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Original Research Article

A prospective randomized controlled trial to study the effect of preoperative and intraoperative magnesium over postoperative ileus and postoperative pain in major non–laparoscopic abdominal surgeries

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ABSTRACT

Background: The objective of the study were postoperative pain on 1st postoperative hour and 2, 4, 12, 24th postoperative hour as per numeric rating scale (NRS); total dose of postoperative analgesic consumption; postoperatively time of first appearance of bowed sounds; postoperatively time of first passage of flatus.
Methods: A randomized controlled study will be performed. Patients of ASA 1 and 2, scheduled for major abdominal (GI) surgery, were divided into magnesium group and control group. Serum magnesium levels are estimated in both groups. Magnesium group receives 40 mg/kg of magnesium sulfate in 100 cc NS 30 minutes before the induction* as Intravenous drip, followed by 10 mg/kg/hr during the intraoperative hours. Control group receives the same volume of isotonic saline solution. Intra-operative hemodynamic parameters are evaluated constantly by recording pulse rate, blood pressure and Spo2. Further, post- operative analgesic will be ensured by epidural top-up using bupivacaine and tramadol when patients complaints of pain or when monitored with numeric rating scale (NRS). Postoperative patient pain is going to be evaluated in post-anesthetic care unit (PACU)/ SICU by numeral rating scale (NRS) during 1st hour, 2nd hour, 4th hour, 12th hour and 1 day, total dose of post-operative analgesic consumption will be recorded.
Results: Of the 60 patients studied, 30 belong to magnesium group for which pre-operative and intraoperative intravenous magnesium (cases). Remaining 30 were given equal amounts of preoperative and intraoperative normal saline given (controls).
Conclusions: The results of present study suggests that pre and intra operative. Magnesium as an adjunct to epidural analgesia reduces postoperative pain pre-operative and intra operative IV mg reduces post-operative ileus duration.

Keywords: Preoperative and intraoperative, Magnesium, Postoperative ileus, Pain, Non–laproscopic abdominal surgeries

INTRODUCTION

The international association for the study of pain (IASP) define pain as an unpleasant sensory and emotional experience, associated with actual (or) potential tissue damage (or) described in terms of such damage.

Pain during surgery is often underestimated and under treated. Being purely subjective, pain and its intensity vary widely among patients. The threshold of pain is variable largely because of its emotional component. The relief of pain during surgery is "the raison d'etre" of surgery. It is right to say that the surgeons experience, acquired in the field should be extended into the

postoperative period, as this may have beneficial effects for the patiently.

While the intraoperative pain experienced by the patient has been underestimated, that of postoperative pain relief has been neglected to a large extent by surgeons. In this context, many surgeons have advocated various methods to counter pain both intraoperatively and extending into the post-operative period much to the satisfaction of patients.

The cost of general anaesthesia, the skill and specialized equipment needed for its administration coupled with an indifferent supply of anaesthetic gases and drugs and lack of monitoring equipment especially in peripheral areas of country like India made regional anaesthetic techniques as choice because they are relatively inexpensive and easy to administer.

Regional anaesthesia is currently the most effective method of reducing stress response especially in patients with surgical procedure involving abdomen.

Magnesium is the fourth most common cation in the body, and the second most common intracellular cation after potassium, magnesium is called nature's physiological calcium channel blocker. Its interference with calcium channels and NMDA reports play an important role in relief of pain.[1] As we know NMDA receptor antagonist plays an important role in central sensation of pain by preventing it. On contrary to it, instead of antagonizing NMDA, activation of NMDA cause calcium and sodium influx into cell and with an efflux of potassium and initiation of central sensitization of pain and NMDA receptor signalling may be important determining the duration and intensity of postoperative pain.[2]

Ileus designated clinical syndrome caused by impaired intestinal motility and are characterized by symptoms and signs of intestinal obstruction in the absence of lesion causing mechanical obstruction.[3] Postoperative ileus is the most frequently implicated cause of delayed discharge following an abdominal operation ileus is a temporary motility disorder that is reversed with time as initiating factor is corrected.

Magnesium is the second most common ion in the body Postoperative ileus as a main complication of major non laparoscopic abdominal surgeries, is associated with several causes such as hypomagnesaemia.[4] Ileus effects hospitalization time and this may be reduced using intravenous magnesium and as our knowledge there are no studies investigation the effect of intravenous magnesium on postoperative ileus time.

