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Effects of Magnesium Sulphate ($MgSO_4$) Versus Fentanyl as an Adjuvant to Epidural Bupivacaine in Lower Abdominal Surgeries

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Abstract **Original Research Article**

Background: In modern anaesthesia practice, a number of agents are used as adjuncts with epidural local anesthetics to achieve good perioperative hemodynamic stability as well as prolong the postoperative analgesia period. Among the different adjuvants, Fentanyl and Magnesium sulphate shows the promising results. ***Objectives:*** To study the effects of Magnesium Sulphate (MgSO4) versus Fentanyl as an Adjuvant to single-shot Epidural Plain Bupivacaine in Lower Abdominal Surgeries. ***Methods:*** It is a randomized controlled trail study, carried out in the Department of Anaesthesia, Analgesia, Palliative & Intensive Care Medicine, Dhaka Medical College Hospital Dhaka. Study populations were patients of ASA Status I-II planned for lower abdominal surgery under single-shot epidural anaesthesia. Study populations were randomly allocated into one of the three groups, of 25 each- group C, M&F. Group C-Patients received plain bupivacaine 0.5% 20 ml. Group M - Patients plain bupivacaine 0.5%(19 ml)+500 mg magnesium sulphate (1ml) and group F received plain bupivacaine 0.5% (19 ml)+50µg Fentanyl (1ml). Data were processed and analyzed by SPSS version 22.0. ***Results:*** It was found that the onset of sensory block at T8 was faster in Group M and F (14.2±2.5 min & 13.8±2.2 min) than Group C (18.5±3.1 min). On comparison of the required time to achievement of sensory loss between groups, required time was 11-15 minutes in 12(48.0%) patients of Group-M, 15(60.0%) in group F versus 16-20 minutes in 12(48.0%) patients of Group-C. The result was significant (*p-value < 0.05). In this study duration of sensory block was longer in Group-M >Group-F> group C. Result was significant between groups (p<0.01). But the motor block was almost similar between groups. No statistically significant difference was seen in between groups. It was evident that intensity of pain was lower up to 6 hrs. After anaesthesia, following that pain increases and analgesic also required in all groups, comparatively lower in Group-M & F. Mean VAS was 2.5, 2.8 and 4.3 in group M, F & group C respectively at 6 hrs. after surgery. Postoperatively 1st demand for analgesia was earlier in Group-C. The difference was statistically significant (p=<0.0001). The total analgesic requirement was higher in Group-C>F>M, which was statistically significant (p=<0.0001). Heart rate was more stabilized those patients getting MgSO4 and 6 hours& 9 hours after anaesthesia it was statistically significant. ***Conclusion:*** Present study shows that Magnesium Sulphate as an adjunct to epidural bupivacaine produces a longer duration of anaesthesia, provides optimum postoperative pain control and maintains excellent hemodynamics without any side effects where the addition of fentanyl to epidural bupivacaine produces earlier onset of surgical anaesthesia.

Keywords: Group, Anaesthesia, Anaesthesia, Bupivacaine, Patient, Epidural, Fentanyl, Sensory.

I. INTRODUCTION

Epidural anesthesia is the most commonly used technique for inducing surgical anesthesia and postoperative analgesia in patients undergoing lower abdominal, gynecological & lower limb surgeries. Advances in perioperative and postoperative anesthesia and analgesia have improved pain relief and satisfaction in surgical patients. Opioids administered via patient-controlled analgesia (IV-PCA) provide better analgesia and patient satisfaction than conventional delivery. However, IV-PCA has not been demonstrated to affect postoperative outcomes significantly. Recent studies

