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Original Research Paper

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TO COMPARE THE ANALGESIC EFFICACY OF 0.25% BUPIVACAINE AND 0.25% ROPIVACAINE IN TAP BLOCK AS A PART OF A MULTIMODAL ANALGESIA REGIMEN FOR POST CAESAREAN DELIVERY PAIN MANAGEMENT

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ABSTRACT

Background: Women undergoing Cesarean delivery often face postoperative pain, which requires effective management to ensure their comfort and ability to care for their newborn. Transversus Abdominis Plane (TAP) block, a regional anesthetic technique, is increasingly used for postoperative analgesia in abdominal surgeries. This study aimed to evaluate the analgesic efficacy of 0.25% bupivacaine versus 0.25% ropivacaine in TAP blocks for pain relief following Cesarean delivery. **Material And Methods:** After approval from Indian Ethical Committee, this prospective, randomized, double-blinded, cross-sectional study was conducted at Sri Aurobindo Medical College and PG Institute, Indore, with 120 ASA grade I/II patients undergoing Cesarean section under spinal anesthesia. Patients were randomly assigned to receive TAP blocks with either 20 mL of 0.25% bupivacaine (Group B) or 0.25% ropivacaine (Group R). Postoperative pain intensity was measured using the Visual Analog Scale (VAS) at multiple time points (30 minutes, 2, 4, 6, 12, and 24 hours). Rescue analgesia, postoperative nausea and vomiting (PONV), and adverse effects were also monitored. **Results:** Patients in Group B experienced significantly lower VAS scores at all time intervals compared to Group R ($p < 0.05$). The mean duration of analgesia and time to first rescue analgesia were longer in Group B, suggesting superior pain relief with bupivacaine. The incidence of postoperative nausea was comparable between the two groups, with no cases of vomiting reported. **Conclusion:** 0.25% bupivacaine in TAP block provided superior postoperative analgesia compared to 0.25% ropivacaine, with longer-lasting pain relief and reduced need for rescue analgesia. TAP block is an effective and safe addition to multimodal postoperative pain management in Cesarean delivery.

KEYWORDS : Cesarean delivery, Transversus Abdominis Plane (TAP) block, bupivacaine, ropivacaine, postoperative pain, analgesia, Visual Analog Scale (VAS), postoperative nausea and vomiting (PONV), regional anesthesia, rescue analgesia.

INTRODUCTION

Women undergoing Cesarean delivery face unique postoperative challenges, as they require effective pain management to remain alert, comfortable, and able to care for their newborn. Lower segment cesarean section (LSCS) is a significant surgical procedure that results in considerable postoperative pain [1].

Postoperative analgesia is crucial, offering benefits such as reduced stress response, lower morbidity, and improved surgical outcomes in certain cases. It also plays a key role in accelerating recovery and promoting rehabilitation. Several strategies are employed for pain relief, including nonsteroidal anti-inflammatory drugs (NSAIDs) such as parecoxib/valdecoxib [2], ketoprofen [3], and paracetamol, as well as opioids (intravenous or patient-controlled analgesia). Other techniques include local anaesthetic infiltration (pre- and post- pneumoperitoneum),epidural block [4], multimodal analgesia [5] (which combines opioids, NSAIDs, and local anaesthetic infiltration), and transversus abdominis plane (TAP) block.

Localized analgesic methods significantly reduce pain intensity, minimize the side effects of systemic analgesics, and enhance overall patient comfort. In abdominal surgeries such as caesarean sections, blocking the neural afferent fibres of the abdominal wall through techniques like abdominal field blocks, ilioinguinal, and hypogastric nerve blocks has proven effective in providing substantial postoperative relief [6].

The TAP block, a regional anesthetic technique, targets the parietal peritoneum and the skin and muscles of the anterior abdominal wall, extending up to the T6 level [7]. Initially introduced for specific applications, this technique has evolved to include various modifications for broader surgical use [8]. TAP block has become a cornerstone in multimodal analgesia, particularly for abdominal surgeries. Drugs such as ropivacaine [9], bupivacaine [10], and levobupivacaine have been used for the procedure.

