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**Original research article**

# Effectiveness of magnesium sulphate as an adjunct to ropivacaine in local infiltration for postoperative analgesia following lower segmental caesarean section

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**Abstract**

Magnesium (Mg) is a physiological blocker of calcium channels and a non- competitive antagonist of N-methyl di aspartate (NMDA) receptors, which can relieve pain by inhibiting central sensitization to pain. Magnesium Sulphate (MgSO4) infusion during general anaesthesia decreased the need for intraoperative and postoperative analgesics, and other studies suggested that Mg administration affected the postoperative pain. The minimum sample size is 57. So, we included 60 patients considering few dropouts. We included 30 patients in each group. There is significant difference statistically in the mean VAS score in between two groups for 4$^{th}$ time pain reported. It was 3.86 in group R and 0 in group RM. This implies that RM is more effective than R. There is no significant variation statistically in the incidence of adverse drug reactions of both groups. Headache was seen in 3 patients and nausea ,vomiting was seen in 8 patients.

**Keywords:** Magnesium sulphate, ropivacaine, postoperative analgesia

## Introduction

The lower segment cesarean section (LSCS) plays a vital role in decreasing morbidity and mortality and postpartum complications in both mother and fetus. Some of the complications during post-operative period include pain, bleeding, wound infection, pulmonary atelectasis and lung infections [1]. Inadequate pain relief affects both mother and newborn, as a parturient who is experiencing pain finds it difficult to feed her newborn [2]. Postoperative pain is routinely controlled by opioids and non-opioids drugs through peripheral analgesia and neuraxial techniques [3]. Opioids are the mainstay of management during postoperative period, as most of them predispose neonate to their side effects [4]. It is of critical importance to find techniques with minor unwanted adverse effects, along with appropriate pain control [5]. In regional methods, various adjuvants can help patients achieve prolonged postoperative analgesia. They include fentanyl, ketamine, neostigmine, midazolam, clonidine, magnesium etc., which are added with local anaesthetics during spinal anesthesia [6].

Magnesium (Mg) is a physiological blocker of calcium channels and a non-competitive antagonist of N-methyl di aspartate (NMDA) receptors, which can relieve pain by inhibiting central sensitization to pain. Magnesium sulphate (MgSO4) infusion during general anaesthesia decreased the need for intraoperative and postoperative analgesics [7], and other studies suggested that Mg administration affected the postoperative pain [8, 9].

Ropivacaine is a long-acting amide-type local anesthetic [10], that is available in the concentration of 0.75%. It provides good analgesia and is easily available and inexpensive [11, 12].

Postoperative pain reduction is considered a vital factor for both physicians and patients. Hence the current study was done to show which medication is more effective and safer in reducing pain among mother after LSCS.

## Methodology

**Data collection:** 18 months.

**Type of study:** Randomised observational study.

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**Source of data:** Patients scheduled for elective LSCS during the study tenure at our tertiary centre.

**Sample size calculation**
As per the national family survey, the prevalence of LSCS in India was 21.5%
The sample size is calculated as:
Sample size= $Z^2PQ/N^2$

Where
n = sample size
Error = 7%
Confidence levels = 80%

After substituting the respective values in the above formula, the minimum sample size of 57. So, we included 60 patients considering few dropouts.
We included 30 patients in each group.

**Groups**
- Group R (n=30) received 20ml of 0.5% ropivacaine only-by local subcutaneous infiltration.
- Group RM (n=30)-Inj. magnesium sulphate 1 ml of 50% solution added to injection 0.5% ropivacaine 19 ml. Now the total volume is 20 ml-given by subcutaneous infiltration.

**Inclusion Criteria**
1. Female patients aged 18 to 35 years, scheduled for elective LSCS.
2. Patients with ASA physical status I and II.
3. Patients who provided informed consent.

**Exclusion Criteria**
1. Patients who refused to participate.
2. Patients with psychiatric disorders.
3. Patients with known allergies to ropivacaine or magnesium.
4. Patients with history of drug abuse.
5. Patients with severe coagulopathy.
6. Morbidly obese patients.

**Results**
There is a significant variation statistically in the mean number of times, pain was reported by the patients in between two groups. Patients in group R reported pain 4 times on average compared to patients in group RM. This implies that RM is more effective compared to R.