suggest that advances in anesthesia and postoperative analgesia can affect postoperative outcome [1, 2]. Epidural anesthesia and analgesia have the potential to reduce or eliminate the perioperative physiologic stress responses to surgery. And thereby it decreases surgical complications and improves outcomes. The epidural procedure with catheter placement has several advantages. It can be topped up with a more local anaesthetic, and therefore its effects can be made to last longer than a spinal anaesthetic. It can be used to make the patients comfortable for several days after the operation [3]. By blocking the transmission of signals through nerves in or near the spinal cord, epidural anesthesia can cause both a loss of sensation and pain. Its versatility means it can be used as an anesthetic, as an analgesic. To maintain continuous anesthesia after placement of an epidural catheter, the advantage of epidural over spinal anesthesia is the ability thus making it suitable for procedures of long duration. but create some sorts of complications like hypotension, bradycardia developed after the epidural technique. Due to dilatation of resistance and capacitance vessels, a more important effect of sympathetic inhibition during spinal or epidural anaesthesia is a significant decrease in venous return. The high sympathetic blockade caused more hypotension due to dilatation of splanchnic vessels and a decrease of catecholamines released by the adrenal medulla. Adjuvant prolongs the action of local anaesthetic provides satisfactory postoperative analgesia, as well as better hemodynamic stability, which co-administered with local anesthetic agents, may improve the speed of onset duration of analgesia and counteract the disadvantageous effects of local anesthetics. By adding these adjuvants, the dose of local anesthetics like bupivacaine can be reduced, thereby reducing its side effects. The use of adjuvants to local anesthetics has been promoted a lot based on "Combination Wisdom". For both neuraxial and peripheral nerve blocks, a wide variety of drugs have been used. It is broadly divided into non-opioids and opioids, with non-opioids being epinephrine, α - adrenoceptor agonists, acetylcholine esterase inhibitors, adenosine, ketorolac, midazolam, magnesium, sodium bicarbonate, and hyaluronidase, and opioids being lipophilic and hydrophilic [4]. Haemodynamic stability, analgesia, and anxiolysis are an integral part of the perioperative period of any surgery. Anaesthetic consideration for lower abdominal surgery requires some special attention, age and co-morbidity of patients, duration of surgery, and special requirements for patient's satisfaction after surgery. Therefore, proper hemodynamic stability, pleasant analgesia, and anxiolysis are required to maintain. Adjuvant drugs may be added to the anaesthetic solution not only to prolong the duration of the block but also to provide postoperative analgesia. Various types of adjuncts e.g., dexmedetomidine [5], fentanyl, magnesium sulfate, 6 clonidine [7], etc. are used for post-operative pain attenuation after lower abdominal surgeries. Fentanyl and Magnesium are commonly used adjuvants with local anaesthetics having various results. Fentanyl being highly lipid-soluble diffuses into the spinal cord and binds to dorsal horn receptors rapidly when administered epidurally. This produces rapid onset of analgesia with minimal cephalic spread. A previous study reported Fentanyl added to bupivacaine and Magnesium sulfate for labor epidural analgesia resulted in faster onset, longer duration of action, and reduced breakthrough pain [6]. Magnesium, the fourth most common cation in the body, has postsynaptic N-methyl D-aspartate calcium channel blocker properties and has been used successfully to potentiate opioid analgesia and to treat neuropathic pain in animals [8]. Another clinical study for demonstrating the requirements of perioperative analgesia showed that using Magnesium Sulphate causes less consumption of total analgesic agents in the postoperative period [9]. Other studies examined different routes of magnesium administration such as the intravenous or the intrathecal route and were found to improve anesthetic and analgesic quality. Post-operative pain has the potential for significant adverse effects on physiology and can also drown the patient into psychological suffering. The relief of pain has always been a part of the anaesthesiologist's role in the most immediate postoperative period and the development of acute postoperative pain services has extended this interest beyond the post-anesthesia care unit. Therefore, the aim of this study was to evaluate the MgSO4 versus.

II. OBJECTIVES

General objectives

To study the effects of Magnesium Sulphate (MgSO4) versus Fentanyl as an Adjuvant to single shot Epidural Plain Bupivacaine in Lower Abdominal Surgeries.

