 highly significant and >0.05 was considered insignificant.

RESULTS

Our study showed that the mean age of patients was 35.58±10.31 years in MgSO4 group and 33.28±10.02 years in C group. There was no significant difference in mean age of patients between two groups (P > 0.05). There was no significant difference in weight, ASA grades & gender in between the two groups (Table 1).

Table 1: Demographic profile of study and control group

Demographic variables	study ($MgSo_4$) group (N=20)	Control Group (N=20)	P-value
Age (yrs) (Mean±SD)	35.58±10.31	33.28±10.02	>0.05 (NS)
Weight (kg) (Mean±SD)	53.77±9.12	56.03±8.79	>0.05 (NS)
Sex			
Male	11 (55%)	11 (55%)	1.000 (NS)
Female	9 (45%)	9 (45%)	
ASA Grade			
Grade I	19 (95%)	19 (95%)	1.000 (NS)
Grade II	1 (5%)	1 (5%)	

Table 2: The comparison of mean value of duration of surgery, total dose of analgesic and duration of analgesia in between groups

Variables	study ($MgSo_4$) group (Mean±SD)	Control Group (Mean±SD)	P-value
Duration of Surgery (Min.)	62.18±10.67	61.96±11.28	>0.05 (NS)
Duration of analgesia (Min.)	187.56±18.66	25.23±5.16	<0.01 (HS)
Total dose of analgesia (mg)	86.78±26.63	238.67±28.30	<0.01 (HS)

Table 3: The comparison of pain assessment using VAS Score in postoperative period in both the groups

Observation time	Mean change ± SD		P-value
	study ($MgSo_4$) group (Mean±SD)	Control Group (Mean±SD)	
1 hr. after extubation	0.21±0.48	1.63±0.55	<0.01 (HS)
2 hr. after extubation	0.63±0.47	1.03±0.51	<0.01 (HS)
4 hr. after extubation	1.04±0.59	1.33±0.78	>0.05 (NS)
6 hr. after extubation	0.30±0.66	1.87±0.59	<0.01 (HS)
12 hr. after extubation	0.65±0.56	0.89±0.78	<0.05 (S)
24 hr. after extubation	0.89±0.67	1.07±0.99	>0.05 (NS)

Table 4: Post-operative side effect

Complications	study ($MgSo_4$) group (N=20)	Control Group (N=20)
Nausea	0 (0%)	1 (5%)
Vomiting	2 (10%	2 (10%)
Others	0 (0%)	0 (0%)

Our study showed that there was no significant difference in mean duration of surgery between two groups ($p > 0.05$). A VAS score >4 was considered unsatisfactory and a rescue analgesia in the form of I.V. inj. Diclofenac sodium was given. The amount of rescue analgesic consumed in the postoperative study period was noted as a measure of the difference in analgesic efficacy. The average amount of I.V. inj. Diclofenac sodium received as rescue analgesic by patients in control group was 238.67 mg and in group MgSO4 was 86.78 mg. Rescue analgesic consumption was seen during the first 24 hours of postoperative period especially in the immediate post-operative period. In control group, the mean duration of post-operative analgesia was 25 minutes and in MgSO4 Group the mean duration of post-operative analgesia was 187 minutes (Table 2).

The comparison of mean value of pain assessment using VAS Score in both the groups at various interval postoperatively in table no. 3.

In control Group 5% of the patients were having the complaint of nausea; 10% had vomiting while in MgSO4 Group none of the patients were having the complaint of nausea; only 10% had vomiting. None of the patients had any major side effects and require special treatment (Table 4).

DISCUSSION

Our study has shown that infusion of magnesium sulphate 50 mg/kg given before induction of anaesthesia was associated with less postoperative pain in patients undergoing lower abdominal surgery. Previous studies done by Levaux et al[4] on orthopaedic surgery, Seyhan et al[5] and Ryu et al[6] on gynaecological surgery have also reported that magnesium sulphate boluses were effective for postoperative pain relief. However, they had used continuous infusion or repeat bolus in addition to initial bolus of magnesium sulphate in their studies in contrast we use single bolus preoperatively in the present study.

We administered magnesium sulphate in dosage of 50 mg/kg IV infused over 30 min before induction of anaesthesia without any subsequent infusion. This dosage has been reported to be safe without any adverse effects as reported by several studies. It has been suggested that NMDA (N- Methyl D- Aspartate) blocking drugs should be given before beginning of nociceptive stimulus to inhibit process of central sensitization.

