Original Article

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Anaesthesia Section

Comparison of Magnesium Sulphate versus Clonidine as Adjuvants to Ropivacaine in Ultrasound-guided Bilateral Transversus Abdominis Plane Block for Postoperative Analgesia in Lower Segment Caesarean Section: A Randomised Controlled Trial

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ABSTRACT

Introduction: Anaesthesia plays a vital role in providing effective pain relief during surgical procedures while maintaining haemodynamic stability, ensuring maternal and foetal safety and enhancing overall recovery. In obstetric anaesthesia, particularly during Lower-Segment Caesarean Section (LSCS), the choice of anaesthetic agents and adjuvants significantly influences perioperative outcomes such as analgesia duration, haemodynamic parameters and patient comfort. The optimisation of these factors remains a crucial aspect of current research.

Aim: To evaluate the difference between the efficacy of Magnesium Sulphate and Clonidine as adjuvants to Ropivacaine in ultrasound-guided bilateral Transversus Abdominis Plane (TAP) block for postoperative analgesia and haemodynamic stability in patients undergoing LSCS under subarachnoid block.

Materials and Methods: This study was designed as a randomised, double-blind, controlled trial conducted at Chettinad Hospital and Research Institute, Kelambakkam, Chennai, Tamil Nadu, India, involving 60 female patients undergoing elective or emergency LSCS under subarachnoid block. Random allocation was used to assign patients into two groups of 30 each-Magnesium Sulphate as an adjuvant (group RM) and Clonidine as an adjuvant (group RC)-for the ultrasound-guided administration of Ropivacaine in bilateral TAP block. Postoperative analgesia duration, pain intensity (measured using the Visual Analogue Scale (VAS) score), haemodynamic parameters and side-effects were recorded over a 48-hour postoperative period. Statistical Package for the Social Sciences (SPSS) software was used for data analysis.

Results: Both groups were comparable in demographic parameters, with mean age, height and weight being 28.3±4.79 years, 160.07±10.57 cm and 70.77±5.29 kg in the RM group (Ropivacaine with Magnesium Sulphate) and 28.67±4.21 years, 161.27±5.06 cm and 69.84±4.81 kg in the RC group (Ropivacaine with Clonidine). The duration of analgesia was similar between group RC (10.53±5.68 hours) and Group RM (9.72±5.186 hours), with a p-value of 0.563, indicating no significant difference between the groups. The duration of analgesia was consistent in both groups, with lower VAS scores recorded at multiple intervals. Haemodynamic parameters remained stable in both groups, with no significant adverse effects or complications observed.

Conclusion: Ultrasound-guided TAP block with magnesium sulphate as an adjuvant to ropivacaine demonstrated comparable efficacy to clonidine in providing postoperative analgesia, without compromising haemodynamic stability or causing major adverse effects. Both magnesium sulphate and clonidine are equally effective in enhancing postoperative analgesia in patients undergoing LSCS.

Keywords: Anaesthetic, Patient satisfaction, Recovery of function, Treatment outcome

INTRODUCTION

Over the past decades, Caesarean sections (C-sections) have become increasingly prevalent, either due to patient preference or obstetric necessity. Improved maternal and foetal monitoring has enabled the early identification of complications, necessitating optimal anaesthetic care [1]. Spinal anaesthesia is widely used for C-sections, offering benefits such as intraoperative consciousness, reduced stress response, lower pulmonary complications, minimal blood and effective intraoperative pain control. However, it is associated with adverse effects like low blood pressure, extended motor block, urinary retention and postspinal headache [2]. Postoperative pain management remains a significant challenge following C-sections. Moderate to severe pain resulting from abdominal incisions and soft-tissue dissection can adversely affect early ambulation, breastfeeding, maternal comfort and overall recovery. Effective pain control is, therefore, essential in facilitating early mobility and improving postoperative outcomes. In recent years, pre-emptive analgesia, the administration of analgesics before the onset of surgical stimulus, has emerged as an important strategy to reduce postoperative pain intensity, minimise analgesic requirements and enhance maternal satisfaction [3].