**Table 1:** Mean no of times pain reported

| Group | | No. | Total | Mean | Variance | Std. Dev. |
|---|---|---|---|---|---|---|
| R | | 30.0000 | 120.0000 | 4.0000 | 0.0000 | 0.0000 |
| | RM | 30.0000 | 66.0000 | 2.2000 | 0.1655 | 0.4068 |
| **T-Test** | | | | | | |
| Method Variances | DF | t Value | Pr > \|t\| Pooled | Equal 58 | 24.23 | 0.0000 |

There is significant variation statistically in the mean time for reporting pain for 1st time in between two groups. Patients in group R reported pain 1st time in 3.9 hrs on average and the patients in group RM reported pain 1st time in 6.4 hrs on average. This implies that RM is more effective compared to R.

**Table 2:** Mean time for reporting time 1st time

| Group | | No. | Total | Mean | Variance | Std. Dev. R |
|---|---|---|---|---|---|---|
| | | 30.0000 | 117.0000 | 3.9000 | 1.9552 | 1.3983 |
| | RM | 30.0000 | 192.0000 | 6.4000 | 9.4897 | 3.0805 |
| **T-Test** | | | | | | |
| Method Variances | DF | t Value | Pr > \|t\| Pooled | Equal 58 | -4.05 | 0.0002 |

There is significant variation statistically in the meantime for reporting pain for 2nd time in between two groups. Patients in group R reported pain 2nd time in 8 hrs on average and the patients in group RM reported pain 2nd time in 22.4 hrs on average. This implies that RM is more effective compared to R.

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**Table 3:** Mean time for reporting pain 2nd time

| Group | | Obs. | Total | Mean | Variance | Std. Dev. R |
|---|---|---|---|---|---|---|
| | | 30.0000 | 240.0000 | 8.0000 | 0.0000 | 0.0000 |
| | RM | 30.0000 | 672.0000 | 22.4000 | 10.5931 | 3.2547 |
| T-Test | | | | | | |
| Method Variances | DF | t Value | Pr > \|t\| Pooled | Equal 58 | -24.23 | 0.0000 |

There is no significant variation statistically in the mean VAS score in between two groups. It was 4 for all patients.

**Table 4:** Mean VAS

| Group | | No. | Total | Mean | Variance | Std. Dev. R |
|---|---|---|---|---|---|---|
| | | 30.0000 | 120.0000 | 4.0000 | 0.0000 | 0.0000 |
| | RM | 30.0000 | 120.0000 | 4.0000 | 0.0000 | 0.0000 |

There is no difference in the mean VAS score in between two groups statistically. It was 4 for all patients.

**Table 5:** Mean VAS second time

| Group | | No. | Total | Mean | Variance | Std. Dev. R |
|---|---|---|---|---|---|---|
| | | 30.0000 | 120.0000 | 4.0000 | 0.0000 | 0.0000 |
| | RM | 30.0000 | 120.0000 | 4.0000 | 0.0000 | 0.0000 |

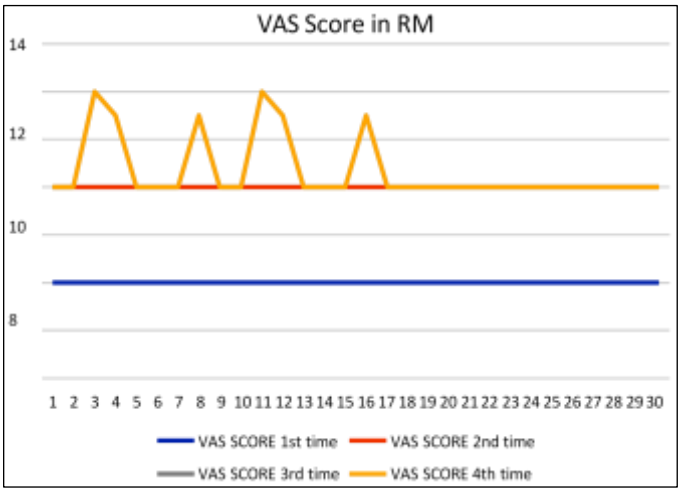
There is a significant variation statistically in the mean VAS score in between two groups for 3rd time pain reported. It was 3.5 in group R and 0.66 in group RM.

