Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

A randomized controlled trial comparing subarachnoid block with 0.75% isobaric ropivacaine (15 mg) and 0.5% hyperbaric bupivacaine (8 mg) in patients undergoing caesarean section.

Dr. B. Babitha[1], Dr. G. Alekhya[1]*, Dr. M. Sreya Santhoshi[1]
[1]Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, India.

Abstract

Background:
Subarachnoid block (SAB) remains the preferred anaesthetic technique for lower segment caesarean section (LSCS) because it ensures rapid onset, dense surgical anaesthesia, and minimal drug transfer to the foetus.

Aim:
To compare the clinical efficacy, block dynamics, haemodynamic responses, and safety of 0.75% isobaric ropivacaine (15 mg) and 0.5% hyperbaric bupivacaine (8 mg) in parturients undergoing elective LSCS.

Methods:
A prospective, randomized comparative study was performed on 100 full-term parturients aged 18–35 years scheduled for elective LSCS under SAB. Participants were allocated to either Group I (bupivacaine 0.5%, 8 mg) or Group II (ropivacaine 0.75%, 15 mg). Sensory and motor block characteristics, haemodynamic variables, neonatal APGAR scores, and adverse events were recorded and analyzed.

Results:
Sensory block onset at T10 was faster with bupivacaine (2.28 ± 0.56 min) than with ropivacaine (3.63 ± 0.72 min; $p < 0.001$). Although the overall duration of sensory block was similar, regression to L1 occurred **earlier** with ropivacaine ($p = 0.047$). Motor block reached Grade III more rapidly with bupivacaine (3.06 ± 0.9 min vs 8.46 ± 2.48 min; $p < 0.001$) and lasted longer (129.30 ± 21.09 min vs 93.20 ± 11.10 min; $p < 0.001$). Haemodynamic trends and neonatal outcomes showed no significant intergroup differences. Adverse effects were infrequent and comparable.

Conclusion:
Both drugs provided reliable and safe spinal anaesthesia for caesarean delivery. Bupivacaine produced a quicker and more sustained motor block, whereas ropivacaine enabled faster postoperative recovery with stable haemodynamics. Ropivacaine may be advantageous when early ambulation and enhanced maternal comfort are priorities.

Recommendations:
Larger multicentric trials, dose-response evaluations, and assessments of adjunct use with opioids may further refine the choice of intrathecal agents for obstetric anaesthesia.

Keywords: *Ropivacaine, Bupivacaine, Caesarean section, Subarachnoid block, Intrathecal anaesthesia*
Submitted: *October 10, 2025* ***Accepted:*** *November 14, 2025* ***Published:*** *December 30, 2025*

Corresponding Author: *Dr. G Alekhya*
Email: ***alekhya.gangishetty@gmail.com.***
Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, India.

INTRODUCTION
Regional anaesthesia, particularly subarachnoid block (SAB), has become the preferred anaesthetic technique for lower segment caesarean section (LSCS) due to its reliability, rapid onset, dense sensory and motor blockade, and minimal risk of foetal drug exposure [1, 2]. Among the

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

various local anaesthetic agents used for spinal anaesthesia, bupivacaine has long been considered the gold standard because of its prolonged duration of action and profound analgesia [3]. However, its association with cardiotoxicity and central nervous system toxicity has encouraged the exploration of safer alternatives.

Ropivacaine, a pure S-enantiomer of propivacaine, was introduced as a long-acting amide local anaesthetic with a similar pharmacological profile to bupivacaine but with a better safety margin. Ropivacaine produces differential blockade with greater sensory than motor block, making it particularly useful in obstetric anaesthesia where early ambulation and minimal motor blockade are desirable [4, 5]. The isobaric form of 0.75% ropivacaine offers stable haemodynamics and adequate surgical anaesthesia while minimizing hypotension and motor block duration. On the other hand, hyperbaric bupivacaine (0.5%) remains widely used in spinal anaesthesia for caesarean sections because of its predictable spread within the subarachnoid space, profound motor block, and reliable sensory level [6-8]. However, higher incidences of maternal hypotension and prolonged motor blockade can complicate intra- and postoperative recovery.