Specific objectives

- To compare motor and sensory block, progression and regression of each group (Group C: Pt received only plain bupivacaine, Group M: Pt received $MgSO_4$ with plain bupivacaine and Group F: Pt received fentanyl with plain bupivacaine).
- To measure the hemodynamic parameters of each group.
- To see the analgesic effects and post-operative pain attenuation of both drugs ($MgSO_4$ versus fentanyl).
- To compare the visual analogue score (VAS) as effectiveness of both groups.

III. METHODS AND MATERIALS

This prospective, randomized, double-blinded study was conducted in the Department of Anaesthesia, Analgesia, Palliative & Intensive Care Medicine, Dhaka Medical College Hospital. This study was conducted over a period of six months from 22nd January 2020 to 21st July 2020. Total 75 patients, ASA physical status I and II, aged 18–60 years, undergoing lower abdominal surgeries under epidural anesthesia were included in the study. Patients were recruited and randomized into three

groups of 25 each using a computer-generated random number chart. From each patient with respect to the nature of anesthesia and options of analgesia, informed written consent was taken. The ethical approval was taken by the Ethical Review Board, Dhaka medical college hospital. The eligible patients were randomly allocated into three equal groups. Using computer-generated random list, the participants were randomized into three equal treatment groups, Group C: plain bupivacaine 0.5% 20 ml, Group M: plain bupivacaine 0.5% (19 ml) + 500 mg Magnesium sulphate (1ml) and Group F: plain bupivacaine 0.5% 19 ml + 50µg Fentanyl (1 ml). At the preoperative visit, the pain evaluation score using the visual analog scale (VAS) was 10 cm where (0 cm=no pain and 10 cm= the worst pain) was explained to each patient. All patients were administrated intravenous 20 ml/kg Ringer's lactate before and during the epidural block. To the nature of the prepared epidural solution, the epidural anesthesia was performed by an anesthetist who was blinded. With the patient in a sitting position and under strict aseptic conditions, an 18-gauge epidural Tuohy needle was introduced at the lumbar L2-3 interspace in the midline. The epidural space was identified by performing the loss of resistance to isotonic saline. At that point, the multi-orifice catheter was inserted 5 cm cephalic into the epidural space. The catheter was secured and the patient turned supine. The "test dose" by 3 ml of 2.0% lignocaine with 1:200,00 epinephrine was injected through the catheter and observed for the response. After observing the effects of the test dose and again after negative aspiration, an "incremental dose" of 5mL of the prepared local anesthetic drug was injected. If any unwanted event does not occur, then the rest of the 15 mL prepared drug is injected into each group of patient's every time the epidural injection gave after negative aspiration for blood or cerebrospinal fluid. After completion of epidural injection using analgesia to pinprick, the sensory block was tested caudal to T6 at 2 min intervals for 30 minutes. The time taken to achieve the sensory block up to the T8 level was recorded. If the sensory block did not reach T8 after 30 min from the block, it was considered as failed epidural block and was excluded from the study. For 30 min using Modified Bromage Scale, Motor block was assessed at 5 min intervals. In the postoperative period respiratory rate, heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure were monitored at 0,1, 2, 3, 6, 9, 12, and 24 h. Postoperatively pain was assessed using VAS scoring at 0, 1, 2, 3, 6, 9, 12, and 24 hours. A resting VAS score < 3 is considered satisfactory. If patients noticed inadequate analgesia (VAS > 3), intramuscular Inj. Pethidine 1.5mg/kg was administered as a supplementary rescue analgesic. The duration of analgesia and total consumption of opioids were evaluated. Statistical analysis of the data was done using the SPSS version 22.0.

IV. RESULTS

Table-1: Demographic characteristics of the study participants (N=75)

	Group M n= 25	Group F n= 25	Group C n= 25	p- Value
Age (years)	43.4 ± 12.5	45.5 ± 8.9	46.2 ± 10.2	0.412
Gender				
Male	13 (52.0)	15 (60.0)	12 (48.0)	0.387
Female	12 (48.0)	10 (40.0)	13 (52.0)	
BMI (kg/m^2)	21.73 ± 4.37	23.54 ± 5.24	21.98 ± 5.72	0.512

Values are expressed as mean ±SD or absolute number. Statistical analysis was done by chi-square test and one-way ANOVA test where p- value < 0.05 is considered as statistically significant.

