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Comparison of Bilateral Ultrasound Guided TAP Block with Dexamethasone and Magnesium Sulphate as an Adjuvant with Ropivacaine in Patients Undergoing Lower Segment Cesarean Section

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KEYWORDS

Dexamethasone; Magnesium Sulphate; Ropivacaine, Postoperative pain management, Subarachnoid Block, Visual analogue score

ABSTRACT:

Background:Postoperative pain from lower segment cesarean section (LSCS) can hinder nursing, ambulation, and maternal bonding. After LSCS, somatic pain comes from surgical wound nociceptors and visceral pain from muscles. Methods: This study included 72 patients undergoing LSCS from a single centre , patients were divided equally into 2 groups undergoing TAP block with Ropivacaine 0.25 % . Group RD (n=36) subjects were given with Dexamethasone (8mg) and Group RM (n=36 subjects were given bilateral with Magnesium sulphate (1gram) as an additive. Results: The results of study supports magnesium sulphate as a better adjuvant compared to dexamethasone for enhancing the analgesic efficacy of ropivacaine in cesarean section patients. Conclusion: This study emphasizes significance of selecting appropriate adjuvant medications for achieving postoperative pain in cesarean section subjects

Introduction

It is well known that females experience significant postoperative discomfort following a lower segment cesarean section (LSCS)and this further has a detrimental effect on walking, nursing, and even the mother-child connection. Following LSCS, pain is divided into two categories: somatic pain that comes from nociceptors inside the surgical site and visceral pain that comes from muscles.Post-cesarean section pain management is essential for early ambulation, faster recovery, and optimal maternal-neonatal bonding.Opioids

are the norm for postoperative pain, although they can cause respiratory depression, emesis, constipation, and pruritus. A multimodal postoperative analgesia method that includes parenteral and regional analgesics may improve analgesia and reduce its adverse effects. TAP block provides good post-operative pain management and decreases narcotic and epidural

block adverse effects. TAP block is safe, decreases or eliminates analgesics requirement , and reduces postoperative nausea and vomiting (PONV .Local anesthetics (LA) in this plane generate TAP block, which relieves surgery pain.Rafi introduced TAP block in 2001 as refined abdominal field block

Upon due consideration, one must note that ropivacaine has a superior safety profile than bupivacaine and lasts longer than lignocaine,hence most nerves and fascial plane blocks are done with ropivacaine, nowadays. Local anesthetics alone can give good operational conditions but has shorter post-operative analgesia. Strong long-acting glucocorticoids like dexamethasone have anti-inflammatory, analgesic, and antiemetic effects. It lessens postoperative nausea and vomiting (PONV) and extends analgesia duration with negligible adverse effects when used as an adjuvant in peripheral nerve block.

When added to ropivacaine during ultrasound-guided TAP block, dexamethasone lengthens the block's duration and lowers the need for rescue analgesia.

This study compares the effectiveness of dexamethasone and magnesium sulfate as supplements

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to ropivacaine in transversus abdominis plane (TAP) block for postoperative pain management in

patients undergoing Cesarean section.

This study was designed with the aim of evaluating Dexamethasone versus Magnesium sulphate as an adjuvant for Ropivacaine(0.25%) in ultrasound-guided bilateral TAP block in patients scheduled for Lower Segment Caeserean Section under Subarachnoid Block.

Methodology:

This study was a prospective, interventional, randomised, double- blinded case study conducted at Chettinad Hospital and Research Institute, Chennai following approval from the Institutional Human Ethics Committee and registration with the Clinical Trials Registry of India (CTRI). Written informed consent was obtained from all participants in a language of their understanding.

The sample size was calculated based on data from a previous study by Shelly Rana et al., which reported a mean (±SD) Visual Analogue Scale (VAS) score at 4 hours postoperatively as 1.40 ± 1.70 in the Magnesium group and 2.40 ± 1.33 in the Normal saline group, both with bupivacaine. Using these estimates and assuming, power = 80% and Alpha error = 5%. The minimum required sample size was calculated as 36 patients per group (total n = 72).