In the posterior approach of the TAP block, a local anaesthetic is administered into the neurofascial plane between the internal oblique and transversus abdominis muscles, blocking the abdominal wall nerves, including the T7-T12 intercostal nerves, ilioinguinal nerve, iliohypogastric nerve, and lateral cutaneous branches of the dorsal rami of the L1-L3 spinal nerves [11].

Following lower abdominal surgery, TAP block provides significant analgesia, particularly when pain is primarily due to discomfort in the parietal wall. The deposition of local anaesthetic over the transversus abdominis muscle effectively blocks sensory signals from the lower abdominal wall, including the skin and muscles [12].

Despite its high success rate and relatively low complication risk, TAP block remains underutilized [12,13]. This may be attributed to limited access to comprehensive training and resources for anesthesiologists. Although the technique is

conceptually simple, its integration into routine clinical practice has been gradual.To address this gap, our study aims to evaluate the analgesic efficacy of 0.25% bupivacaine and 0.25% ropivacaine in TAP block as part of a multimodal analgesia regimen for post- caesarean delivery pain management.

MATERIAL AND METHODS

After approval from the Institutional Ethical Committee, the present prospective, randomized, double-blinded, cross-sectional study was conducted in the Department of Anaesthesia, Sri Aurobindo Medical College and PG Institute, Indore (M.P.), over a duration of 18 months. A total of 120 ASA grade I/II patients undergoing Caesarean section under spinal anesthesia, classified as American Society of Anesthesiologists (ASA) physical status Grade I and II, were included after obtaining informed written consent. Ethical guidelines were strictly followed, ensuring patient confidentiality and adherence to institutional protocols.

Inclusion Criteria

- Pregnant women more than 18 years of age undergoing lower segment Caesarean section under spinal anaesthesia (both elective and emergency);
- ASA grade I and II parturient; and
- Who could understand and rate their pain on Visual Analog Scale (VAS scale of 0 – 10)?

Exclusion Criteria

- Patient refusal;
- Allergy to study medications;
- Patients with significant coagulopathies and with contraindications with regional anaesthesia;
- Patients with history of cardiac, respiratory, renal or hepatic failures;
- Psychological disorders;
- Infection at the site of block; and
- Patients converted to general anaesthesia after giving subarachnoid block

Methodology

Data was collected in a pre-structured proforma, assessing and comparing analgesic efficacy, duration of pain relief, and adverse effects in both groups. All patients satisfying the criteria of inclusion were enrolled and randomly assigned into two groups using an alternate method: Group B (N=60) received a TAP block with 10 mL of 0.25% Bupivacaine and 10 ml of normal saline total volume being 20ml, while Group R (N=60) received a TAP block with 10 mL of 0.25% Ropivacaine and 10 ml of normal saline comprising total volume 20ml.

Patients were recruited from the ward, and a pre-anesthetic check-up was conducted. Informed written consent was obtained from all patients before the procedure. They were kept nil by mouth for six hours prior to the procedure, and an intravenous (IV) line was secured.

In the operating room, standard monitoring including electrocardiogram (ECG), non-invasive blood pressure (NIBP), and arterial oxygen saturation (SpO_2) was maintained throughout theprocedure. Patients were premedicated with IV Ranitidine and IV Ondansetron and were preloaded with 500 mL of Ringer's lactate solution.

All patients received a standardized spinal anesthesia using 2mL of 0.5% hyperbaric Bupivacaine in the sitting position, without any additive. The level of analgesia achieved was noted, and the sensory block height was assessed using a pinprick method, with the target height set at T4.

Patients were monitored intraoperatively, and hypotension was defined as a >20% decrease in systolic blood pressure from baseline and was managed using incremental doses of IV Ephedrine (0.3 mg) and a 200 mL bolus of Ringer's lactate. Bradycardia was defined as a heart rate <60 beats per minute and was treated with IV Atropine (0.6 mg). No intraoperative analgesic or sedative was administered to any patient.