Table 1 showed that age of the study participants is well matched. Mean age of the patients was 43.4 ± 12.5, 45.5 ± 8.9 & 46.2 ± 10.2 in group M, group F & group C respectively. In group M & F male were predominant (52% & 60% respectively), where group C was female predominant. Regarding BMI study, it was 21.73 ± 4.37, 23.54 ± 5.24 and 21.98 ± 5.72 in group M, group F and group C respectively. However, there were no statistical difference found in age and BMI comparison dates in all groups (p> 0.05).

Table-2: Time to onset of sensory block (N=75)

Time (min)	Number of Patient			p- Value
	Group M (n=25)	Group F (n=25)	Group C (n=25)	
5-10	1(4.0)	3(12.0)	0	
11-15	12(48.0)	15(60.0)	7(28.0)	
16-20	9(36.0)	7(28.0)	12(48.0)	
>20	3(12.0)	0	6(24.0)	
Mean ± S.D.	14.2±2.5 min	13.8±2.2 min	18.5±3.1 min	0.011[s]

Values are expressed as frequency and percentage then mean ± SD was calculated. Statistical analysis was done by using one- way ANOVA test where p-value < 0.05 was considered as significant.
* s= significant

Table 2 showed the time to onset of sensory block. Onset of sensory block at T8 was faster in Group M and F (14.2±2.5 min & 13.8±2.2 min) than Group C (18.5±3.1 min). On comparison of the required time to achievement of sensory loss between groups, required time was 11-15 minute in 12(48.0%) patients of Group-M, 15(60.0%) in Group F versus 16-20 minute in 12(48.0%) patients of Group-C. The result was significant (*p value < 0.05).

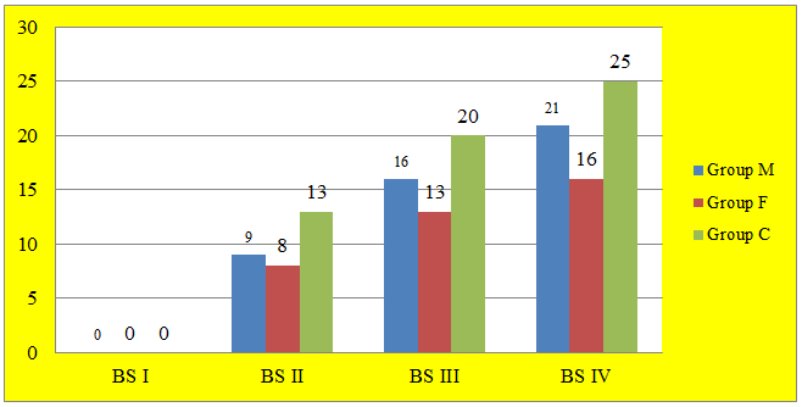

Fig-I: Assessment of Bromage scale and time to onset of motor block (N=75)

Figure I show the onset of motor block was 17.7±2.1 min in Group M patients, 14.7±2.1 min in Group F patients and 20.1. ±2.7 min in Group C patients. The difference was statistically non-significant. Time taken to achieve Bromage 3 following epidural was considered as onset of motor block. An average Bromage score of 4 was achieved for the motor block in both groups (p = 0.165).

Table-3: Mean duration of sensory and motor block (N=75)

Variables	Mean duration (min)			p- Value
	Group M (n=25)	Group F (n=25)	Group C (n=25)	
Sensory block	441.3±42.7	355.1±27.9	214.9±29.3	0.007^{s}
Motor block	245.3±15.6	239.4±15.4	186.3±15.6	0.078^{ns}

Values are expressed as mean ±SD. Statistical analysis was done by one-way ANOVA in between the groups. P-value < 0.05 is considered statistically significant.

