



Effect of additive magnesium sulphate on spinal block characteristics in pre-eclampsia patients undergoing lower segment caesarean section

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Abstract

Background and Aims: Spinal anaesthesia is commonly used anaesthetic technique in preeclampsia patients. Adding additive in spinal anaesthesia improves block characteristics as well as prolongs post-operative analgesia. In this study we aimed to evaluate the effect of additive magnesium sulphate on sensory and motor block properties.

Methods: This prospective randomized study was conducted on 60 ASA II /III preeclampsia patients planned for caesarean section. Patients were randomly allocated to two groups and were given the following drugs intrathecally as per group allocation: Group Mg received 9 mg of 0.5% bupivacaine heavy (1.8 ml) + 20 microgram of fentanyl 50µg/ml (0.4ml) + 50mg of 50% MgSO₄ (0.1 ml). Group NS received 9 mg of 0.5% bupivacaine heavy (1.8 ml) + 20 microgram of fentanyl 50µg/ml (0.4ml) + 0.1 ml Normal Saline. Parameters monitored were sensory, motor block characteristics and postoperative analgesia.

Results: Time to regress sensory block to L1 and postoperative analgesia was longer in group Mg. Time for complete motor recovery were significantly longer in group Mg as compared to group NS. Group Mg taken more time for onset of sensory and motor blockade.

Conclusion: Addition of magnesium sulphate at 50mg dose as adjuvants to intrathecal bupivacaine and fentanyl significantly prolongs period of the sensory and motor blockade. It also gives longer postoperative analgesia in preeclampsia patients undergoing caesarean section.

Keywords: Caesarean section, Spinal anesthesia, NMDA antagonists, Magnesium sulphate, Postoperative analgesia.

Introduction

Spinal anaesthesia is preferred anaesthetic technique in preeclampsia patients as it is safe and simple to perform in this patient group. It also provides excellent post-operative analgesia when some additive is used along with local anaesthetic agents^{[1],[2],[3]}.

Neuraxial administration of magnesium as an analgesic adjuvant in the peri-operative setting are promising^[4]. Magnesium has analgesic properties, primarily related to the regulation of

calcium influx into cells^[5] and antagonism of N- methyl- d- aspartate (NMDA) receptors in the central nervous system^{[6],[7]}. Intrathecal administration of magnesium sulphate has been shown to suppress nociceptive impulses in neuropathic pain and potentiates opioid anti-nociception in animal studies^{[8],[9]}. It has been used in doses of 25-100 mg along with local anaesthetic agent lidocaine, bupivacaine, levobupivacaine and ropivacaine with or without opioids^[10].

Magnesium sulphate is the drug of choice for prevention of seizures as part of comprehensive management of the disease. It is considered a safe drug to use in preeclampsia and eclampsia patient^[11]. In this study we added magnesium sulphate to evaluate its effect on sensory-motor block characteristics in preeclampsia patients undergoing caesarean section.

Materials and Methods

This prospective randomized controlled trial was carried out after obtaining ethics committee approval from our institution. We performed this study on 60 patients, aged 20-40 years who belonged to American society of anaesthesiologist (ASA) grade II or III. All patients were diagnosed cases of pre-eclampsia and were scheduled for caesarean section under spinal anaesthesia.

Pre-operative reassessment was done evening before surgery and patients were advised for 8 hours fasting before surgery. Exclusion criteria were coagulopathy, skin infection on back, placenta previa, severe foetal distress and patient on magnesium therapy. Written and informed consent was taken after explaining procedure and its consequences. Randomization in two groups was done by computer generated random number and group allocation was conducted by sealed envelopes. This study was single blinded as patients were unaware of what spinal anaesthesia drug they will be given.

After taking patient on operating table, intravenous access was obtained and pre-loading with 7.0 ml/kg of ringer lactate was done. Standard monitors such as pulse oximeter, electrocardiogram and non-invasive BP were used intraoperatively. Midline lumbar puncture was performed with 25-gauge Quincke spinal needle under standard aseptic precautions in sitting position at L3- L4 space. Patient were given spinal drugs according to group allocation:

Group Mg: 9 mg of 0.5% bupivacaine heavy (1.8 ml) + 20 microgram of fentanyl 50µg/ml (0.4ml) + 50mg of 50% MgSO₄ (0.1 ml).