At the end of surgery, Petit's triangle was identified on the surgical side, located above the iliac crest between the fibers of the external oblique and latissimus dorsi muscles. Under aseptic precautions, a 22-G hypodermic needle, attached to a 20 mL syringe containing the allocated drug, was introduced perpendicular to the skin and advanced until two "POPS" or "give way" sensations were felt. After aspiration, the drug was injected into the fascial plane, with check aspiration performed every 5 mL to avoid intravascular administration. Patients were observed for 15 minutes before being transferred to the post-anesthesia care unit (PACU).

Postoperatively, pain intensity, nausea, vomiting, and other adverse symptoms were assessed at 30 minutes in the PACU and at 2, 4-, 6-, 12-, and 24-hours post-surgery. Patients were asked to rate their pain and nausea levels at each interval. Pain severity was measured using a Visual Analogue Scale (VAS: 0 = no pain, 10 = worst imaginable pain). IV tramadol (2 mg/kg) was administered as a rescue analgesic for patients with a VAS score of 4 or higher. The time of first pain onset and the first analgesic request were recorded within the initial 24-hour postoperative period. Antiemetics were administered to patients experiencing nausea or vomiting. Additionally, patients were monitored for local site infection, hematoma formation, and signs of local anesthetic toxicity, including dizziness, tinnitus, perioral numbness, tingling, lethargy, seizures, and cardiac complications such as atrioventricular conduction block, arrhythmias, myocardial depression, and cardiac arrest.

The Visual Analogue Scale (VAS) used for pain assessment consisted of a 10 cm (or 100 mm) line, labeled "no pain" at one end and "worst pain imaginable" at the other. Patients marked their pain intensity on this scale using a slide-rule-like device. The VAS remains one of the most commonly used tools in clinical practice for evaluating pain severity and relief.

RESULTS

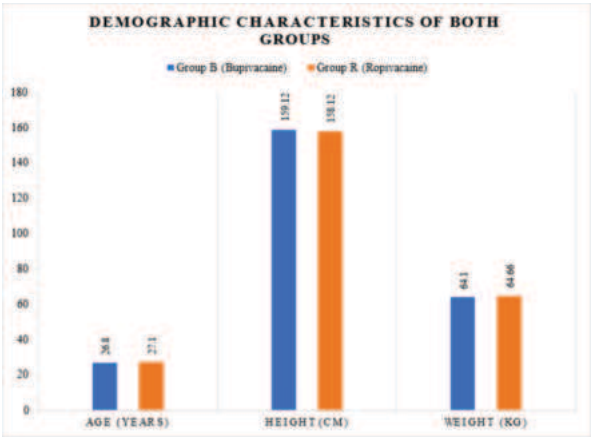
This study included 120 patients, randomly assigned to two groups to compare the efficacy of 0.25% Bupivacaine and 0.25% Ropivacaine for postoperative pain management through a Transversus Abdominis Plane (TAP) block. Group B received Bupivacaine, while Group R received Ropivacaine.

Demographic characteristics: The demographic characteristics of both groups were comparable. The mean age was 26.8 ± 3.13 years in Group B and 27.1 ± 4.17 years in Group R (p = 0.58). The average height was 159.12 ± 5.48 cm in Group B and 158.12 ± 5.12 cm inGroup R (p = 0.60). The mean weight was 64.10 ± 5.25 kg in Group B and 64.66 ± 5.10 kg in Group R, with no statistically significant difference (p = 0.782). In Group B, 40 patients were ASA I and 20 were ASA II, while in Group R, 35 were ASA I and 25 were ASA II (p = 0.45). These results confirm that both groups had similar baseline characteristics. [Table 1, Graph 1]

Table 1. Demographic Characteristics Of Both Groups

Parameter	Group B (Bupivacaine)	Group R (Ropivacaine)	p-value
Age (years)	26.8 ± 3.13	27.1 ± 4.17	0.58
Height (cm)	159.12 ± 5.48	158.12 ± 5.12	0.60
Weight (kg)	64.10 ± 5.25	64.66 ± 5.10	0.782
ASA I/ASAII	40/20	35/25	0.45