Study Population : Seventy-two patients scheduled to undergo elective lower segment cesarean section (LSCS) under spinal anesthesia were enrolled. Criteria are detailed as follows,

Inclusion Criteria:

- Women aged 18–40 years
- ASA physical status II or III
- Singleton term pregnancy
- Scheduled for elective cesarean section under spinal anesthesia

Exclusion Criteria:

- Known allergy or contraindication to study drugs
- Coagulopathy or anticoagulant use
- Local infection at block site
- Chronic pain or opioid use
- Severe cardiac, hepatic, or renal impairment
- BMI > 35 kg/m²
- Patient refusal

Participants were randomly assigned to two groups (n = 36 each) using a computer-generated randomization code. Allocation concealment was ensured using sealed opaque envelopes. The study followed a double-blind design: both the patient and the investigator assessing outcomes were blinded to group assignment. An independent anesthesiologist not involved in outcome assessment prepared the drug solutions. Groups were then allocated as Group RD (Ropivacaine + Dexamethasone): Patients received bilateral ultrasound-guided TAP block with Ropivacaine 0.25% (20 ml) + Dexamethasone 8 mg on each side. Group RM (Ropivacaine + Magnesium Sulphate): Patients received bilateral ultrasound-guided TAP block with Ropivacaine 0.25% (20 ml) + Magnesium sulphate 1 g on each side.

Preoperatively, baseline vital parameters (heart rate, blood pressure, respiratory rate, and SpO_2) were recorded. After preloading, spinal anesthesia was administered in the sitting position at the L3–L4 or L4–L5 interspace using a 26G Quincke needle, injecting 0.5% hyperbaric bupivacaine (2 ml) with 0.5 ml fentanyl.

Following surgical closure, bilateral ultrasound-guided transversus abdominis plane (TAP) block was performed under strict aseptic precautions using a 23G Quincke needle, with drug solutions administered as per group allocation.

Postoperative parameters were recorded at 1, 2, 3, 4, 5, 6, 12, 18, and 24 hours. Pain assessment with VAS score at rest and movement. Hemodynamics with heart rate, systolic and diastolic blood pressure Analgesic consumption by time to first analgesic request, total rescue analgesia used (in mg) . All adverse events were noted and managed appropriately. Patients were followed up for a period of 24 hours.

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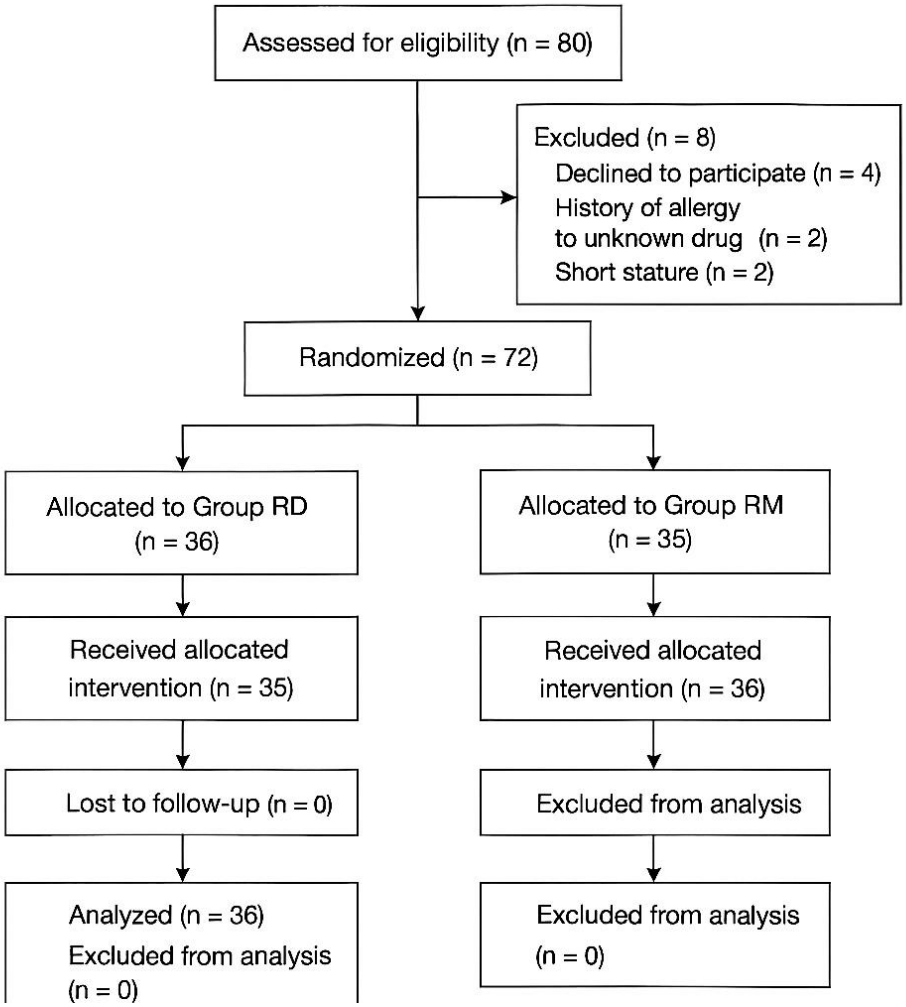