Table 3 showed mean duration of sensory and motor block among the groups. The duration of sensory block was longer in Group-M > Group-F > Group C. It was 441.3 ± 42.7 for group M, 355.1 ± 27.9 for group F and 214.9 ± 29.3. The difference was statistically significant (p value 0.007). But motor block was almost similar between the groups No statistical significant was found among the groups (p value>0.05).

Table-4: Mean heart rate at different point of time in between the groups. (N=75)

HR (beats/min)	Group M (n=25)	Group F (n=25)	Group C (n=25)	p_1 value
Baseline	87.7 ± 7.3	86.7 ± 9.4	85.9 ± 7.1	0.171^{ns}
3 hrs after	92.7 ± 8.2	87.7 ± 11.4	92.0 ± 11.9	0.060^{ns}
6 hrs after	90.5 ± 6.9	76.1 ± 8.2	98.5 ± 7.7	0.009^{s}
9 hrs after	92.2 ± 6.0	83.2 ± 7.8	100.9 ± 5.1	0.012^{s}
12 hrs after	96.1 ± 5.2	95.2 ± 10.1	104.2 ± 8.1	0.201^{ns}
p_2 value	0.040^{s}	0.020^{s}	0.042^{s}	

Values are expressed as mean ± SD. Statistical analysis was done by one-way ANOVA in between the groups and repeated measures ANOVA within the groups. p1 value: p value between the groups and p2 value: p value among the groups, where p value < 0.05 is considered as statistically significant.

Table 4 showed mean heart rate variables at different point of time in between the groups. It reveals at baseline & 3 hours after anesthesia there was no statistical significance of mean HR in between the groups. After 6 hrs. mean HR was 90.5± 6.9, 76.1 ± 8.2 and 98.5 ± 7.7 in Group M, Group F & Group C respectively. After 9 hrs. mean HR was 92.2± 6.0, 83.2 ± 7.8 and 100.9 ± 5.1 in group M, group F & group C respectively. It was statistically significant both after 6 and 9 hrs. (p value 0.009 and 0.012 respectively). However, after 12 hrs. values were not significant (p value>0.201). There was statistical significance found after analysis of the data's within the groups.

Table-5: Mean blood pressure at different point of time in between the groups. (N=75)

MAP (mmHg)	Group M (n=25)	Group F (n=25)	Group C (n=25)	p_1 Value
Baseline	87.44 ± 7.55	88.27 ± 8.58	88.85 ± 7.95	0. 254^{ns}
3 hrs after	82.37 ± 6.37	80.57 ± 5.42	84.37 ± 7.01	0. 042^{s}
6 hrs after	83.73 ± 5.73	82.75 ± 4.72	89.69 ± 6.72	0. 021^{s}
9 hrs after	84.26 ± 7.31	85.61 ± 5.26	90.08 ± 7.21	0. 031^{s}
12 hrs after	91.14 ± 5.86	88.62 ± 6.48	90.21 ± 6.29	0. 234^{ns}
p_2 value	0.025^{s}	0.022^{s}	0.043^{s}	

Values are expressed as mean ± SD. Statistical analysis was done by one-way ANOVA in between the groups and repeated measures ANOVA within the groups. p1 value: p value between the groups and p2 value: p value among the groups, where p value < 0.05 is considered as statistically significant.

Table 5 showed that MAP values of each group at different point of time. It had been observed that the fall of MAP was more in group F after 3 hours of epidural aneasthesia (p value 0.042) in contrast to group M & group C. After 6 hours & 9 hours MAP became higher in group C, 89.69 ± 6.72 & 90.08 ± 7.21 respectively compared to group M and group F. Intergroup comparison of these values became statistically significance (p value 0.021 & 0.031 respectively). The average MAP peaked was notified after 12 hours of epidural aneasthesia in each group. However, it was not statistically significant (p value > 0.05). But there was statistical significance found after analysis of data within the groups.