Group NS: 9 mg of 0.5% bupivacaine heavy (1.8 ml) + 20 microgram of fentanyl 50µg/ml (0.4ml) + Normal Saline (0.1 ml).

Patient was taken in supine position with left uterine displacement immediately after spinal anaesthesia. Supplemental oxygen via a face mask was given at a rate of 4-6 L/min. We evaluated following parameters during this study: Onset time to sensory block (dermatome T6), maximum height of sensory block achieved, time to regress sensory block to L1, time of onset of motor block, time to achieve complete motor block, time of complete motor recovery and time of first rescue analgesia required.

Onset time to sensory block was assessed as the time interval between completion of injection of local anaesthetic solution to the loss of sensation at T6 dermatome. It was assessed by pinprick in the midclavicular line bilaterally by a hypodermic needle every 2 min for 15 min. Sensory block regression to L1 was assessed by pinprick at L1 after completion of surgery.

Motor block was assessed every two minutes for 20 minutes and then every 20 minutes after surgery till full motor recovery using modified Bromage scale (0 = able to move hip, knee & feet, 1 = unable to move hip but able to move the knee & feet, 2 = unable to move hip, knee but able to move feet, 3 = unable to move the hip, knee and feet). Time of onset of motor blockade was assessed as the time interval between injection of local anaesthetic solution to the presence of grade-1 Bromage scale. Time of complete motor block was from completion of intrathecal injection to achieve Bromage score grade-3. Complete motor block recovery was considered as the time interval between completion of local anaesthetic injection to presence of grade-0 Bromage scale.

Post-operatively VAS scale was used to assess pain intensity and injection paracetamol 1.0 gm administered intravenously as first line rescue analgesic once the VAS score was more than three. Duration of post-operative analgesia was noted from the time of injection of local anaesthetic to the first demand for rescue

analgesic. Potential spinal drug side-effect such as itching, drowsiness, respiratory depression, nausea and vomiting were documented.

Statistical Methods

The results were obtained by comparisons between the group Mg and NS (Figure 1). Categorical data were summarized in proportions and percentages (%) and quantitative data were summarized in mean ± SD. Statistical comparison was carried out using the Chi-square or Independent Student's t-test. A value of P < 0.05 was considered statistically significant.

Results

The baseline characteristics of patients including age, weight and height were comparable in both groups. The mean age of the patients in group Mg and group NS were 29.37±5.21 years and 28.27±3.39 years respectively. The mean height of patients was 158.40±20.54cm and 154.57±6.70 cmin group Mg and group NS respectively. The mean weight of patients in group Mg and group NS were 59.50±6.49 kg and 57.7±5.87 kg respectively (Table 1).

In both groups, most patient achieved T6 height of sensory block but in group Mg more patient achieved T4 level sensory block in comparison to

group NS (36.7% of group Mg and in 26.7% of group NS). Group Mg produced sensory block little later than group NS (8.40 min and 7.39 min respectively). Time to regress sensory block to L1 was longer in group Mg. Time to L1 regression was 191.00±31.74 min in group Mg and 163.83±16.73 min in group NS. This difference was found to be statistically significant (Table 2). Both onset time and time to achieve complete motor block was significantly prolonged in group Mg. Complete motor block recovery time was longer in group Mg than group NS. So, addition of magnesium in spinal anaesthesia prolonged sensory and motor block significantly.

The time of first analgesic requirement was significantly longer in group Mg. The time duration of first analgesic requirement was 222.33 min in group Mg and 208.50min in group NS (Table 2).

Incidence of common complication like nausea, pruritus and shivering were compared between groups but difference was not found to be statistically significant as shown in Table 3. We did not find any other significant complication in perioperative period (Table 3).