Multimodal analgesia is essential, balancing efficacy and safety for both mother and newborn [4,5]. Neuraxial opioid administration, either as a single shot or via Patient-Controlled Analgesia (PCA), provides effective pain relief but is often associated with nausea, vomiting and pruritus, affecting patient comfort [6]. Introduced in 2001 by Rafi and refined in 2007 by Hebbard with ultrasound guidance, the TAP block effectively blocks sensory nerves supplying the anterior abdominal wall, thus reducing postoperative pain [7,8]. Despite its high success rate and minimal complications, its clinical adoption remains limited, with few studies evaluating its efficacy for LSCS patients [9-11]. Various studies have demonstrated

the effectiveness of TAP block in reducing postoperative pain and opioid consumption in LSCS patients, but further research is still warranted to establish its routine clinical practice [12,13]. Ropivacaine, an S-stereoisomer of bupivacaine, is a preferred local anaesthetic due to its lower cardiotoxicity, better safety profile and differential blockade favouring sensory over motor inhibition. It has an extended half-life, making it suitable for peripheral nerve blocks and has demonstrated effective pain relief after surgery with minimal side-effects [14,15].

Various adjuvants are used with local anaesthetics to prolong analgesia, including dexmedetomidine, clonidine, fentanyl and magnesium sulphate [16]. Clonidine, a widely utilised alpha-2 adrenergic agonist, has been extensively employed as an adjunct in regional anaesthesia due to its sedative, haemodynamic and analgesic properties [17]. Through its N-methyl-D-aspartate (NMDA) receptor and calcium channel modulation, magnesium sulphate exhibits antinociceptive properties, reducing central sensitisation and providing analgesic benefits in both animal and human models [18].

In 2017, the International Association for the Study of Pain (IASP) recognised the "Global Year Against Pain After Surgery," emphasising the importance of effective postoperative pain management to facilitate early mobilisation, improve newborn care and reduce morbidity [19]. Although several studies have evaluated the efficacy of different adjuvants in TAP block for various abdominal surgeries, limited literature is available specifically comparing their effects in LSCS patients [20-23]. Hence, this research was undertaken to compare the duration of pain relief as the primary objective, while the secondary objectives included assessing the intensity of pain using the VAS score and monitoring haemodynamic parameters.

MATERIALS AND METHODS

This randomised, double-blinded, controlled study was conducted at Chettinad Hospital and Research Institute, Kelambakkam, Chennai,Tamil Nadu, India, over six months, from September 2022 to February 2023. Ethical clearance was obtained from the Institutional Human Ethics Committee (IHEC-I/1129/22) and the study was registered in the Clinical Trials Registry-India (CTRI/2022/09/045394). All participants provided written consent before inclusion.

Inclusion criteria: Patients aged 18 to 40 years, classified as American Society of Anaesthesiologists (ASA) grade II or III, and scheduled for elective or emergency LSCS under spinal anaesthesia were included in the study.

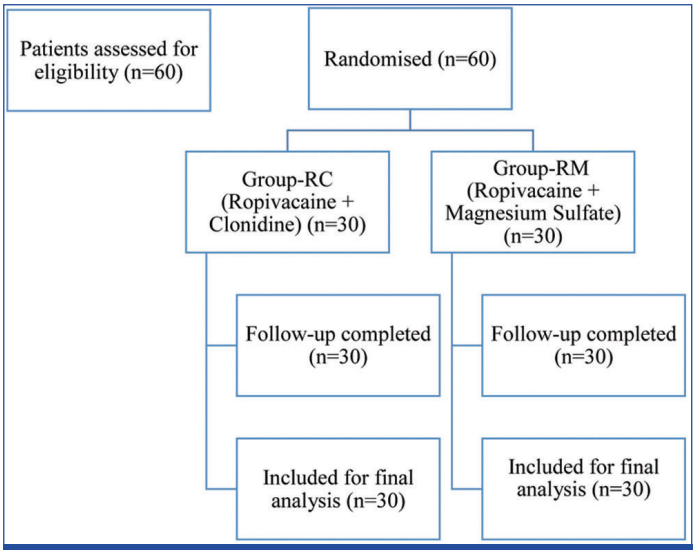
Exclusion criteria: Patients who refused consent, had known drug allergies, injection site infections, spinal surgery or deformities, coagulopathy, dysrhythmia, a height of less than 150 cm, or altered mental status were excluded from the study.