**Table 6:** Mean VAS score 3rd time

| Group | | No. | Total | Mean | Variance | Std. Dev. R |
|---|---|---|---|---|---|---|
| | | 30.0000 | 170.0000 | 3.5667 | 0.2540 | 0.5040 |
| | RM | 30.0000 | 20.0000 | 0.6667 | 18851 | 1.3730 |
| T-Test | | | | | | |
| Method Variances | DF | t Value | Pr > \|t\| Pooled | Equal 58 | 10.86 | 0.0000 |

**Table 7:** Mean VAS score reported 4th time

| Group | | No. | Total | Mean | Variance | Std. Dev. R |
|---|---|---|---|---|---|---|
| | | 30.0000 | 116.0000 | 3.8667 | 0.1195 | 0.3457 |
| | RM | 30.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| T-Test | | | | | | |
| Method Variances | DF | t Value | Pr > \|t\| Pooled | Equal 58 | 61.25 | 0.0000 |




**Graph 1:** VAS in group RM

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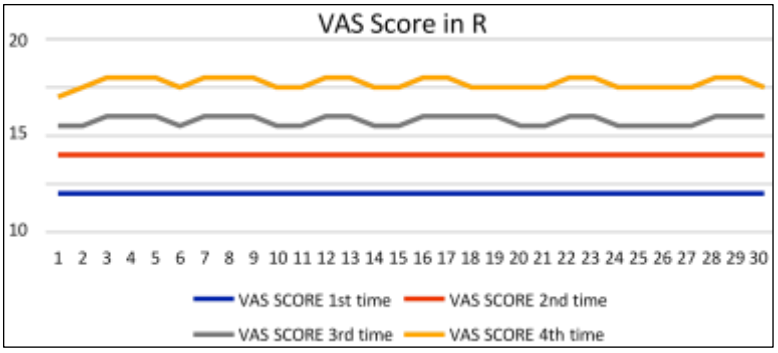


**Graph 2:** VAS in group R

There is no significant variation statistically in the incidence of adverse drug reactions in both groups. Headache was seen in 3 patients and nausea ,vomiting was seen in 8 patients.

**Table 8:** Side effects

| Group | | | |
|---|---|---|---|
| **ADR** | **R** | **RM** | **Total** |
| Headache | 2 | 1 | 3 |
| N/V | 5 | 3 | 8 |
| Nil | 25 | 24 | 49 |
| Total | 30 | 30 | 60 |

**Discussion**

There is no difference in the mean VAS score in between two groups. It was 4 for all patients. There is no difference in the mean VAS score in between two groups. It was 4 for all patients. There is significant difference statistically in the mean VAS score in between two groups for 3rd time pain reported. It was 3.5 in group R and 0.66 in group RM. There is significant difference statistically in the mean VAS score in between two groups for 4th time pain reported. It was 3.86 in group R and 0 in group RM. This implies that RM is more effective than R in the current study.

**Zewdu *et al*.** [13] did a study on 58 women scheduled for elective LSCS.

Patients were randomized into wound infiltration group and control group. Post-operative pain was assessed using numeric rating scale and, in our study, it was assessed using visual analogue scale. Results showed that the mean time to request 1st analgesia was late or prolonged significantly in wound site infiltration group compared to the control group. Mean time for 1st analgesic requirement was 314 min. The postoperative verbal NRS score was low in the wound site infiltration compared to the control group.

There is no significant variation statistically in the mean SBP of patients between two groups as per T test (p=0.49). The mean SBP of patients in group R was 114.3 mm of Hg and the mean SBP of patients in group RM was 116.0 mm of Hg. There is no statistical significant variation in the mean DBP of patients between two groups as per T test (p=0.15). The mean DBP of patients in group R was 82.0 mm of Hg and the mean DBP of patients in group RM was 80.0 mm of Hg. There is no statistical significant variation in the mean HR of patients between two groups as per T test (p=0.36). The mean HR of patients in group R was 82.8 bpm and the mean HR of patients in group RM was 85.56 bpm. There is no statistical significant variation in the mean RR of patients between two groups as per T test (p=0.06).

The mean respiratory rate of patients in group R was 15.6 and the mean respiratory rate of patients in group RM was 15.13 per minute. There is no statistical significant variation in the mean Sp02 of patients between two groups as per T test (p=0.84). The mean Sp02 of patients in group R was 99.2% and the mean Sp02 of patients in group RM was 99.23% at 12 hours of postoperative period. This implies that hemodynamic stability is being maintained by both ropivacaine and ropivacaine with magnesium.