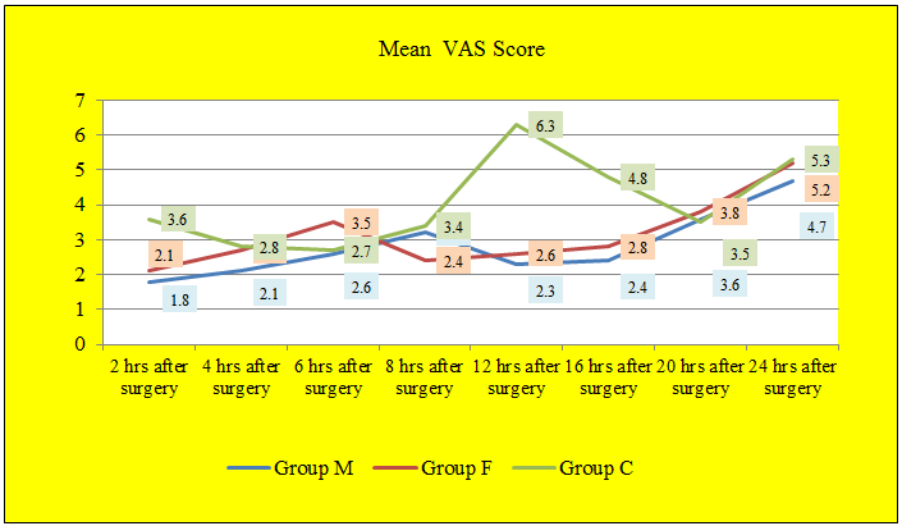

Fig-II: Observation of intensity of pain by Visual Analogue Score (VAS) (N=75)

The day before surgery patients were instructed about the Visual Analog Scale (VAS) in which 0=no pain and 10=worst pain (imaginable). In this study it was evident that intensity of pain was lower up to 8 hrs after administration of anaesthesia in group M whereas it about 6 hours in group F and only about 3 hours in group C, following that pain increases and analgesic also required in all groups. Comparatively lower in Group-M, F. Patients in the Group-C had higher VAS (3.6) during the second hours (P = 0.0001), compared with the Group-M (1.8) & F (2.5). Mean VAS was 2.5, 2.8 and 4.3 in group M, F & group C respectively at 6 hrs after surgery. The difference was statistically significant. Six hours after anaesthesia, all groups showed upward trends of the pain VAS, but significantly in group C. At the 24th hour, VAS score almost equal in group of patients, 5.2 in group M, 5.3 in group F & 5.3 in group C.

Table-6: Distribution of the study patients according to rescue analgesic requirement (N=75)

Analgesic Variable	Mean Duration (min)			p- Value
	Group M (n=25) Mean ±SD	Group F (n=25) Mean ±SD	Group C (n=25) Mean ±SD	
Time of first demand of analgesic (min)	479.5±48.1	385.7±34.2	225.3±39.2	0.001^{s}
Total analgesic requirement in 24 hrs (mg)	86.35± 11.72	166.26±30.53	220.86±31.61	0.001^{s}

Values are expressed as mean ± SD. Statistical analysis was done by one- way ANOVA in between the groups. p- value < 0.05 considered as statistically significant.

Table 6 shows the Distribution of the study patients according to rescue analgesic requirement. In this study post-operative pain was treated according to operational definition. All patients were given 100 mg (50mg ×2) suppository diclofenac every 8 h. If pain not alleviated and pain score >4, rescue medication was given as Inj. Pethidine 1.5mg/kg intramuscular. Post operatively 1st demand of analgesia was earlier in Group-C and it was 225.3±39.2 whereas 479.5±48.1 and 385.7±34.2 for group M and group F respectively. The difference was statistically significant (p=< 0.0001). Total analgesic requirement was lower in group M, 86.35±11.72 and highest in group C, 220.86±31.61 which was alsos statistically significant (p=< 0.0001).