Sample size: Previous studies were used as a reference for calculating the sample size, considering a minimum of 30 participants in each group to achieve adequate statistical power. The sample size was calculated based on findings from the study by Chethanananda T et al., where patients who received clonidine as an adjunct with ropivacaine in the TAP block reported a mean time to first rescue analgesia of 20.17±3.42 hours, compared to 13.07±2.12 hours in the magnesium sulphate group. Postoperative VAS scores in both groups were lower for up to 14 hours, after which the clonidine group demonstrated significantly better analgesia. These findings were used to estimate the sample size required to detect a meaningful difference in analgesic duration and pain scores, with a minimum of 30 participants per group needed to achieve 80% power and a significance level of 5% [23].

In this double-blinded study, both the patients and the investigator assessing the outcomes were blinded to the group allocation, while the anaesthesiologist performing the block was not blinded due to the nature of the procedure.

Eligible participants (n=60) were enrolled and distributed equally between two groups through randomisation (30 each), with no exclusions during the study period.

Patients were randomised using a computer-generated randomisation method into two groups [Table/Fig-1].



[Table/Fig-1]: CONSORT flow diagram of patient distribution in the study.

- Group RC was designated as the control group, as clonidine is a well-established adjuvant in TAP block, while
- Group RM was the intervention group to evaluate magnesium sulphate as a novel adjuvant:
- Group RC (n=30): A bilateral TAP block was performed under ultrasound guidance using ropivacaine 0.25% (20 mL per side) combined with 75 µg of clonidine, as supported by previous studies demonstrating its efficacy and safety in postoperative analgesia [23].
- Group RM (n=30): A bilateral TAP block was performed under ultrasound guidance using ropivacaine 0.25% (20 mL per side) combined with 1 g of magnesium sulphate, in accordance with doses used in earlier clinical studies for enhancing analgesic effects [23].

Data collection parameters: Baseline demographic details such as age, weight, gender and physical status (ASA) of the patients were recorded. Postoperative pain was assessed using the VAS at 1, 2, 3, 4, 5, 6, 12, 18 and 24 hours following surgery. Haemodynamic parameters, including Heart Rate (HR), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) and Diastolic Blood Pressure (DBP), were recorded at these intervals. Additionally, the duration until the first request for postoperative analgesia, representing the duration of analgesia, was documented for both groups.

Study Procedure

After obtaining informed consent, a detailed preoperative assessment, incorporating physical examination, medical history and baseline vital signs, was performed. An 18G intravenous catheter was inserted and standard monitoring (continuous electrocardiogram, Non Invasive Blood Pressure (NIBP) and pulse oximetry) was established. All patients received spinal anaesthesia at the intervertebral space of L3-L4 or L4-L5. A 25G Quincke's spinal needle was primarily used; however, in cases where difficulty was encountered (such as in obese patients or due to technical issues), a 23G Quincke's spinal needle was employed as an alternative, as per clinical requirement. The intrathecal drug administered was 0.5% hyperbaric bupivacaine (2 mL) combined with fentanyl (25 µg).

Following the surgical procedure and before emergence from anaesthesia, a bilateral ultrasound-guided TAP block was performed utilising a high-frequency linear probe (6-19 MHz, Esaote ultrasound machine) placed transversely over the abdominal wall. A 23G Quincke's spinal needle was inserted using an in-plane technique between the mid- and anterior axillary lines, targeting the area between the internal oblique and transversus abdominis muscle layers. Under aseptic conditions and after negative aspiration, the drugs were injected according to the assigned groups:

- Group RC: 20 mL of 0.25% ropivacaine combined with 75 µg of clonidine on each side.
- Group RM: 20 mL of 0.25% ropivacaine with 1 g of magnesium sulphate on each side.