Results:

A total of 80 patients were screened for eligibility. Of these, 8 patients were excluded (4 declined to participate, 2 had a history of allergy to an unknown drug, and 2 were excluded due to short stature), leaving 72 patients who were randomized equally into two groups (n = 36 each).

The analysis employs statistical methods to compare the pain scores, analgesic requirements and side effects between the two groups, aiming to identify significant differences and draw reliable conclusions about the efficacy of the adjuvants used.

Table 1 : GROUPWISE DISTRIBUTION OF THE TOTAL CASES

Study Group	No of Cases	Percentage
RD	36	50%
RM	36	50%
Total	72	100%

Table 2: AGE DISTRIBUTION

AGE	Group RD		Group RM		p value
	No of Cases	Percentage	No of Cases	Percentage	

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< 30 Years	30	83.3	28	77.8	.359
31 - 45 Years	6	16.7	8	22.2	
Total	36	100.0	36	100.0	
Mean ± SD	27.25 ± 4.49		28.00 ± 3.68		

The age distribution between the two study groups was statistically comparable. In Group RD, 83.3% of patients were under 30 years of age, while 77.8% of patients in Group RM fell into the same age category. The mean age in Group RD was 27.25 ± 4.49 years, and in Group RM it was 28.00 ± 3.68 years. The p-value of 0.359 indicates no statistically significant difference in age distribution between the groups, confirming that both cohorts were age-matched.

Table 3 : GRAVIDA DISTRIBUTION

GRAVIDA	Group RD		Group RM		p value
	No of Cases	Percentage	No of Cases	Percentage	
Primigravida	18	50.0	24	66.7	.786
Multigravida	18	50.0	12	33.3	
Total	36	100.0	36	100.0	

Gravidity status was assessed and compared between both groups. The p-value of 0.786 suggests no statistically significant difference in the number of previous pregnancies between the two groups. This baseline similarity indicates that gravidity is unlikely to have influenced postoperative pain perception or analgesic requirements in this study.