**P value<0.05 considered statistically significant*



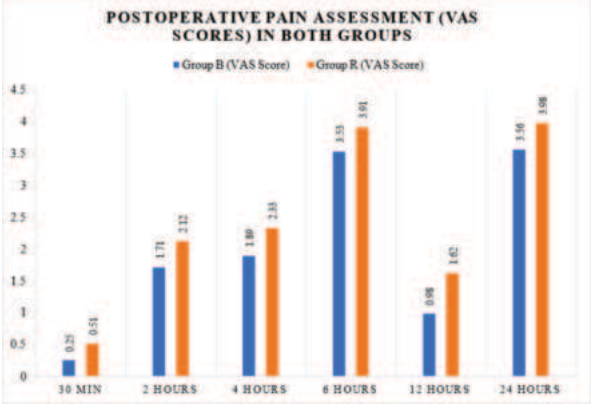
Graph 1. Demographic Characteristics Of Both Groups

Postoperative Pain Assessment: Postoperative pain was assessed using the Visual Analog Scale (VAS) at 30 minutes, 2, 4, 6, 12, and 24 hours after surgery. Patients in Group B consistently reported lower VAS scores compared to those in Group R, with the difference being statistically significant ($p < 0.05$) at all time intervals. Additionally, 12 patients in Group B and 16 patients in Group R required rescue analgesia during the first 12 hours after surgery. [Table 2, Graph 2]

Table 2. Postoperative Pain Assessment (VAS Scores) In Both Groups At Different Time Intervals

Time Interval	Group B (VAS Score)	Group R (VAS Score)	p-value
30 min	0.25 ± 0.40	0.51 ± 0.48	<0.05
2 hours	1.71 ± 0.41	2.12 ± 0.88	<0.05
4 hours	1.89 ± 0.58	2.33 ± 0.78	<0.05
6 hours	3.53 ± 0.62	3.91 ± 0.80	<0.05
12 hours	0.98 ± 0.61	1.62 ± 1.10	<0.05
24 hours	3.56 ± 0.78	3.98 ± 0.92	<0.05

**P value <0.05 considered statistically significant*



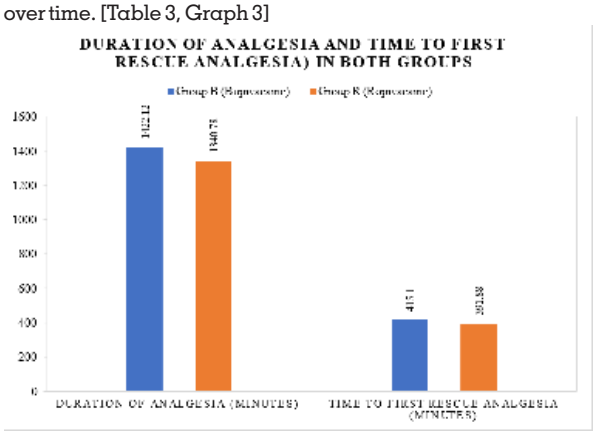
Graph 2. Postoperative Pain Assessment (VAS Scores) at Different Time Intervals

Table 3. Duration Of Analgesia And Time To First Rescue Analgesia) In Both Groups

Parameter	Group B (Bupivacaine)	Group R (Ropivacaine)	p-value
Duration of analgesia (minutes)	1422.12 ± 125.1	1340.78 ± 33.11	<0.05
Time to first rescue analgesia (minutes)	415.10 ± 32.88	391.88 ± 18.92	<0.05

**P value <0.05 considered statistically significant*

Duration of Analgesia and Time to First Rescue Analgesia: The mean duration of analgesia was significantly longer in Group B (1422.12 ± 125.1 minutes) compared to Group R (1340.78 ± 33.11 minutes) ($p < 0.05$). Similarly, the mean time to first rescue analgesia was also longer in Group B (415.10 ± 32.88 minutes) than in Group R (391.88 ± 18.92 minutes) ($p < 0.05$), suggesting that Bupivacaine provided superior pain relief over time. [Table 3, Graph 3]