V. DISCUSSION

This randomized controlled trial was conducted in the Department of Anaesthesia, Analgesia, Palliative & Intensive Care Medicine, Dhaka Medical College Hospital, Dhaka to see the effects of Magnesium Sulphate (MgSO4) versus Fentanyl as an Adjuvant to single-shot Epidural Bupivacaine in Lower Abdominal Surgeries. Epidural analgesia offers superior pain relief and early mobilization, especially when the local anesthetic dose is combined with an adjuvant as compared to LA use alone. It permits analgesic dosing through the catheter for postoperative pain management. It also avoids invasive dural penetration and spinal hypotension. The synergism between epidural local anesthetics and opioids is well established, but evidence regarding the combination of LA with magnesium through the epidural route is scarce in the literature. In this study, the demographic characteristics of the study participants were statistically similar in context to age and sex. In group M and group F, there was male predominant wherein in group F it was female predominant. Standard BMI was found in all groups. However, there was no statistical significance found in demographic data among the groups. On comparison of the required time to achievement of sensory loss between groups, the maximum number of patients was achieved sensory block in group F (60 % of study participants) and group M (48% of study participants) within 11-15 minutes, on the other hand, it was 16-20 minutes for group C (48% of study participants). The result was significant (*p value< 0.05). Time taken to achieve Bromage 3 following epidural was considered as onset of motor block. However, Bromage 3 was achieved in 17.7±2.1 min in Group M patients, 14.7±2.1 min in Group F patients, and 20.1±2.7 min in Group C patients. An average Bromage score of 4 was achieved for the motor block in both groups. But the difference was statistically non-significant (p = 0.165). We had observed that with the addition of magnesium to epidural bupivacaine, the onset of sensory and motor blockade was delayed than that of fentanyl but earlier than bupivacaine alone. It could be because of the difference in pH of the solution containing magnesium that contributed to the delayed onset. This was reported in the previous study in Chandigarh, India [10] in mild pre-eclampsia patients. A comparative study [11] demonstrated the delayed onset of analgesia. It may be due to the increase in the metabolism of bupivacaine due to the activation of cytochrome p450 by magnesium sulphate. In this study duration of sensory block was longer in Group-M > Group-F > Group C. Mean duration for the sensory block was 441.1 ±46.7 mins in Group M, 355.1 ±27.9 mins in Group F, and 214.9 ± 29.3 mins in Group C. Result was significant between groups (p<0.05). But the motor block was almost similar (a little bit more in group M) between groups. No statistically significant difference was seen in the between-group (p>0.05). So, epidural anesthesia with Magnesium Sulphate(MgSO4) was prolonged duration of the sensory block than Fentanyl.Previous study6 reported, the addition of magnesium to bupivacaine prolonged the analgesia by approximately 1 -2 hours (169 ±50 min) than the control group. Also, the breakthrough pain and the top-up doses needed in 4 h were reduced significantly by adding magnesium to epidural bupivacaine and fentanyl. Another study was done to determine the effects of adding magnesium sulfate to epidural bupivacaine and fentanyl in patients undergoing elective cesarean section using combined spinal-epidural anesthesia (CSE), patients who received magnesium had good intraoperative conditions as well as good quality of postoperative analgesia.20 Studies reported epidural administration of magnesium had an additive analgesic effect to bupivacaine and fentanyl during labor analgesia, in comparison with the bupivacaine fentanyl only.6 In two cases reported by another study [12], larger doses (8.7g, 9.6g) of magnesium sulphate were accidentally administered into the epidural space and did not result in any neurologic complication. So, it is suggested that magnesium is a safe drug. On comparison at baseline and 3 hours after anaesthesia, HR was more or less stabilized in all groups but after 6 hours it significantly reduced in group F than group M and group C. After 6 hours the variation was significant (p-value <0.05). Even, 9 hours after anesthesia variations were significant (p value<0.05). However, we hadn't any experience of bradycardia in any group, probably due to the optimum dose of the drug used in both groups. In our study, the addition of magnesium sulfate to epidural bupivacaine did not seem to impact heart rate, but fentanyl showed a moderate reduction of heart rate in a few patients. This result become statistically significance (p-value for group F< 0.05 & for group M > 0.05). However, a prospective randomized double-blind study [13] reported some incidence of bradycardia while using MgSO4 as an adjunct with bupivacaine in epidural anesthesia. This result is in contrast to our present study findings. In the comparison of the Mean arterial pressure of the study groups, MAP was almost stabilized in group M at 3 hours, 6 hours & 9 hours after anesthesia, but it reduced in group F at the same point of time. And the variations were statistically