Table 1: Baseline characteristics of patients

Parameters	Group Mg		Group NS		¹ p-Value
	Mean	±SD	Mean	±SD	
Age (years)	29.37	5.21	28.27	3.39	0.337
Weight (kg)	59.50	6.49	57.7	5.87	0.253
Height (cm)	158.40	20.54	154.57	6.70	0.335

SD=Standard deviation, ¹=Independent t-test

Table 2: Comparison of Sensory and Motor Block Characteristics

Parameters	Group Mg		Group NS		¹ p-Value
	Mean m(min)	±SD	Mean (min)	±SD	
Highest dermatome level of sensory block achieved T4/T6	11 (36.7%)/19 (63.3%)		8(26.7%)/22(73.3%)		0.168
Onset time of sensory block (T6 level)	8.40	2.77	7.39	2.88	0.181
Time to regression of sensory block to L1	191.00	31.74	163.83	16.73	<0.001*
Onset time of motor block	5.50	2.24	4.50	1.89	0.067
Time of completes motor block	9.80	2.83	7.76	2.81	0.03*
Time taken for complete motor recovery	194.33	16.12	181.67	24.79	0.022*
Duration of postoperative analgesia	222.33	17.75	208.50	23.75	<0.013*

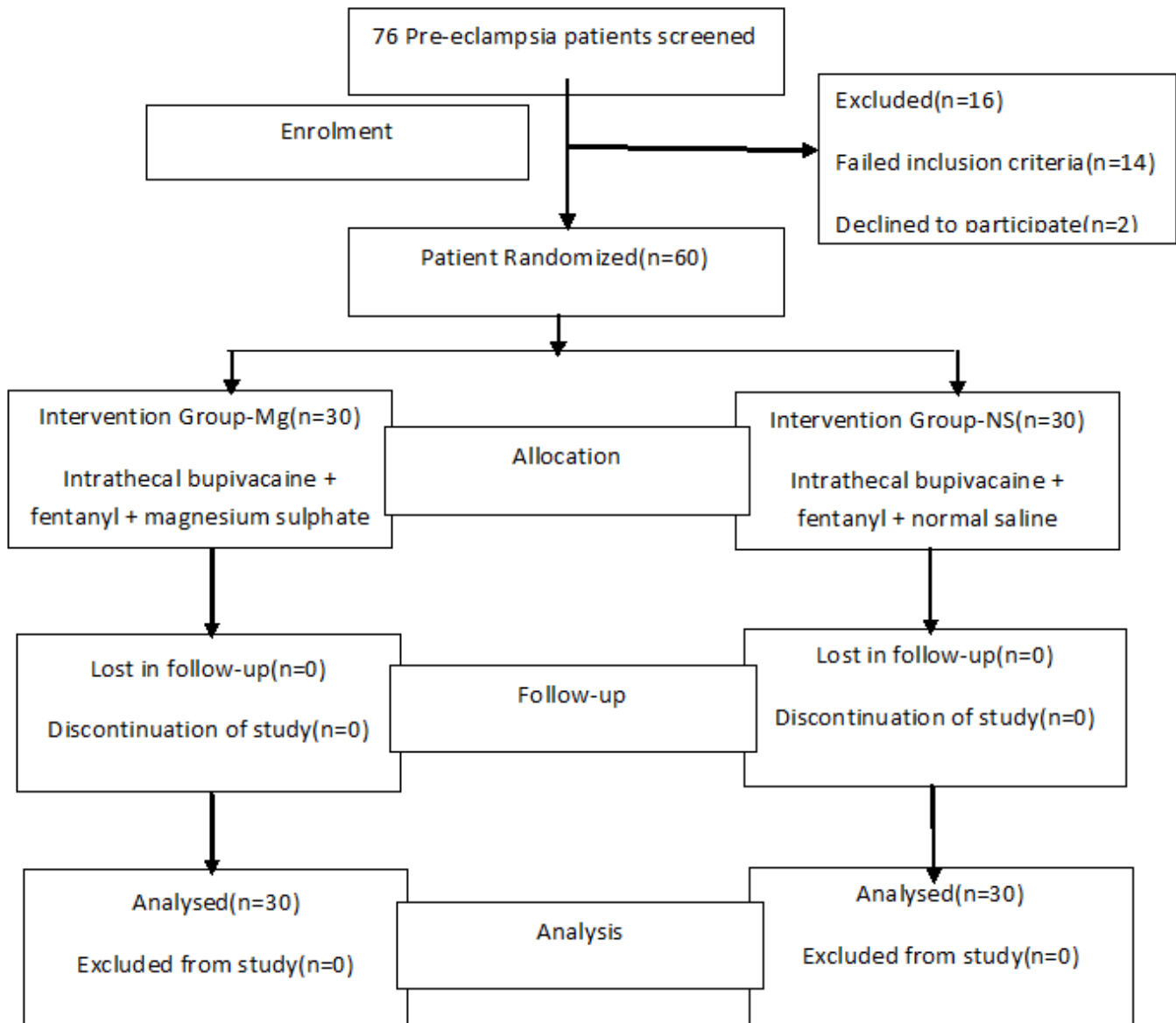
SD=Standard deviation, ¹=Independent t-test, * =Significant (p<0.05)