Given these pharmacodynamic differences, it is clinically relevant to compare the efficacy, onset, duration, and safety profiles of isobaric ropivacaine and hyperbaric bupivacaine when used for SAB in caesarean section [9,10]. Evaluating these agents in terms of haemodynamic stability, sensory and motor block characteristics, and neonatal outcomes will provide valuable insights into selecting the most appropriate local anaesthetic for spinal anaesthesia in obstetric patients. Hence, this study titled "A Randomized Controlled Trial Comparing Subarachnoid Block with 0.75% Isobaric Ropivacaine (15 mg) and 0.5% Hyperbaric Bupivacaine (8 mg) in Patients Undergoing Caesarean Section" aims to assess and compare the onset, duration, quality of sensory and motor block, haemodynamic changes, and side effects associated with both agents in parturients undergoing caesarean delivery under spinal anaesthesia.

Materials and Methods

Study Setting and Design

This prospective, randomized comparative study was conducted in the Department of Anaesthesiology, Gandhi Medical College, from May 2023 to October 2025. A total of 100 full-term parturients scheduled for elective caesarean section were enrolled.

Sample size determination

The sample size was determined based on previous comparative studies evaluating sensory and motor block characteristics of intrathecal local anaesthetics in caesarean section. Assuming a clinically meaningful difference in the onset time of sensory block between groups, with a power of 80% and a two-sided alpha error of 5%, a minimum of 45 participants per group was required. To account for possible dropouts or protocol deviations, the sample size was increased to 50 participants per group, resulting in a total sample of 100 parturients.

Randomization and allocation concealment

Randomization was performed using a computer-generated random number sequence to allocate participants into two groups in a 1:1 ratio. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes (SNOSE). Each envelope contained the group assignment and was opened only after the participant had been enrolled and prepared for spinal anaesthesia, thereby preventing foreknowledge of group allocation.

Implementation of randomization

The random allocation sequence was generated by an anaesthesiologist who was not involved in patient recruitment or outcome assessment. Participant enrolment was carried out by the attending anaesthesiologist in the preoperative area. Group assignment was implemented by opening the sealed envelope just before intrathecal drug administration.

Blinding

Due to differences in the physical characteristics and preparation of the study drugs, blinding of the anaesthesiologist administering the spinal block was not feasible. However, the participants were blinded to group allocation, and postoperative assessments of sensory block regression, motor recovery, and adverse events were performed by an independent observer who was blinded to the study group, thereby reducing assessment bias.

Inclusion Criteria

Parturients aged 18–35 years planned for elective lower segment caesarean section under spinal anaesthesia and willing to provide written informed consent were included.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

Exclusion Criteria

Exclusions included infection at the puncture site, coagulopathy, raised intracranial pressure, or active bleeding tendencies. Patients with systemic illnesses—hypertension, diabetes mellitus, cardiac disease, haematological disorders, obesity, or eclampsia—were excluded. Multiple gestation, fetal distress, and fetal anomalies were also not included.

Pre-anaesthetic Evaluation and Preparation

Each participant underwent a structured pre-anaesthetic evaluation consisting of medical history, systemic examination, and relevant investigations. Baseline heart rate, blood pressure, and oxygen saturation were documented. An 18-gauge IV cannula was inserted, and premedication with IV metoclopramide 10 mg and IV ranitidine 50 mg was administered. Patients received Ringer's lactate 10 ml/kg over 15 minutes before the spinal block.

Randomization and Study Groups

Simple random allocation was used to divide the participants into two groups of 50 each:

Group I (Bupivacaine): 0.5% hyperbaric bupivacaine 8 mg diluted to 2 ml.

Group II (Ropivacaine): 0.75% isobaric ropivacaine 15 mg (2 ml).

Operating Room Preparation

The anaesthesia workstation, suction apparatus, laryngoscope, endotracheal tubes, and neonatal resuscitation equipment were checked for readiness. Continuous HR, NIBP, and SpO_2 monitoring was initiated on arrival to the operating theatre.