The main finding of this study was to reduce the intake of intra and postoperative analgesia and lowering the duration of postoperative ileus, after major non laparoscopic abdominal surgeries, followed by administration of intraoperative magnesium.[5]

Objectives

- Postoperative pain on 1st postoperative hour and 2, 4, 12, 24th postoperative hour as per numeric rating scale (NRS).
- Total dose of postoperative analgesic consumption.
- Postoperatively time of first appearance of bowed sounds.
- Postoperatively time for first passage of flatus.

METHODS

Study methodology

A randomized controlled study conducted in department of general surgery Konaseema institute of medical science Amalapuram Andhra pradesh. Patients of ASA 1 and 2 scheduled for major abdominal (GI) surgery, were divided into magnesium group and control group. Serum magnesium levels are estimated in both groups.

Magnesium group receives 40 mg/kg of magnesium sulfate in 100cc NS 30 minutes before the induction* as Intravenous drip, followed by 10 mg/kg/hr during the intraoperative hours.

Control group receives the same volume of isotonic saline solution.

Intra-operative hemodynamic parameters are evaluated constantly by recording pulse rate, blood pressure and Spo2. Further, post- operative analgesic will be ensured by epidural top-up using bupivacaine and tramadol when patients complaints of pain or when monitored with numeric rating scale (NRS). Postoperative patient pain is going to be evaluated in post-anesthetic care unit (PACU)/ SICU by numeral rating scale (NRS) during 1st hour, 2nd hour, 4th hour, 12th hour and 1 day, total dose of post-operative analgesic consumption will be recorded.

Duration of post-operative physiological abdominal obstruction (ileus) is going to be evaluated based on the onset of bowel sounds, time of first passage of flatus and other side effects if any will be recorded.

Induction with Fentanyl 2 mcg/kg, Propofol/thiopentone sodium 2 mg/kg, atracurium/ vecuronium 0.5 mg/kg.

Duration of study

Proposed to complete the study in stipulated period from 2016-2018.

Inclusion criteria

Inclusion criteria were all patients with age range from 18 -55 years; American Society of Anesthesiologist (ASA)

physical status of 1 or 2; indication of laparotomy for major abdominal surgeries; patients who are ready to give informed written consent for the study; subjects with normal serum magnesium levels at the time of admission.

Exclusion criteria

Exclusion criteria were non compensated liver failure; renal failure (GFR <60), heart failure (ejection fraction <45%); heart block; heart arrhythmia; neurological disorders; pregnancy; history of hypersensitivity to any anesthetic agents; sensitivity to magnesium compounds; any recent consumption of calcium channel blockers or magnesium consumption; serum magnesium level above normal.

Statistical data

At the end of the study all the data is compiled and entered in MS-Excel and analysed.

Descriptive statistics were represented with percentage, mean, standard deviation median, IVR. Independent t-test, Mann-Whitneey U test and chi square test were applied based on the nature of the data. P<0.05 was considered as statistically significant.

RESULTS

Of the 60 patients studied, 30 belong to magnesium group for which preoperative and intraoperative intravenous magnesium (cases). Remaining 30 were given equal amounts of preoperative and intraoperative normal saline given (controls).

Represented as Table 1, the age distribution in case group is 18-55 years. The age distribution in control group is 18-15 years. There is no statistical significance.

Of the 60 cases study 35 were male (with 16 cases and 19 controls), 25 were females (with 14 cases and 11 controls).

Table 1: Age distribution.

Age (in years)	Group			
	Case		Control	
	Count	%	Count	%
≤20	4	13.3	1	3.3
21-30	3	10.0	6	20.0
31-40	6	20.0	7	23.3
41-50	11	36.7	11	36.7
>50	6	20.0	5	16.7
Total	30	100.0	30	100.0
Chi-square value=2.97; p=0.56				

	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Age	Case	18.0	55.0	40.6	12.6	45.0	19.8	0.91
	Control	19.0	55.0	40.9	10.7	43.5	18.5	

Table 2: Sex distribution.

Sex	Group			
	Case		Control	
	Count	%	Count	%
Female	14	46.7	11	36.7
Male	16	53.3	19	63.3
Total	30	100.0	30	100.0

P=0.6.

Table 3: Pain at first hour.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Pain at 1st hour	Case	1.0	4.0	1.5	0.8	1.0	1.0	<0.001
	Control	2.0	10.0	6.5	1.8	6.0	3.0	

Mean pain at 1st hour is 1.5 for cases, 6.0 for controls.