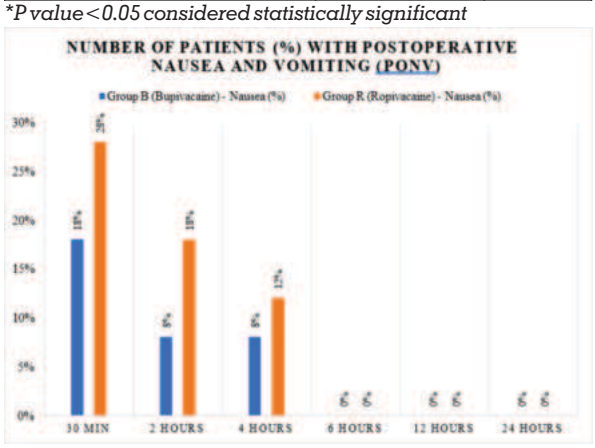
Graph 3. Duration Of Analgesia And Time To First Rescue Analgesia) In Both Groups

Postoperative Nausea and Vomiting (PONV): Postoperative nausea was assessed at 30 minutes, 2 hours, and 4 hours after surgery. In Group B, 17% of patients reported nausea at 30 minutes, 7% at 2 hours, and 7% at 4 hours. In Group R, 27% experienced nausea at 30 minutes, 17% at 2 hours, and 10% at 4 hours. However, no patients in either group reported nausea at 6, 12, or 24 hours. There were no recorded cases of vomiting in either group, and no patients required rescue antiemetics. The incidence of nausea between the two groups was not statistically significant ($p > 0.05$).

Table 4. Number of Patients (%) with Postoperative Nausea and Vomiting (PONV)

Time Interval	Group B (Bupivacaine) - Nausea (%)	Group R (Ropivacaine) - Nausea (%)	p-value
30 min	18%	28%	>0.05
2 hours	8%	18%	>0.05
4 hours	8%	12%	>0.05
6 hours	0%	0%	-
12 hours	0%	0%	-
24 hours	0%	0%	-

**P value <0.05 considered statistically significant*



Graph 4. Number of Patients (%) with Postoperative Nausea and Vomiting (PONV)

DISCUSSION

The present study aimed to evaluate various postoperative analgesia techniques, emphasizing the effectiveness of multimodal approaches and specific nerve block methods, particularly transversus abdominis plane (TAP) block, in

abdominal surgeries like caesarean sections. Effective postoperative pain management is essential to improve recovery, reduce surgical morbidity, and enhance patient comfort. The results underscore the pivotal role of regional anaesthesia and localized analgesic treatments in managing pain, reducing reliance on systemic analgesics, and minimizing potential side effects.

The main finding of our study is that both 0.25% bupivacaine and 0.25% ropivacaine provided effective postoperative analgesia for patients undergoing Lower Segment Caesarean Section (LSCS). However, bupivacaine demonstrated a longer duration of analgesia and lower Visual Analog Scale (VAS) scores compared to ropivacaine.

Our study data were comparable between both groups in terms of demographics, ASA classification, VAS score, postoperative analgesia duration, time to first rescue analgesia, nausea, vomiting, and other side effects. These findings are consistent with previous studies, such as Sravani V et al. [6], which also indicated that TAP block is an effective method for immediate postoperative pain relief, evidenced by significantly lower VAS scores.

Demographic data showed no statistically significant differences between the groups, with mean ages of 25.7 ± 3.03 years for the bupivacaine group (Group B) and 25.2 ± 4.37 years for the ropivacaine group (Group R). Additionally, mean body weights were 62.40 ± 5.15 kg inGroup B and 62.13 ± 5.17 kg in Group R, suggesting that both groups were comparable at baseline.