Anaesthetic Technique

With full aseptic precautions, spinal anaesthesia was performed in the right lateral position using a 23-gauge Quincke needle inserted at the L2–L3 or L3–L4 interspace. The study drug (2 ml) was injected slowly over 30 seconds. Patients were then positioned supine with left uterine displacement to minimise aortocaval compression.

Monitoring and Observation

HR, RR, SpO_2, and blood pressure were recorded immediately post-injection, every 2 minutes for 10 minutes, every 5 minutes during surgery, and at 15-minute intervals postoperatively.

Hypotension: ≥20% fall in systolic pressure, treated with IV mephentermine 6 mg.

Bradycardia: HR < 60/min, treated with IV atropine 0.5 mg.

Parameters Studied

Measured variables included sensory block onset at T10, the highest sensory level, and time to reach it, two-segment regression, regression to L1, onset and duration of Grade III motor block, duration of analgesia, injection-to-delivery interval, APGAR scores, intraoperative haemodynamics, and complications.

Assessment Techniques

Sensory block was assessed bilaterally with a 27-gauge needle at the midclavicular line. Motor block was graded using the Modified Bromage Scale until full recovery. Neonatal status was recorded from APGAR scores at 1 and 5 minutes. Postoperative monitoring in the PACU included surveillance for nausea, vomiting, post-dural puncture headache, and neurological deficits.

Statistical Analysis

Data were expressed as mean ± SD. Student's t-test and Chi-square test were applied for comparison. A p-value **< 0.05** was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee before enrolment began. All participants received detailed information about the procedure, possible risks, and expected benefits. Written informed consent was obtained from every patient. Confidentiality of personal and clinical data was maintained throughout the study, and all procedures adhered to the ethical principles of the Declaration of Helsinki.

Results

Participant recruitment and flow

A total of 112 parturients scheduled for elective caesarean section were assessed for eligibility during the study period. Of these, 12 were excluded before randomization due to not meeting the inclusion criteria or declining to participate. The remaining 100 eligible parturients provided written informed consent and were randomly allocated in a 1:1 ratio

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

to Group I (0.5% hyperbaric bupivacaine, n = 50) or Group II (0.75% isobaric ropivacaine, n = 50).

All randomized participants received the allocated intervention and were followed up throughout the intraoperative and immediate postoperative period. No participant was lost to follow-up, discontinued the intervention, or was excluded from analysis. Therefore, data from all 100 participants were included in the final analysis.

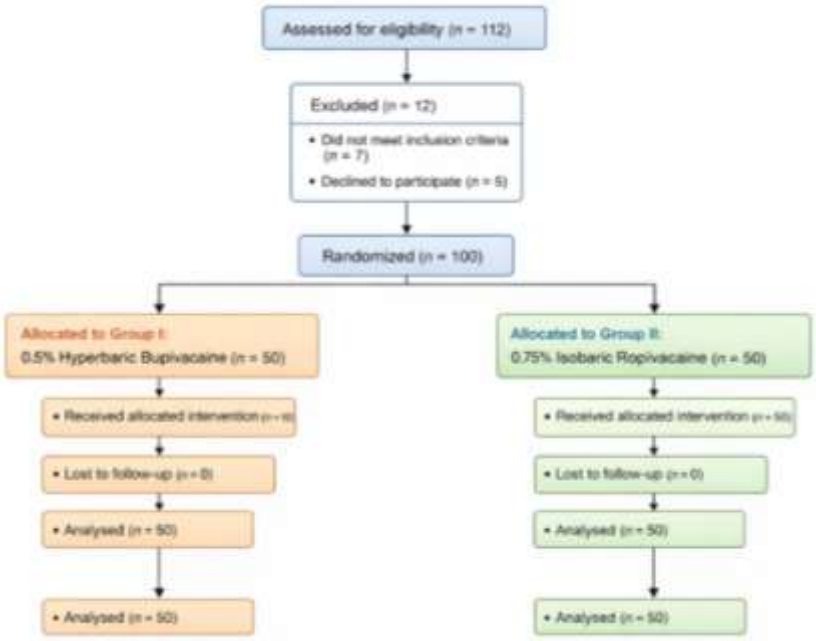

Figure 1: Participant Flow Diagram

Demographic Characteristics

A total of 100 parturients were enrolled and randomly allocated into two groups of 50 each. Group I received 0.5% hyperbaric bupivacaine (8 mg), while Group II received 0.75% isobaric ropivacaine (15 mg). The baseline demographic variables, including age, weight, and height, were comparable between the two groups ($p > 0.05$ for all parameters).