On ultrasound, the spread of the local anaesthetic was visualised as a hypoechoic enlargement. Patients were subsequently monitored in the postoperative recovery room.

Postoperative Monitoring and Pain Assessment

Patients' postoperative pain was measured using the VAS at predefined time intervals, while oxygen saturation (SpO_2), NIBP, VAS scores and HR were continuously monitored for 24 hours postoperatively.

Management of Adverse Events:

- **Hypotension:** This condition was defined as a SBP lower than 90 mmHg or a drop greater than 30 mmHg from baseline. It was managed with intravenous (i.v.) fluids and incremental doses of 6 mg i.v. ephedrine.
- **Bradycardia:** Defined as a HR of less than 60 bpm. This was managed with i.v. atropine (0.3 mg).
- **Respiratory depression:** Defined as a respiratory rate of fewer than 8 breaths per minute or SpO_2 <90%.

Rescue analgesia: All patients received 1 g of i.v. paracetamol postoperatively. If patients reported pain, the first rescue analgesic administered was 50 mg i.v. tramadol. If pain persisted, a second rescue analgesic of 75 mg i.v. diclofenac was administered.

STATISTICAL ANALYSIS

The SPSS version 20.0 was used for statistical analysis. The mean and Standard Deviation (SD) were employed to summarise continuous data, while percentages were used to represent categorical data. The Student's t-test and the Chi-square test were applied as appropriate. A p-value <0.05 was considered statistically significant. Randomisation was performed to reduce selection bias and double-blinding ensured allocation concealment.

RESULTS

This research included 60 patients, who were equally divided into two groups of 30 participants each. The demographic data revealed that the mean age of participants in group RM was 28.3 years, while in group RC it was 28.67 years. The mean weight for group RM was 70.777 kg, compared to 69.847 kg in group RC. The mean height for group RM was 160.07 cm, while for group RC it was 161.27 cm.

The distribution of patients according to the ASA classification is as follows: in group RC, 18 patients were classified as ASA II, while 12 were classified as ASA II E. In group RM, 17 patients were ASA II and 13 were ASA II E. This classification indicates the overall health status and anaesthetic risk of the participants, which is illustrated in [Table/Fig-2]. The duration of surgery was recorded for all participants, with a mean surgical duration of 65±10 minutes in group RC and 68±12 minutes in group RM.

The HR was comparable between both groups at all measured postoperative intervals, with no clinically significant variation. The p-values for the HR comparisons at each time point, made between the two groups, were generally above 0.05, suggesting that there were no significant differences between the groups. This data is shown in [Table/Fig-3].

Parameters	Group RM (Mean±SD)	Group RC (Mean±SD)
Age (years)	28.3±4.79	28.67±4.21
Weight {Kilograms (kg)}	70.77±5.29	69.84±4.81
Height {Centimeters (cm)}	160.07±10.57	161.27±5.06
ASA II (n)	17	18
ASA II (E) (n)	13	12
Duration of surgery (minutes)	68±12	65±10

[Table/Fig-2]: Demographic characteristics of RM (n=30) and RC (n=30) groups, ASA II-E, denotes an emergency surgical procedure.

Time (Hours)	Mean±SD (RM group)	Mean±SD (RC group)	p-value
0	77.33±11.03	78.45±10.15	0.688
0.5	76.97±11.29	78.76±9.78	0.518
1	76.77±10.82	78.97±8.74	0.395
1.5	77.8±11.42	79.14±9.56	0.628
2	77.1±9.89	78.9±9.12	0.472
3	76.67±10.21	79.34±8.45	0.278
4	76.97±9.47	79.45±8.00	0.283
6	77.5±9.82	79.66±7.90	0.358
8	77.6±8.65	80.31±7.36	0.201
10	77.77±9.50	80.04±7.18	0.312
12	80.17±9.66	80.88±6.25	0.765
24	77.25±9.66	83±5.41	0.086
Mean surgical duration (mins)	77±7.91	86.25±2.98	0.5

[Table/Fig-3]: Comparison of Mean Heart Rate (HR) (beats per minute) between RM and RC groups at different time intervals and mean duration of surgery (in minutes).