Regarding VAS Pain Scores, Group B consistently exhibited lower mean VAS scores at all time points, including 30 minutes, 2 hours, 4 hours, 6 hours, 12 hours, and 24 hours post-surgery ($p < 0.05$). At 6 hours, Group B showed a mean score of 3.53 ± 0.62 compared to 3.91 ± 0.80 in Group R, while at 12 hours, Group B had a mean score of 0.98 ± 0.61 compared to 1.62 ± 1.10 in Group R. The higher pain scores in Group R at 6 hours could be attributed to some patients in Group B receiving rescue analgesia. These results align with those of Patel D et al. [14] observed higher VAS scores in the ropivacaine group compared to the bupivacaine group at 6 and 12 hours postoperatively. Similarly, Sharma N et al. [15], who found significantly lower pain scores in patients receiving bupivacaine in TAP block compared to those receiving ropivacaine at 8 and 12 hours postoperatively.

The mean duration of analgesia was significantly longer in the bupivacaine group, with an average duration of 1422.12 ± 125.1 minutes compared to 1340.78 ± 33.11 minutes in the ropivacaine group. This extended analgesic duration is consistent with findings from Sravani V et al. [6], who also reported that bupivacaine had greater analgesic potency and longer-lasting effects following TAP block.

The time to first rescue analgesia was significantly longer in Group B, with a mean time of 415.10 ± 32.88 minutes, compared to 391.88 ± 18.92 minutes in Group R ($p < 0.05$). This suggests that bupivacaine offered more sustained pain relief before additional analgesics were needed. Similar results were reported by Sravani V et al. [6] and El Dawlatley et al. [16], who found that TAP block significantly reduced the need for rescue analgesia after laparoscopic cholecystectomy.

Our findings support the effectiveness of TAP block for providing immediate postoperative analgesia, in line with McDonnell et al. [13], who demonstrated superior analgesia with TAP block as part of a multimodal regimen following elective caesarean delivery. Carney et al. [17] also reported that anatomical TAP block significantly reduced postoperative pain scores for up to 48 hours after total abdominal hysterectomy.

Additionally, our results corroborate the efficacy of bupivacaine (0.25%) in TAP block, offering superior pain relief compared to ropivacaine (0.25%) during the immediate postoperative period, as shown in prior studies by Sravani V et al. [6], Patel D et al. [14], Sharma N et al. [15], and El-Dawlatly AA et al. [16].

In conclusion, both bupivacaine and ropivacaine were effective in providing postoperative analgesia via TAP block. However, bupivacaine demonstrated superior pain relief, longer analgesia duration, and a more delayed need for rescue analgesia compared to ropivacaine. These findings suggest that bupivacaine should be the preferred local anaesthetic for TAP block in postoperative analgesia, particularly for patients undergoing LSCS.

Our study's limitations include a small sample size, the absence of long-term follow-up, and the lack of blinding, which could affect the generalizability and objectivity of the results. Furthermore, potential confounding factors and the narrow focus on immediate postoperative outcomes may limit the applicability of these findings. Future studies with larger sample sizesand additional outcome measures, including long-term pain relief, would provide more comprehensive insights into the optimal choice of local anaesthetics for TAP block.

CONCLUSION

Transversus abdominis plane blocks are a relatively recent method for providing postoperative analgesia following abdominal surgery in a multimodal approach. It is regarded as a technically straight forward block with a large margin of safety. TAP block is a safe and effective addition to multimodal postoperative analgesia. Multiple studies have shown that it is better than normal medical therapy in the treatment of postoperative pain.

This study demonstrated that 0.25% Bupivacaine TAP block (Group B) provided superior postoperative pain relief compared to 0.25% Ropivacaine TAP block (Group R). Group B had lower VAS scores, longer analgesia duration, and delayed need for rescue analgesia compared to Group R. The incidence of postoperative nausea and vomiting was comparable between the two groups, with no cases of vomiting reported. Based on these findings, Bupivacaine appears to be a more effective choice for postoperative analgesia using the TAP block technique.

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