The majority of participants in both groups belonged to the 19–26 years age range, accounting for 74% in Group I and 82% in Group II, with mean ages of 24.40 ± 3.78 and 24.12 ± 3.63 years, respectively. Most parturients weighed between 50–59 kg (76% in Group I and 78% in Group II), with mean weights of 55.80 ± 5.21 kg and 55.02 ± 5.36 kg, respectively. The average heights were comparable, with mean values of 155.70 ± 2.74 cm in Group I and 155.60 ± 2.83 cm in Group II. No statistically significant differences were observed between the two groups in any of these parameters, confirming that the study population was demographically homogeneous.

Table 1: Demographic Characteristics of the Study Population

Parameter	Category / Measurement	Group I (n = 50)	Group II (n = 50)	p-value
Age group (years)	19–26	37 (74%)	41 (82%)	
	27–34	13 (26%)	9 (18%)	
	Mean ± SD	24.40 ± 3.78	24.12 ± 3.63	>0.05

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

Weight (kg)	50–59	38 (76%)	39 (78%)	
	60–69	12 (24%)	11 (22%)	
	Mean ± SD	55.80 ± 5.21	55.02 ± 5.36	>0.05
Height (cm)	151–155	24 (48%)	27 (54%)	
	156–160	26 (52%)	23 (46%)	
	Mean ± SD	155.70 ± 2.74	155.60 ± 2.83	>0.05

Indications for Surgery

The most frequent indication for lower segment cesarean section (LSCS) in both groups was multipara with cephalopelvic disproportion (CPD) and previous LSCS, observed in 29 patients (58%) in Group I and 26 patients (52%) in Group II. Other common indications included primipara with premature rupture of membranes (PROM) (14% vs. 8%) and primipara with abnormal presentation (8% vs. 10%). Less frequent indications were postdated pregnancy (8% vs. 10%), multipara with abnormal presentation (4% vs. 8%), and multipara with PROM (0% vs. 10%). Only one case (2%) in Group I underwent LSCS due to previous pregnancy loss, with none in Group II.

Overall, the distribution of surgical indications was comparable between the two groups, with no statistically significant differences across all parameters ($p > 0.05$). The mean operative time was identical between the two groups (60.36 ± 9.25 minutes; $p = 1.00$), demonstrating similar surgical durations (Table 2).

Table 2: Indications for Surgery

Indication for LSCS	Group I (n = 50)	Group II (n = 50)	p-value
Primipara with CPD	3 (6%)	1 (2%)	0.61
Multipara with CPD with previous LSCS	29 (58%)	26 (52%)	0.54
Primipara with abnormal presentation	4 (8%)	5 (10%)	0.73
Multipara with abnormal presentation	2 (4%)	4 (8%)	0.68
Primipara with PROM	7 (14%)	4 (8%)	0.53
Multipara with PROM	0 (0%)	5 (10%)	0.06
Postdated pregnancy	4 (8%)	5 (10%)	0.73
Previous pregnancy loss	1 (2%)	0 (0%)	0.31
Duration of Surgery (minutes)			
45 – 54	11 (22%)	10 (20%)	
55 – 64	22 (44%)	23 (46%)	
65 – 74	11 (22%)	11 (22%)	
75 – 84	6 (12%)	6 (12%)	
Mean ± SD (min)	60.36 ± 9.25	60.36 ± 9.25	1.00

NS = Not significant ($p > 0.05$)