Table 4 : PROCEDURE DISTRIBUTION

PROCEDURE	Group RD		Group RM		p value
	No of Cases	Percentage	No of Cases	Percentage	
ELECTIVE	16	44.4	13	35.1	.989
EMERGENCY	20	55.6	23	63.9	
Total	36	100.0	36	100.0	

Figure 4 : PROCEDURE DISTRIBUTION

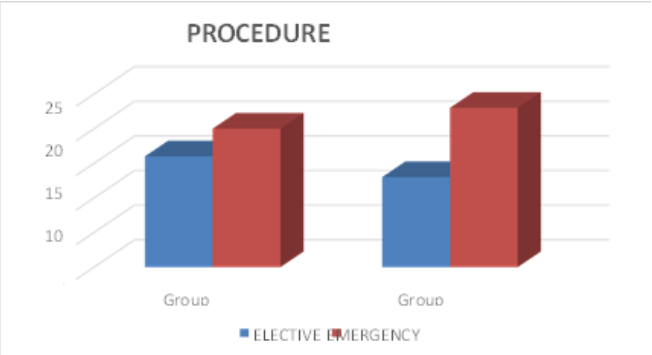

Table 4 and Figure 4 compare the distribution of elective versus emergency lower segment cesarean sections (LSCS) was analyzed. In Group RD, 44.4% of surgeries were elective and 55.6% were emergency. In Group RM, 35.1% were elective and 63.9% were emergency. Despite the observed differences, the p-value of 0.989 confirms no statistically significant difference in procedure type distribution between groups. This balance ensures that surgical urgency did not confound the assessment of postoperative analgesia outcomes.

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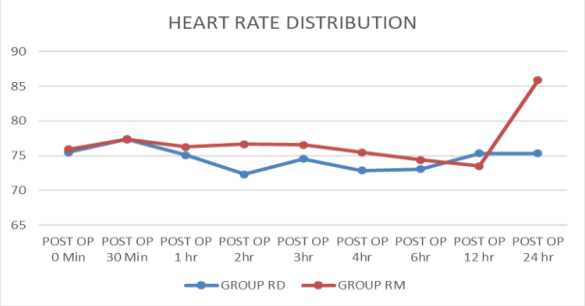
Table 5 : DURATION OF SURGERY DISTRIBUTION

DURATION OF SURGERY	Group RD		Group RM		p value
	No of Cases	Percentage	No of Cases	Percentage	
< 60	3	8.3	3	8.3	.987
61 – 90	17	47.2	14	38.9	
91 - 120	15	41.7	16	44.5	
121 - 240	1	2.8	3	8.3	
Total	36	100.0	36	100.0	

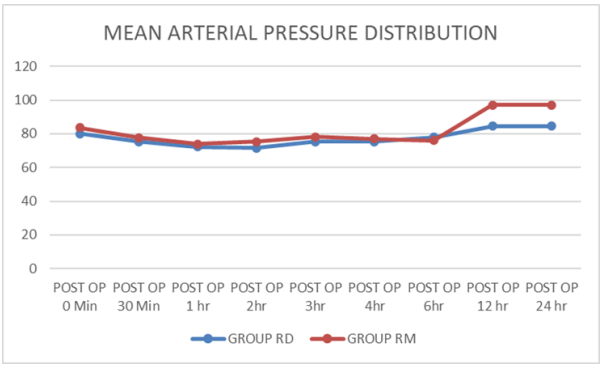
Surgery duration was categorized into four time intervals (<60 min, 61–90 min, 91–120 min, 121–240 min) and analyzed across both groups. The distribution was uniform, with each group having 36 patients. The p-value of 0.987 confirms that there were no significant differences in surgical duration between the groups. This suggests that both cohorts had similar procedural exposure, thereby minimizing duration-related bias in analgesic requirement and pain response.

Figure 6 : HEART RATE DISTRIBUTION (per minute)