The differences in SBP and DBP readings were not statistically significant between group RM and group RC at most of the postoperative time intervals. Both groups exhibited a comparable trend of blood pressure variation throughout the observation period, as shown in [Table/Fig-4].

Systolic Blood Pressure (SBP)- Post OP				Diastolic Blood Pressure (DBP)- Post OP			
	RM	RC			RM	RC	
Minutes	Mean± SD	Mean± SD	p-value	Minutes	Mean± SD	Mean± SD	p-value
0	116.73± 11.59	117.93± 10.01	0.67	0	73.67± 8.29	72.72± 5.7	0.61
30	115.77± 11.32	115.31± 12.25	0.88	30	72.9± 5.87	71.17± 6.70	0.29
60	114.4± 10.58	114.48± 9.66	0.97	60	71.43± 6.40	70.52± 7.19	0.60
90	112.87± 9.16	115.07± 7.82	0.32	90	71.83± 5.84	70.79± 6.68	0.52
120	112.87± 10.26	116.83± 8.63	0.11	120	72.6± 6.71	71.28± 6.74	0.45
150	114.1± 9.52	116.86± 8.92	0.25	150	72.5± 8.02	72.52± 7.39	0.99
180	114± 10.92	117.38± 10.23	0.22	180	73.2± 8.62	71.97± 8.56	0.58
210	114.5± 12.08	117.59± 9.34	0.27	210	72.67± 8.87	74.86± 7.04	0.29
240	115.93± 10.13	116.14± 9.18	0.93	240	74.07± 7.63	73.9± 7.58	0.93
360	117.87± 11.06	118.07± 8.94	0.93	360	74.93± 8.37	74.93± 7.74	0.99
480	118.71± 9.83	119.92± 6.99	0.62	480	74.75± 7.74	75.21± 7.19	0.83
600	113.92± 12.32	118.92± 6.45	0.22	600	74.67± 6.82	77.83± 6.79	0.26

720	115.63± 12.95	117.6± 6.58	0.76	720	73.13± 6.46	77.75± 4.64	0.23
1440	124.5± 11.15	121± 3.60	0.63	1440	84± 5.35	80.67± 1.15	0.34

[Table/Fig-4]: Blood Pressure (BP) Distribution (mmHg).

The postoperative SpO_2 levels were well maintained and comparable between group RM and group RC throughout the observation period. No statistically significant difference was observed in SpO_2 measurements between the two groups at any time interval, as shown in [Table/Fig-5].

Minutes	RM Mean±SD	RC Mean±SD	p-value
0	99.87±0.43	100±0	0.10
30	99.93±0.25	99.97±0.18	0.58
60	99.93±0.25	100±0	0.16
90	99.93±0.25	99.97±0.18	0.58
120	99.93±0.25	99.97±0.18	0.58
150	99.93±0.25	99.93±0.25	0.97
180	99.9±0.30	99.93±0.25	0.67
210	99.9±0.30	99.93±0.25	0.67
240	99.9±0.30	99.93±0.25	0.67
360	99.9±0.30	99.93±0.26	0.70
480	99.96±0.20	99.92±0.28	0.56
600	100±0	99.92±0.28	0.32

[Table/Fig-5]: Oxygen Saturation (SpO_2) distribution.

The postoperative Mean Arterial Pressure (MAP) values remained stable and comparable between group RM and group RC across all recorded time points, with no statistically significant differences observed, as illustrated in [Table/Fig-6]. Similarly, postoperative VAS scores indicated low pain levels in both groups throughout the study period, with no significant variation between them, as shown in [Table/Fig-6].

All patients in both groups received their first rescue analgesia when their VAS score exceeded the threshold for pain relief. In the RC group, 12 patients required a second dose of rescue analgesia during the 24-hour postoperative period. In contrast, only seven patients in the RM group required a second dose of rescue analgesia. This indicates that the RM group had a lower requirement for additional analgesia compared to the RC group, suggesting effective analgesia in the RM group.