Sensory and Motor Block Characteristics

Comparison of sensory and motor block parameters between the two study groups is presented in Table 3. The onset of sensory analgesia (T10) was significantly faster in Group I (2.28 ± 0.56 min) compared to Group II (3.63 ± 0.72 min) ($p < 0.0001$, highly significant). The highest level of sensory analgesia attained was comparable in both groups ($p = 0.416$). The time for two-segment regression and complete sensory recovery did not differ significantly between the groups ($p > 0.05$). However, the time for sensory regression to L1 was marginally shorter in the ropivacaine group (152.6 ± 25.6 min) than in the bupivacaine group (164.10 ± 31.19 min), showing a statistically significant difference ($p = 0.047$). The total duration of analgesia was slightly longer in Group I (153.6 ± 29.9 min) compared to Group II (143.8 ±

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

25.14 min), though this difference was not statistically significant ($p = 0.079$).

Regarding motor block characteristics, the onset of Grade III motor block occurred significantly earlier in Group I (3.06 ± 0.9 min) than in Group II (8.46 ± 2.48 min) ($p < 0.0001$, highly significant). Similarly, the total duration of Grade III motor block was substantially longer in the bupivacaine group (129.30 ± 21.09 min) compared to the ropivacaine group (93.20 ± 11.10 min) ($p < 0.0001$, highly significant). The intrathecal injection-to-delivery interval was nearly identical in both groups ($p = 0.662$), indicating comparable intraoperative timelines.

Table 3. Comparison of Sensory and Motor Block Characteristics between Groups I and II

Parameter	Group I (Mean ± SD)	Group II (Mean ± SD)	p-value
Time of onset of sensory analgesia (T10)	2.28 ± 0.56	3.63 ± 0.72	< 0.0001 HS
Highest level of sensory analgesia	5.11 ± 1.71	5.37 ± 1.46	0.416 NS
Time for two-segment sensory regression (min)	90.40 ± 20.7	89.6 ± 20.7	0.847 NS
Time for sensory regression to L1 (min)	164.10 ± 31.19	152.6 ± 25.6	0.047 S
Time for complete sensory recovery (min)	169.6 ± 30.43	160.0 ± 24.8	0.087 NS
Total duration of analgesia (min)	153.6 ± 29.9	143.8 ± 25.14	0.079 NS
Time of onset of Grade III motor block (min)	3.06 ± 0.9	8.46 ± 2.48	< 0.0001 HS
Total duration of Grade III motor block (min)	129.30 ± 21.09	93.20 ± 11.10	< 0.0001 HS
Intrathecal injection to delivery interval (min)	6.6 ± 1.17	6.7 ± 1.11	0.662 NS

HS – Highly significant ($p < 0.001$); S – Significant ($p < 0.05$); NS – Not significant ($p > 0.05$).

Neonatal Outcomes (APGAR Scores)

The neonatal condition at birth was assessed using the APGAR score at 1 minute and 5 minutes following delivery. All neonates in both groups demonstrated satisfactory scores at both time intervals, indicating no adverse effects of either anesthetic agent on neonatal well-being. At 1 minute, APGAR scores ranged between 7 and 9 in both groups, suggesting good initial adaptation. By 5 minutes, all neonates achieved a score of 10, reflecting excellent recovery and stable physiological function. There were no statistically significant differences in APGAR scores between Group I and Group II ($p > 0.05$), confirming that both 0.5% hyperbaric bupivacaine (8 mg) and 0.75% isobaric ropivacaine (15 mg) provided effective anesthesia without compromising neonatal outcomes (Table 4).

Table 4. APGAR Scores of Neonates

Time	Group I (n = 50)	Group II (n = 50)
1 minute	7–9	7–9
5 minutes	10	10

Haemodynamics

The intraoperative haemodynamic parameters, including mean pulse rate and mean arterial pressure (MAP), were monitored at baseline (pre-operative) and at regular intervals up to 240 minutes following intrathecal administration. Both parameters remained stable throughout the observation period in both groups, with no clinically or statistically significant inter-group differences at any time point ($p > 0.05$). The mean pulse rate in Group I decreased gradually from 91.86 bpm pre-operatively to 84.76 bpm at 240 minutes, while in Group II it declined from 92.00 bpm to 84.24 bpm over the same period. Similarly, MAP values showed a mild but clinically insignificant reduction over time—93.46 mmHg to 92.94 mmHg in Group I and 93.16 mmHg to 91.92 mmHg in Group II—demonstrating comparable cardiovascular stability between the two anesthetic agents. Overall, both 0.5% hyperbaric bupivacaine (8 mg) and 0.75% isobaric ropivacaine (15 mg) provided effective spinal anesthesia without inducing significant haemodynamic variations during the intraoperative and early postoperative periods.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