Table 3: Comparison of Adverse Effects

Parameters	Group Mg	Group NS	¹ p-Value
Nausea	6 (20%)	5 (16.67%)	0.131
Pruritus	2 (6.67%)	3 (10.0%)	0.456
Shivering	0	0	-

¹=Independent t-test

Figure 1: Consort flow diagram



Discussion

Additive in spinal anaesthesia is a common practice in obstetric patient to improve quality of anaesthesia as well as prolongs its durations. Prolonged analgesia in post-operative periods may be useful as it reduced post-operative stress as well as analgesic requirement. Decreased stress response in preeclampsia patient is desirable as these patients are already physiologically

compromised. We conducted the study to evaluate the effects and safety of adjuvant magnesium sulphate in spinal anaesthesia.

In present study both groups were comparable for age, weight and height as we found no significant difference between them. In our study duration of postoperative analgesia and time taken for complete motor recovery was longer when magnesium was added in spinal anaesthesia drugs.

But onset of sensory and motor block was delayed in magnesium group than normal saline group.

M Ozalevli (2005) conducted study on patients undergoing lower extremity surgery with addition of magnesium sulphate (50mg) to spinal anaesthesia. They observed that adjuvant magnesium significantly delayed the onset of both sensory and motor blockade but prolonged the period of anaesthesia without additional side-effects. Their findings were like ours, however difference was that their patients undergone lower limb surgery and our caesarean section^[12].

Malleeswaran et al. (2010) observed that in mild preeclampsia women undergoing caesarean section, the addition of magnesium sulphate 50 mg to the intrathecal combination of bupivacaine and fentanyl prolongs sensory block regression to T12 ($P < 0.001$) and total duration of motor block were significantly longer in the magnesium group ($P < 0.001$). Both these finding was similar to our observations^[13].

Our study results correlate with other done by MP Nath et al. (2012). They found that addition of 100 mg intrathecal magnesium led to prolonged duration of analgesia significantly without increasing the incidence of side-effects. Also, there was a significant delay in the onset of both sensory and motor blockade. Here difference with our study was that they used 100mg magnesium sulphate and their patients underwent total abdominal hysterectomy^[14].

Similarly, Kathuria B et al. (2014) had given magnesium sulphate 50mg and 75mg along with local anaesthetic intrathecally for orthopaedic lower limb surgery under subarachnoid block. They found that time of maximum sensory block, time of onset of motor block, duration of sensory block, duration of motor block and time of analgesia request were prolonged in magnesium group than control group^[15].

So, these previously conducted study found that adding magnesium sulphate intrathecally prolonged sensory, motor block and prolonged postoperative analgesia without increasing the

incidence of drug related side-effects. Prolonged sensory block and delayed postoperative analgesia requirement indicate that magnesium sulphate may be useful as an adjuvant in spinal anaesthesia. Limitations of our study were small sample size, single center study and multiple drugs used in intrathecal injection. Result of study could not be applied to general population due to narrow population group.

Conclusions

In pre-eclampsia patients undergoing caesarean surgery, the addition of magnesium sulphate 50 mg to the intrathecal combination of bupivacaine and fentanyl prolongs the duration of postoperative analgesia without additional side effects.

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