The mechanism of analgesic effect of magnesium sulphate is due to the inhibition of calcium channels and NMDA (N- Methyl D-Aspartate) receptors seem to play an important role. It has been commented by various workers that calcium channel blockers have an antinocieptive action in algesiometric tests in rats under acute conditions. The analgesic action of calcium channel blockers could be mediated by an increase of the nociceptive threshold resulting from interference with calcium influx because the latter is important for the release of neurotransmitters and other substances implicated in nociception and inflammation.

Tramer and others[7] observed that pretreatment with IV magnesium sulphate had no impact on postoperative pain and analgesic consumption, but the patients in their study received diclofenac suppository immediate preoperatively. Moreover, in their study all patients undergoing hernia repair had an ilioinguinal and iliohypogastric nerve block done with 20 ml of 0.5% bupivacaine at the end of surgery resulting in consistently decreased pain scores in first 4 hrs.

Similarly, Ko and others[8] have also investigating the efficacy of magnesium sulphate administration on postoperative analgesic requirement, but they had also used epidural analgesia in their study. It is possible that superior analgesic efficacy of nerve block or epidural analgesia in their patients might have masked analgesic efficacy of magnesium sulphate.

No nerve block or epidural analgesia was used in any of our patients. Shashi kiran and others[9] observed that pre operatively single dose of MgSO4 IV decrease post-operative pain and requirement of rescue analgesia after inguinal surgery and patients are more sedated as compared to placebo group.

Koinig H, et al[10] concluded that, in a clinical setting with almost identical levels of surgical stimulation, I.V. Magnesium sulfate administration reduces intraoperative and postoperative analgesic requirements compared with isotonic sodium chloride solution administration and Magnesium can be an adjuvant to perioperative analgesic management.

Hammad Usmani, et al[11] Pain scores (VAS and VRS) were significantly lower in Magnesium group at 0, 1st and 3rd hours postoperatively but comparable to control group at 6th postoperative hour. Requirement of rescue analgesic (Tramadol) was significantly lower in Magnesium group as compared to control group. No major side effect was reported in patients who received $MgSO_4$ during perioperative period. It was concluded that $MgSO_4$ infusion during perioperative period produces significantly better pain relief and less requirement of rescue analgesics in postoperative period in upper abdominal surgery patients.

CONCLUSION

We concluded that administration of intravenous Magnesium sulphate 50 mg/kg preoperatively significantly reduces postoperative pain in patients undergoing lower abdominal surgery.

REFERENCES

1. Wilder-Smith OH, Arendt-Nielsen L, Gäumann D, Tassonyi E, Rifat KR. Sensory changes and pain after abdominal hysterectomy: a comparison of anesthetic supplementation with fentanyl versus magnesium or ketamine. Anesth Analg 1998;86:95-101.

2. Kissin I. Preemptive analgesia. Anesthesiology 2000; 93: 1138-43.

3. Zarauza R, Sáez-Fernández AN, Iribarren MJ, Carrascosa F, Adame M, Fidalgo I, et al. A comparative study with oral nifedipine, intravenous nimodipine, and magnesium sulfate inpostoperative analgesia. Anesth Analg 2000;91:938-43.

4. Levaux Ch, Bonhomme V, Dewandre PY, Brichant JF, Hans P. Effect of intra-operative magnesium sulphate on pain relief and patient comfort after major lumbar orthopaedic surgery. Anaesthesia 2003;58:131-5.

5. Seyhan TO, Tugrul M, Sungur MO, Kayacan S, Telci L, Pembeci K, et al. Effects of three different dose regimens of magnesium on propofol requirements, haemodynamic variables and postoperative pain relief in gynaecological surgery. Br J Anaesth 2006;96:247-52.

6. 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;100:397-403.

7. Tramèr MR, Glynn CJ. An evaluation of a single dose of magnesium to supplement analgesia after ambulatory surgery: randomized controlled trial. Anesth Analg 2007;104:1374-9.
8. Ko SH, Lim HR, Kim DC, Han YJ, Choe H, Song HS. Magnesium sulfate does not reduce postoperative analgesic requirements. Anesthesiology 2001;95:640-6.
9. Shashi kiran and others observed that pre operatively single dose of MgSO4 IV decrease post operative pain and requirement of rescue analgesia after inguinal surgery. Indian Journal of Anaesthesia, Jan-Feb 2011;55(1):26-48.
10. Koinig H, Wallner T, Marhofer P, Andel H, Hörauf K, Mayer N. Magnesium sulfate reduces intra- and postoperative analgesic requirements. Anesth Analg 1998;87:206-210.
11. Hammad Usmani, Abdul Quadir, Mehtab Alam, Akhil Rohtagi, Gulrez Ahmed. Evaluation of perioperative Magnesium sulphate infusion on postoperative pain and analgesic requirements in patients undergoing upper abdominal surgery? J Anesth Clin Pharmacology 2007; 23(3):16-20.

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