Regarding hemodynamic stability, our results are similar to the results of Donadi *et al*., who also observed no significant change statistically in BP on using magnesium [14].

Kumar M *et al*. did a randomized prospective study on 60 patients, aged between 18 to 65 years with ASA grade I and II. Patients were randomized into two groups. Surgeon infiltrated study medications into paravertebral muscles. One group of patients received ropivacaine with dexmedetomidine and another group received 0.75% ropivacaine plus magnesium sulphate [15]. The mean heart rates were comparable at the baseline between two groups ($p > 0.05$). Heart rate was lower in ropivacaine and dexmedetomidine group comparatively than ropivacaine and magnesium sulphate group. Blood pressure was also lower in the ropivacaine and dexmedetomidine group comparatively than ropivacaine and magnesium sulphate group. There is no significant variation statistically in the mean spo2 between two groups, like our study.

Kamel *et al*. [16] did a study on 90 patients who were randomized into 3 groups. Patients were given

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either bupivacaine with magnesium sulphate or bupivacaine only or IV paracetamol and ketorolac. There was no statistically significant variation in BP between 3 groups at various intervals after surgery. There was also no significant variation statistically in heart rate between 3 groups at various intervals after surgery. The mean heart rate in LA only group was 91bpm and the mean heart rate in LA+ Magnesium group was 91 bpm. The mean heart rate of patients in group R was 82.8 bpm and the mean heart rate of patients in group RM was 85.5 bpm at 12 hours of postoperative period in the current study.

Hemodynamic stability was maintained with both LA and LA combined with magnesium, similar to the current study.

There is a statistically significant variation in the mean number of times pain was reported by the patients in between two groups. Patients in group R reported pain 4 times on average compared to patients in group RM. This implies that RM is more effective compared to R. There is no difference in the mean VAS score in between two groups. It was 4 for all patients.There is statistically significant variation in the mean VAS score in between two groups for 3rd time pain reported. It was 3.5 in group R and 0.66 in group RM. There is significant variation statistically in the mean VAS score in between two groups for 4th time pain reported. It was 3.86 in group R and 0 in group RM. This implies that RM is more effective than R in the current study.

Fahima *et al*. [17] did a randomized single-blinded study in Pakistan for six months from January to June 2018. Women aged 19 to 40 years, who were scheduled for LSCS under spinal anaesthesia, with ASA grade II, were included in the study. Authors wanted to assess the efficacy of ropivacaine. Pain severity was measured using VAS, similar to the current study. Paracetamol 1 g intravenous (IV) was given every six hours, over 24 hours. Mean VAS score in ropivacaine group at 12 hours was 1.88. The mean VAS score in ropivacaine only group in our study was 3.5.

Total analgesic usage was more in ropivacaine only group in our study. This was expected, as patients were given supplemental intravenous analgesics if the VAS score is more than 3. R group patients received around 4 doses of supplemental analgesic as compared to two doses received by patients of RM group in the current study.

Our results are similar to the study done by Eldaba *et al*., who used wound infiltration of local anaesthetic with Mg in patients scheduled for LSCS. Results showed that analgesia requirements in combination group as less compared to group who received only local anaesthesia or placebo. Their study also reported that total analgesic consumption during 1st 24 hours was less in combination group compared to local anaesthesia only group.

Lee *et al*., also reported decreased consumption of opioids among patients who received wound infiltration using Mg [18].

In the current study, adverse effects were seen only among 11 patients. Nausea and vomiting are the common adverse effects seen. No patient suffered from hypoxemia, respiratory depression or pruritus or skin rashes or wound inflammation or bradycardia or hypotension.

The incidence of nausea and vomiting was less in combination group compared to ropivacaine only group, similar to the current study. The reason could be due to lesser usage of rescue analgesia in combination group compared to local anaesthesia only group, as injection tramadol itself can increase the risk of nausea and vomiting [19].

Eldaba *et al*. didn't find any statistically significant adverse effects in his study, with the subcutaneous infiltration of local anaesthetic and magnesium [20].

**Conclusion**

The results of the current study suggests that local infiltration of local anaesthetic medication alone or along with adjuvants like magnesium is safe and effective.

Addition of magnesium to local anaesthetics enhances the effect of local anaesthetics and decreases the requirement of opioids during the postoperative period, thereby mitigating the adverse effects related to opioids.

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