Table 5. Comparison of Mean Pulse Rate and Mean Arterial Pressure (MAP) between Groups I and II

Parameter / Time (min)	Group I (Mean ± SD)	Group II (Mean ± SD)	p-value
Pulse Rate (bpm)			
Pre-operative	91.86 ± 8.54	92.00 ± 8.66	0.924
5 min	90.72 ± 7.94	91.10 ± 8.10	0.816
15 min	89.44 ± 8.02	89.86 ± 7.82	0.774
30 min	87.92 ± 8.23	88.14 ± 8.10	0.861
60 min	86.42 ± 8.11	85.96 ± 8.34	0.692
120 min	85.18 ± 8.08	84.76 ± 8.22	0.628
180 min	84.98 ± 8.00	84.46 ± 7.88	0.594
240 min	84.76 ± 7.96	84.24 ± 7.82	0.531
MAP (mmHg)			
Pre-operative	93.46 ± 5.84	93.16 ± 5.90	0.872
5 min	92.88 ± 5.72	92.54 ± 5.81	0.823
15 min	92.60 ± 5.67	92.20 ± 5.76	0.801
30 min	92.38 ± 5.63	92.06 ± 5.70	0.774
60 min	92.22 ± 5.59	91.96 ± 5.62	0.755
120 min	92.10 ± 5.54	91.88 ± 5.60	0.708
180 min	92.02 ± 5.48	91.94 ± 5.52	0.684
240 min	92.94 ± 5.41	91.92 ± 5.46	0.661

Abbreviations: MAP – Mean Arterial Pressure; HS – Highly significant ($p < 0.001$); S – Significant ($p < 0.05$); NS – Not significant ($p > 0.05$).

Adverse Events

The overall incidence of intraoperative and postoperative complications was low and comparable between the two study groups. No major adverse events were observed in either group, and all recorded complications were mild and self-limiting. Hypotension was the most commonly observed complication, occurring in 21 patients (42%) in Group I and 20 patients (40%) in Group II ($p = 1.000$; NS). Episodes of bradycardia were infrequent, noted in 3 patients (6%) in Group I and 2 patients (4%) in Group II ($p = 1.000$; NS). Minor instances of nausea and vomiting were reported in one patient (2%) from Group I and two patients (4%) from Group II ($p = 1.000$; NS). Shivering occurred in 2 patients (4%) from Group I, while none were observed in Group II ($p = 0.495$; NS). Importantly, no cases of post-dural puncture headache (PDPH) or neurological complications were recorded in either group.

These findings indicate that both 0.5% hyperbaric bupivacaine (8 mg) and 0.75% isobaric ropivacaine (15 mg) were safe and well-tolerated, with similar profiles regarding intraoperative and postoperative adverse events (Table 6).

Table 6. Comparison of Intraoperative and Postoperative Complications

Complication	Group I n (%)	Group II n (%)
Hypotension	21 (42%)	20 (40%)
Bradycardia	3 (6%)	2 (4%)
Nausea/Vomiting	1 (2%)	2 (4%)
Shivering	2 (4%)	0 (0%)
PDPH/Neurological	0 (0%)	0 (0%)

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

Discussion

Subarachnoid block is a preferred anaesthetic technique for caesarean delivery because it provides rapid, predictable anaesthesia, avoids airway manipulation, minimises polypharmacy, and reduces postoperative nausea and vomiting. Hyperbaric bupivacaine is commonly used due to its potency and consistent performance. However, the choice of intrathecal agent must balance sensory and motor block characteristics, haemodynamic stability, and maternal–neonatal safety. Ropivacaine, the S-enantiomer of bupivacaine, offers comparable sensory block with a shorter and less intense motor block, along with lower cardiotoxicity. These properties may support earlier mobilisation in the postoperative period. Reported intrathecal doses of isobaric ropivacaine for caesarean section range from 8–22.5 mg, with 15 mg often producing adequate surgical anaesthesia.