Mean number of epidural top ups received by cases is 1.5. Mean no. of epidural top ups received by controls is 4.4 and p value obtained is <0.001 which is very highly significant.

Mean time for first appearance of bowel sounds for cases is 15.7 hours, mean time for first appearance of bowel sounds for controls is 28.0 hours, p value is <0.001 which considered very highly significant.

Mean time for first passage of flatus for cases is 19.0 hours, mean time for first passage of flatus for controls is 35.9 hours, p value is <0.001 which considered very highly significant.

Table 4: Pain at 2nd hour.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Pain at 2nd hour	Case	1.0	4.0	1.5	0.9	1.0	1.0	<0.001
	Control	2.0	10.0	6.0	1.7	6.0	2.0	

Mean pain at 2nd hour is 1.6 for cases, 5.8 for controls.

Table 5: Pain at 4th hour.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Pain at 4th hour	Case	1.0	5.0	1.6	0.9	1.0	1.0	<0.001
	Control	1.0	9.0	5.8	1.7	6.0	2.0	

Mean pain at 4th hour is 1.6 for cases, 5.8 for controls.

Table 6: Pain at 12th hour.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Pain at 12th hour	Case	1.0	2.0	1.3	0.5	1.0	1.0	<0.001
	Control	1.0	7.0	5.2	1.3	5.0	1.0	

Mean pain at 12th hour is 1.3 for cases, 5.2 for controls.

Table 7: Pain at 24th hour.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Pain at 24th hour	Case	1.0	2.0	1.1	0.3	1.0	0.0	<0.001
	Control	3.0	8.0	5.2	1.1	5.0	1.0	

Mean pain at 24th hour is 1.1 for cases, 5.2 for controls.

Table 8: No. of epidural top ups received for cases versus controls.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Epidural top-ups	Case	0.0	2.0	1.5	0.6	1.5	1.0	<0.001
	Control	3.0	6.0	4.4	0.7	4.0	1.0	

Table 9: Time of first appearance of bowel sounds in cases v/s controls.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Time of first appearance	Case	4.0	30.0	15.7	5.4	15.0	7.3	<0.001
	Control	20.0	42.0	28.0	6.7	26.0	5.0	

Table 10: Time of first passage of flatus.

Variable	Group	Minimum	Maximum	Mean	SD	Median	IQR	P value
Time of first passage flatus	Case	8.0	34.0	19.0	5.4	17.5	6.3	<0.001
	Control	29.0	49.0	35.9	6.1	33.5	5.0	

DISCUSSION

Regional anaesthesia has always been associated with excellent outcomes in more than 95% of patients posted for various surgical procedures

Its importance has been recognized not only by the anesthesiologists, but also by the surgeons. Hence there is a rapid increase in the usage of regional techniques like spinal, epidural, peripheral nerve blocks, plexus blocks, field blocks etc.

Adjuvants are pharmacological drugs that when co administered with local anaesthetics may improve quality of blockade and have additional effects on, for example intestinal motility improvement and reducing the need for postoperative continued analgesic consumption during early postoperative periods.

Inhibition of gastric emptying and drug absorption by narcotic analgesics is well known.[6]

Among the magnesium sulphate when co administrated through intravenous route (IV) immediate preoperative and intraoperatively titrated to patients body weight as 40 mg/kg bolus and further 10 mg/kg/hr intraoperatively have shown excellent result in terms of postoperative pain and postoperative intestinal motility (by reducing postoperative ileus time and reducing time of first appearance of bowel sounds and time of first passage of flatus.

Levaux et al studied 24 patients undergoing major lumbar surgeries.[10] In this study intervention group received 50 mg/kg of intravenous magnesium sulfate this study reveals the bowls dose reduces postoperative analgesic consumption and makes greater satisfaction and better sleep in first 24 hours.

A few similar studies administered just a single bolus dose of magnesium sulfate just before induction of general anaesthesia.

In another study of knee arthroscopy patients were received bolus and infusion doses of magnesium and were assessed 4 hours after the operation, which the magnesium group received significantly lower amount of fentanyl, intraoperative and postoperatively.

In another study effect of adjuvant intrathecal magnesium sulphate to bupivacaine for spinal anesthesia is done as randomized controlled trial.[7]

Physiologically obstructive ileus as the main complications of GI surgery is associated with several causes such as hypomagnesemia ileus affects hospitalization time and this may be reduced using intravenous magnesium and as our knowledge there are no studies investigating the effect of intravenous magnesium on postoperative ileus time.