Both the MAP and VAS scores showed no significant differences between group RM and group RC throughout the postoperative period. MAP remained stable in both groups, with p-values greater than 0.05, indicating no significant variations. Similarly, the VAS scores, while slightly higher in group RM at certain points, also showed no significant differences, suggesting comparable pain levels between the two groups throughout the study.

[Table/Fig-7] shows the distribution of rescue analgesia during the postoperative period. The duration of analgesia was similar between group RC (10.53±5.68 hours) and group RM (9.72±5.186), with a p-value of 0.563 indicating no statistically significant difference between the two groups [Table/Fig-7]. This suggests that the analgesic effects observed in both groups have similar efficacy. No side-effects were reported in either group.

DISCUSSION

In present study, demographic characteristics were comparable between the two groups, including age, weight, height and procedural duration. Both clonidine (75 µg) and magnesium sulphate (1 g) used as adjuvants to 0.25% ropivacaine in the TAP block provided effective postoperative analgesia.

MAP				VAS			
Minutes	RM Mean± SD	RC Mean± SD	p-value	Minutes	RM Mean± SD	RC Mean± SD	p-value
0	85.37± 7.72	87.1± 6.47	0.35	0	-	-	-
30	84.77± 6.78	84.69± 7.48	0.96	30	-	-	-
60	84.4± 7.86	84.72± 8.47	0.87	60	-	-	-
90	84.1± 6.63	85.21± 7.90	0.56	90	0	0.07± 0.25	0.14
120	85.4± 7.36	85.66± 7.43	0.89	120	0.07± 0.25	0.1± 0.31	0.61
150	85.87± 7.60	87.03± 7.56	0.55	150	0.23± 0.43	0.28± 0.52	0.73
180	85.6± 9.37	86.14± 8.31	0.81	180	0.43± 0.62	0.66± 0.72	0.21
210	86.03± 9.30	89.31± 7.70	0.14	210	1.07± 1.04	1± 0.87	0.33
240	86.9± 8.92	87.69± 7.27	0.71	240	1.53± 0.62	1.48± 0.98	0.81
360	88.27± 9.57	88.54± 10.66	0.92	360	2.3± 0.98	1.89± 0.78	0.08
480	89.25± 8.03	88.13± 8.93	0.65	480	2.75± 0.94	2.5± 1.10	0.40
600	86.42± 7.78	88.75± 12.06	0.57	600	2.33± 0.65	2.75± 1.05	0.25
720	85± 7.29	90.5± 4.79	0.20	720	3± 1.19	2.25± 1.25	0.33
1440	92.75± 5.12	94± 1.73	0.70	1440	3.25± 0.5	3± 0	0.43

[Table/Fig-6]: MAP and VAS scores.

Rescue analgesia				Second rescue analgesic requirement			
	Group RC	Group RM	p-value		Group RC	Group RM	p-value
Mean±SD (hours)	10.53± 5.68	9.72± 5.18	0.563	Number of patients	12	9	0.03

[Table/Fig-7]: Duration of analgesia distribution.

The results showed that both groups reported no pain at 0, 30 and 60 minutes after the TAP block, with a slight increase in pain observed at 90 minutes (mean score of 0.07 in group RC). While pain levels gradually increased over time, there was no significant difference between the two groups. All patients in both groups required a first rescue analgesic (Tramadol 50 mg); however, 12 patients in group RC and nine patients in group RM required a second rescue analgesic (Diclofenac 75 mg). The difference in results compared to the study by Chethanananda T et al., could be attributed to the lower magnesium dose of 150 mg used in their research [23].

The time to first rescue analgesia was 10.53±5.68 hours for clonidine and 9.72±5.18 hours for magnesium sulphate, with no significant difference (p=0.563). In the study by Chethanananda T et al., clonidine demonstrated superior analgesic duration compared to magnesium sulphate in ultrasound-guided TAP blocks, with rescue analgesia times of 20.17±3.42 hours for clonidine versus 13.07±2.12 hours for magnesium sulphate. This contrasts with present study findings of similar analgesic durations in both groups. The discrepancy could be due to differences in dosages (150 µg clonidine vs. 75 µg) [23].