In the present comparison of 15 mg isobaric ropivacaine and 8 mg hyperbaric bupivacaine, both agents produced effective sensory block suitable for caesarean section. Time to reach T10 was significantly faster with bupivacaine (2.28 ± 0.56 min) than with ropivacaine (3.6 ± 0.7 min), consistent with earlier observations of a slower onset with ropivacaine [11,15]. Peak sensory levels ranged between T4–T6 for bupivacaine and T2–T6 for ropivacaine, with no statistical difference between groups. Surgical anaesthesia remained adequate throughout, and no patient experienced visceral discomfort, indicating sufficient cephalad spread. These findings are in line with those reported in earlier work [12,13].

Two-segment regression was similar between the groups but slightly faster with ropivacaine, echoing previously described trends [14]. Regression to L1 occurred significantly sooner with ropivacaine (152.6 ± 25.6 min) than with bupivacaine (164.1 ± 31.19 min), demonstrating quicker sensory recovery. Complete sensory recovery and total duration of analgesia were marginally shorter with ropivacaine but showed no statistical significance. These observations are consistent with earlier comparative evaluations [16].

Motor block characteristics showed more notable differences. Onset of Grade III motor block was significantly faster with bupivacaine (3.06 ± 0.9 min) than with ropivacaine (8.46 ± 2.48 min). Duration of the Grade III block was also longer with bupivacaine (129.30 ± 21.09 min) compared with ropivacaine (93.20 ± 11.10 min) ($p < 0.01$). These findings match previous reports demonstrating a shorter motor block profile with ropivacaine [14,17]. All patients achieved complete motor block, and the quality of anaesthesia was uniformly rated as excellent or good, without the need for conversion or supplemental analgesia.

Haemodynamic variables remained comparable between groups. Incidents of hypotension (42% vs 40%) and bradycardia (6% vs 4%) did not differ significantly and were managed effectively. These patterns reinforce the haemodynamic equivalence of the drugs at the doses used [11]. Neonatal outcomes were consistently favourable, with APGAR scores ≥7 at 1 minute and 10 at 5 minutes for all neonates. Adverse events, including nausea, vomiting, and shivering, were infrequent, and no patient experienced post-dural puncture headache or neurological complications, reflecting previously documented safety profiles [18–20].

Clinically, 8 mg hyperbaric bupivacaine provides a faster onset and a longer motor block, which may be advantageous when a rapidly established, dense block is required. In contrast, 15 mg isobaric ropivacaine offers adequate surgical anaesthesia with a slower onset but significantly shorter motor block, enabling earlier ambulation and improved maternal comfort without compromising haemodynamics or neonatal wellbeing.

Generalizability

The findings demonstrate strong internal validity; however, their broader applicability may vary across different clinical settings. Variations in obstetric demographics, institutional anaesthesia practices, intrathecal drug preparation, and baricity-related behaviour can influence block characteristics. Differences in surgical workflows, patient positioning, and perioperative fluid management may also affect reproducibility. Consequently, while the results provide useful guidance, generalisability is limited, and confirmation through larger, multicentric studies across diverse populations is recommended.

Conclusion

This study compared 8 mg hyperbaric bupivacaine and 15 mg isobaric ropivacaine for spinal anaesthesia in caesarean section. Both agents produced reliable surgical anaesthesia with stable haemodynamics and minimal adverse effects. Bupivacaine showed a quicker onset of sensory and motor block and a longer motor duration, while ropivacaine provided a slower onset but earlier recovery, supporting faster mobilisation and greater postoperative comfort.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

Neonatal outcomes were uniformly favourable, with no drug-related concerns. Overall, both drugs are effective and safe for obstetric spinal anaesthesia. Ropivacaine may be preferred when early ambulation is desired, whereas bupivacaine remains suitable when a longer, denser block is clinically advantageous.