In contrast epidural analgesia in gastrointestinal surgeries won't cause ileus and in turn will reduce ileus duration.[8]

The main finding of this study was to reduce the intake of intraoperative and postoperative analgesia and lowering the duration of postoperative ileus, after major non-laparoscopic GI surgeries, followed by administration of intraoperative magnesium. According to the meta-analysis of 2013, the pain relieving effect of magnesium was examined in a few studies and need to be more evaluated.

Tramer et al, study on abdominal hysterectomy patients under look a bolus of 15 ml of 20% magnesium and 2.5 ml/hr infusion for 20 hours and postoperative pain and analgesic consumption were evaluated. Role of magnesium sulphate on postoperative analgesia is studied.[9] In the present study, intraoperative and postoperative pain were evaluated.

The main difference between our study and Tramer et al was the lower dosage of bolus and maintenance of magnesium. In our study, the magnesium group given is 40 mg/kg for bolus dose of magnesium sulfate and 10 mg/kg/hr for maintenance dose in less infusion time compared to Tramer et al from the start to the end of operation.[9]

In another study "Telci et al" studied the administration of magnesium sulfate infusion, reduces intraoperative anaesthetic requirements.[10] 81 patients (36 female, 45 male) undergoing effective spinal surgeries were divided into two groups. The intervention group received 30 mg/kg bolus and 10 mg/kg infusion during the operation for maintenance lower consumed doses of propofol, remifentanil and rocuronium were identified when magnesium sulfate was increased the dosage of anaesthetic drugs was reduced but in low doses of 10 mg/kg/hr side effect of magnesium were not developed. Some of these side effects was dysrhythmias, in form of premature ventricular contraction (PVC) which increased with higher dosage of magnesium, 50 mg/kg compared to 25 mg/kg.

Since the most recommended magnesium sulfate in previous studies were 40 mg/kg bolus and 10 mg/kg/hr. Infusion during operation, we analyzed this regimen of administration of magnesium.

Our results were observed to be in cases who received magnesium in immediate preoperative and intraoperative period were presented with a mean pain of 1.5 at first hour as per NRS which is a subjective pain scale where patient selects a number between 0–10 where "0" indicates no pain and 10 indicates highest level of pain and mean pain of 6.5 at first hour in those controls who have not received magnesium likewise mean pain at 2nd hour for mg group is 1.5 and control group was 6.0 mean pain of 1.6 at 4th hour for mg group and 5.8 at 4th hour for control group likewise, mean pain at 12th hour for mg group is 1.3 and control group is 5.2 finally, mean pain at 24th hour for mg group is 1.1 and mean pain at 24th hour for control group is 5.2

Which attained p value of <0.001 which is considered to be statically very high significant.

Number of epidural top-ups received in whole postoperative period when each top-up is given with patient request for analgesia attained a mean epidural top-ups for mg group of 1.5 and mean top-up for control group of 4.4 with a maximum top-ups received for mg

group being 2.0 and maximum top-ups received by control group being 6.0 which attained p value of <0.001 which is considered to be statically very highly significant

Mean time of first appearance of bowel sounds postoperatively for major non laparoscopic GI surgeries in mg group is 15.7 hours and control group being 28.0 hours with p<0.001.

Mean time of passage of flatus postoperatively for mg group being 19.0 hours and control group being 35.9 hours with a minimum time to pass flatus in mg group being 8.0 hours and minimum time to pass flatus in control group being 29.0 hours which attained p value of <0.001 which is statically considered very highly significant.

The results of the present study showed that magnesium sulphate is a useful adjuvant to cases undergoing major non laparoscopic Abdominal surgeries interms of reducing postoperative analgesic consumption and relative pain free postoperative period and early improvement from postoperative ileus.

Of the 60 patients studied 30 belong to magnesium group for which preoperative and intraoperative magnesium given.

Remaining 30 belong to control group for which equal amounts of normal saline given preoperatively and intraoperatively.

CONCLUSION

In the present study, the effect of intravenous preoperative and intra operative magnesium over postoperative pain (total analgesic consumption + NRS) and postoperative ileus (time of first appearance of bowel sounds + time of first passage of flatus was studied. The results of present study suggests that pre & intra operative. Magnesium as an adjunct to epidural analgesia reduces postoperative pain. Preoperative and Intra operative IV mg reduces postoperative ileus duration. My group has got early onset of bowel sounds and early passage of flatus. My group has consumed lesser total analgesic post operatively. My group has attained lesser subjective pain numbers as per NRS.

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