significant at different points of time (3 hrs,6 hrs & 9 hrs after anesthesia. Statistical significance was also found at different points in time within the groups. In a randomized controlled trial on effects of MgSO4 versus Fentanyl with epidural Levobupivacaine, no statistically significant difference in mean arterial pressure (MAP) between the three groups were observed in baseline readings, however after activation of the epidural anesthesia at 20 min, at skin incision as well as at 15 and 30 min of surgical time MAP in group C (Levobupivacaine) was slightly higher than groups A (Levobupivacaine with fentanyl) with and B (Levobupivacaine MgSO4), e.g.: at skin incision (group A 80.41±6.27, group B 82.95±4.89, group C 86.41± 5.53, P 0.003), afterward MAP became comparable between the three groups throughout the operation and till recovery of the patients [14]. In this study, it was evident that the intensity of pain was lower up to 8 hours after administration of anaesthesia in group M whereas 6 hours for group F and only about 3 hours for group C. Regarding the analysis of VAS among the groups it was higher in group C and least in group M at different point of time. The difference was statistical significance. However, the VAS score was almost equal in all groups around 20 to 24 hours later of anaesthesia. Previously a randomized controlled trial for evaluating the effect of epidural MgSO4 showed the difference in mean VAS score compared with the controlled group was at 4 hours after anaesthesia.15 Distribution of study patients according to rescue analgesia, it was observed that 1st demand of analgesia was earlier in Group- C (meantime: 225.3 ±39.2 min) whereas it was 479.5±48.1 mins in group M & 385.7±34.2 mins in group F. The difference became statistically significant as "p" value was 0.0001. Again, total requirements of the analgesic agent were also minimum in group M within 24 hours. And maximum in group C. This difference was also statistically significant. Taken together, these results indicate that the addition of MgSO4 through epidural route delayed the urge for rescue analgesia. A similar effect was noticed in an earlier study while evaluating the effect of epidural MgSO4 compared with bupivacaine alone [15]. Again, a prospective, randomized, double-blind controlled trail using epidural MgSO4 minimize the need for postoperative opioid consumption than the control group [16].

VI. LIMITATIONS OF THE STUDY

Though sample was taken from one single hospital with sample size, so the results of the study might not reflect the exact picture of the country. Therefore, in the future, further study may be undertaken with large sample size. In this study, we measure pain by means of the VAS scale which is a psychometric response scale so there is some extent of the chance of business.

VII. CONCLUSIONS

Co-administration of epidural magnesium with plain bupivacaine (in single-shot technique) produces a longer duration of sensory block, provides optimum postoperative pain control, and maintain excellent hemodynamics without any significant side-effects, and addition of fentanyl to epidural plain bupivacaine (in single shot technique) produces earlier onset of surgical anesthesia. As per the result analysis, the results of the present study suggest that magnesium may be a useful alternative as an adjuvant to epidural bupivacaine.

VIII. RECOMMENDATION

Magnesium sulphate has an excellent pharmacological profile through epidural route. As it is a readily available drug in our country so, it can be used routinely as adjuvants in lower abdominal or lower limb surgeries in epidural procedure. Another studies can be undertaken using Magnesium Sulphate with other than bupivacaine. Further studies can be undertaken by including large number of patients in multiple tertiary level hospitals.

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