Imani F et al., studied magnesium sulphate (500 mg) with ropivacaine (0.2%) in ultrasound TAP blocks and found no significant difference in postoperative analgesia compared to a placebo. This discrepancy could be attributed to the higher doses of both magnesium sulphate and ropivacaine used in present study [24].

Mohanakumar A et al., found that the duration of postoperative analgesia did not differ significantly between the clonidine and magnesium sulphate groups (12.10±3.86 hours for clonidine vs. 10.93±3.68 hours for magnesium sulphate, p-value=0.236). This was similar to present study finding that the analgesia duration was comparable between group RC (10.53±5.68 hours) and group RM (9.72±5.186 hours, p-value=0.563). However, the numerical values for analgesia duration are slightly higher in their study. This could be attributed to the use of levobupivacaine, which has a longer duration of action compared to the ropivacaine used in present study. Additionally, the brachial plexus supraclavicular block targets a denser neural plexus compared to the TAP block, potentially contributing to prolonged analgesic effects [25].

Pradhan A et al., reported that clonidine provided a longer duration of analgesia than magnesium sulphate when used as an adjuvant to bupivacaine in epidural anaesthesia. However, present study found no significant difference in the duration of analgesia between the two groups (RC: 10.53±5.68 hours vs. RM: 9.72±5.186 hours). The difference could stem from the route of administration; epidural anaesthesia involves a different mechanism of action and drug absorption compared to the TAP block. The epidural route allows for direct access to nerve roots, potentially enhancing clonidine's effect on prolonging analgesia. In contrast, TAP blocks target peripheral nerves, where both magnesium sulphate and clonidine may exhibit similar efficacy due to limited systemic absorption and localised action [26].

Kaur P et al., found that magnesium sulphate provided better postoperative analgesia than clonidine in Intravenous Regional Anaesthesia (IVRA). The superior performance of magnesium in their study was likely due to the intravenous administration route, which allows for systemic effects, including N-methyl-D-aspartate (NMDA) receptor antagonism at central pain pathways. However, present study focused on TAP blocks, a peripheral nerve block technique where systemic effects are minimised. Furthermore, the context of use (IVRA vs. TAP block) involves different pain dynamics, making a direct comparison challenging. Clonidine's side-effect profile, such as hypotension and bradycardia noted in their study, may also be less relevant in TAP blocks, where systemic absorption is minimal [27].

Present study findings are supported by the study conducted by El Abdein Mohamed AZ, which concluded that lower concentrations of ropivacaine (0.2%) were as effective as higher concentrations (0.5%) for postoperative analgesia [28]. Similarly, in present study used 0.25% ropivacaine combined with either clonidine or magnesium sulphate and found that it provided effective analgesia without significant differences in duration or pain scores.

Limitation(s)

This was a single-centre study and the results may vary in different clinical settings or patient populations. Additionally, the study did not evaluate long-term outcomes or patient satisfaction, which could provide further insights into the efficacy of the adjuvants. Larger, multicentric studies with longer follow-up are needed to confirm these results.

CONCLUSION(S)

In this study, both 0.25% ropivacaine with clonidine (75 µg) and 0.25% ropivacaine with magnesium sulphate (1 g), administered through ultrasound-guided TAP block, were found to deliver satisfactory postoperative analgesia in individuals undergoing elective or emergency caesarean sections. The duration of analgesia and pain relief were comparable between the two groups. Both drug combinations maintained stable haemodynamic parameters without any significant adverse effects. This indicates that the addition of clonidine or magnesium sulphate to ropivacaine effectively enhances postoperative analgesia. Thus, ultrasound-guided TAP block remains a reliable and safe technique for postoperative pain management in caesarean delivery. Further large-scale studies may provide additional insights into optimising adjuvant selection in regional anaesthesia.

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