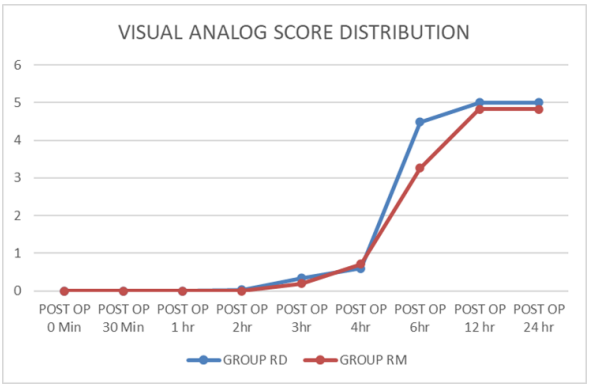
Postoperative heart rate (HR) was measured at multiple intervals over a 24-hour period. At baseline (0 min), mean HR was similar (75.47 bpm in RD vs. 75.91 bpm in RM; p = 0.058). From the 2nd postoperative hour onward, a consistent and statistically significant increase in heart rate was observed in Group RM compared to RD (p < 0.001 at each interval). By the 24th hour, HR had increased to 85.86 bpm in RM versus 75.33 bpm in RD, suggesting heightened sympathetic activity or delayed recovery in the magnesium group.

FIGURE 7:MEAN ARTERIAL PRESSURE (MAP) DISTRIBUTION mmHg



MAP values followed a similar trend to heart rate. Group RM exhibited significantly higher MAP beginning at 0 min (83.69 mmHg vs. 80.08 mmHg in RD; p = 0.032), with differences persisting and becoming more pronounced throughout the postoperative period. The most notable disparity was at the 12th hour, with MAP peaking at 97.00 mmHg in RMversus 84.66 mmHg in RD (p < 0.001). These findings imply a potential difference in hemodynamic recovery profiles between the two adjuvant regimens.

Figure 8 : VISUAL ANALOGUE SCORE DISTRIBUTION



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VAS scores remained at zero during the initial postoperative phase (0 to 1 hour) for both groups. However, at the 2nd hour, Group RD began reporting minimal pain (VAS = 0.0278) while RM continued to report no pain (p = 0.000). By the 6th hour, both groups experienced notable pain (VAS: RD = 4.48, RM = 3.26), though the difference was not statistically significant (p = 0.973). Peak pain levels occurred at the 12th hour, with Group RD at 5.00 and Group RM at 4.83, again without significant difference. This pattern suggests that both dexamethasone and magnesium sulfate provide effective analgesia, though magnesium may have a slightly more sustained effect in early hours.

Figure 9 : RESCUE ANALGESIA DISTRIBUTION

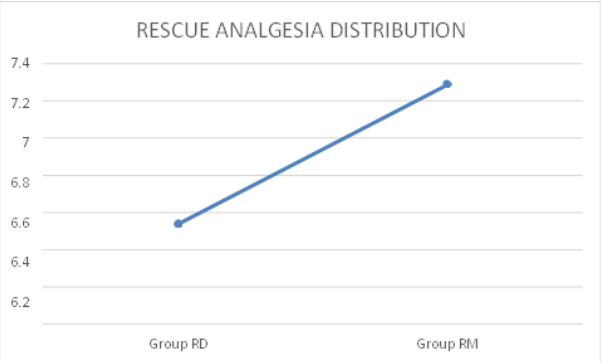

Table 16 : RESCUE ANALGESIA DISTRIBUTION

MEAN RESCUE ANALGESIA	Group RD		Group RM		p value
	No of Cases	Percentage	No of Cases	Percentage	
Mean ± SD	6.54± 2.19		7.29± 1.88		.000

The time to first rescue analgesic request was significantly longer in Group RM (7.29 ± 1.88 hours) compared to Group RD (6.54 ± 2.19 hours) with a p-value of 0.000. This statistically significant finding indicates that magnesium sulfate prolonged the duration of postoperative analgesia more effectively than dexamethasone when used as an adjuvant to ropivacaine in TAP block.

No adverse events or complications were reported in either group.

Discussion

Postoperative pain following lower segment cesarean section (LSCS) significantly affects maternal recovery, ambulation, and the ability to breastfeed and care for the newborn. The transversus abdominis plane (TAP) block, as a component of multimodal analgesia, has been widely accepted for providing effective somatic pain relief after abdominal surgeries. However, the duration of analgesia provided by local anesthetics alone is often limited. Consequently, various adjuvants are increasingly being explored to prolong analgesia and improve the quality of the block. This study aimed to compare the efficacy of dexamethasone and magnesium sulphate as adjuvants to 0.25% ropivacaine in bilateral ultrasound-guided TAP blocks in patients undergoing LSCS under spinal anesthesia.

Our results demonstrate that both dexamethasone and magnesium sulphate, when added to 0.25% ropivacaine, significantly improve postoperative analgesia. However, the group receiving magnesium sulphate (Group RM) experienced prolonged duration of analgesia (7.29 ± 1.88 hours) compared to the dexamethasone group (Group RD: 6.54 ± 2.19 hours). Additionally, VAS scores were consistently lower in the magnesium group, particularly noticeable from the 2nd postoperative hour through the 24th hour, indicating better pain control. The difference reached statistical significance at the 2nd hour (p-value = 0.000), highlighting a key time frame in early postoperative recovery where improved pain control is most beneficial.

The present study's findings are aligned with and add nuance to the growing body of literature supporting the use of adjuvants in TAP blocks. Nitika Singla et al. explored the use of dexamethasone 0.1 mg/kg with 0.375% ropivacaine and reported a duration of analgesia of approximately 407 minutes (~6.78 hours), which correlates well with our findings in the dexamethasone group (6.54 ± 2.19 hours). This supports the reproducibility of dexamethasone's analgesic enhancement, even at a lower concentration of ropivacaine (0.25%) as used in our study, suggesting safety without compromising efficacy.

Akanksha Aggarwal et al. similarly evaluated magnesium sulphate and dexamethasone as adjuvants to ropivacaine in cesarean patients and found prolonged analgesia with magnesium (14.2 ± 0.3 hours) compared to dexamethasone (8.3 ± 0.2 hours). While our reported analgesia durations are shorter, the trend remains consistent, emphasizing magnesium's superior duration. The variation in duration may be attributed to differences in local anesthetic concentration (they used 0.375% or higher), volume, patient population, and methodology.

In contrast, Arnab Banerjee et al. reported a longer

duration (12.44 ± 1.60 hours) for dexamethasone with 0.375% ropivacaine. Anie Gupta et al. observed even longer durations of analgesia (19.04 ± 4.13 hours) when dexamethasone was used with 0.375% ropivacaine. These studies indicate that higher concentrations of ropivacaine combined with adjuvants can significantly prolong analgesia. Our study, however, offers a unique perspective by showing that even with a lower 0.25% concentration, clinically meaningful durations of analgesia can be achieved when adjuvants like magnesium sulphate or dexamethasone are used.

The study by Uma Datt et al. using 0.5% ropivacaine reported a duration of 547.5 minutes (9.1 hours), reaffirming that drug concentration plays a critical role in analgesic outcomes. Our results, although lower in terms of duration, emphasize the importance of balancing efficacy with safety, especially in obstetric populations where minimizing local anesthetic systemic toxicity (LAST) risk is essential.

Ahmed Zein El Abdein's work emphasized the role of lower ropivacaine concentrations in maintaining effective analgesia with fewer side effects. Our study further supports this, demonstrating that 0.25% ropivacaine combined with adjuvants can yield satisfactory pain relief post-LSCS. This insight is valuable, especially in settings where safety and cost-effectiveness are paramount.

One of the most noteworthy aspects of this study is the complete absence of adverse effects in both groups. This supports the safety profiles of both adjuvants when used in appropriate doses. While dexamethasone's anti-inflammatory and antiemetic properties have long made it a favored adjuvant, magnesium sulphate's NMDA antagonism and calcium channel blockade may offer unique advantages in neuropathic and visceral pain modulation, potentially explaining its superior performance in this context.

However, certain limitations must be acknowledged. The sample size of 72 patients, while adequate for preliminary analysis, limits the generalizability and the follow-up period was limited to 24 hours, thus missing any potential delayed analgesic benefits or late-onset adverse effects. Additionally, We did not assess patient satisfaction scores or opioid consumption beyond the first rescue analgesia, which could further elucidate the functional benefit of prolonged analgesia.

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