Limitations

The study compared only fixed doses of the two agents, without exploring dose–response relationships. A single concentration of isobaric ropivacaine was evaluated, which restricts understanding of its performance across a broader dosing range. The sample size, although adequate for primary outcomes, limits the assessment of rare adverse events. The study was conducted in a single institution with a relatively homogeneous obstetric population, which reduces external variability. Differences in practice patterns, baricity behaviour, and perioperative management in other centres could influence reproducibility. Larger multicentric evaluations are required to strengthen the evidence base for intrathecal ropivacaine use in caesarean anaesthesia.

Recommendations

Future studies should evaluate a wider range of intrathecal ropivacaine doses to establish an optimal balance between sensory depth and motor recovery for caesarean anaesthesia. Comparative trials involving both isobaric and hyperbaric formulations would help clarify baricity-related block behaviour in obstetric patients. Multicentric research with larger and more diverse populations is essential to strengthen external validity and identify rare adverse events. Incorporating patient-centred outcomes such as time to ambulation, breastfeeding initiation, postoperative satisfaction, and recovery milestones would provide a more comprehensive assessment. Continuous monitoring of neonatal well-being and long-term maternal recovery should also be integrated into future protocols.

Acknowledgements

The authors express sincere gratitude to the Department of Anaesthesiology, Gandhi Medical College, for continuous support throughout the study. Appreciation is extended to the obstetric team and nursing staff for their cooperation during patient management and data collection. Heartfelt thanks are offered to the participating parturients for their willingness and trust. The authors also acknowledge the assistance of the institutional administrative staff in facilitating ethical clearance and logistical requirements essential for the smooth conduct of the research.

Abbreviations

SAB – Subarachnoid Block
LSCS – Lower Segment Caesarean Section
HR – Heart Rate
NIBP – Non-Invasive Blood Pressure
SpO_2 – Peripheral Oxygen Saturation
RR – Respiratory Rate
PACU – Post-Anaesthesia Care Unit
APGAR – Appearance, Pulse, Grimace, Activity, Respiration
T10, T4, L1 – Thoracic and Lumbar Dermatomal Levels
IV – Intravenous
mg – Milligram
ml – Milliliter

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

GM-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. **SN**-Design of the study, results interpretation, review of literature, preparing the first draft of the manuscript, and revision of the manuscript. **RM** - Review of literature and preparing the first draft of the manuscript. Statistical analysis and interpretation.

Data availability

Data available on request

Author Biographies

Dr. B. Babitha, Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, India. She has a strong academic orientation in obstetric anaesthesia, advanced regional anaesthesia techniques, and perioperative safety optimisation. Her work reflects a commitment to improving maternal outcomes and enhancing clinical standards in anaesthesia practice. **ORCID iD:** https://orcid.org/0009-0006-3517-5697

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

Dr. G. Alekhya, Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, India. Her interests include neuraxial anaesthesia, maternal analgesia strategies, and the development of evidence-based perioperative protocols. She actively participates in clinical training and quality-improvement initiatives within the department. **ORCID iD:** https://orcid.org/0000-0001-9106-156X

Dr. M. Sreya Santhoshi, Assistant Professor, Department of Anesthesiology, Gandhi Medical College, Secunderabad, Telangana, India. She is engaged in obstetric anaesthesia, intraoperative monitoring optimisation, and research focused on patient-centred perioperative care. Her academic efforts emphasise safe practice, clinical precision, and continuous improvement in anaesthetic management. **ORCID iD:** https://orcid.org/0009-0006-3136-6832

REFERENCES

1. Garg A, Rahat A, Sharma D, Mittal T. Comparison of two doses of Phenylephrine in prevention of Oxytocin-induced hemodynamic changes in Caesarean Section under Spinal Anaesthesia: A Randomized Controlled Trial. European Journal of Cardiovascular Medicine. 2025;15:313-22.
2. Karunarathna I. Anesthesia for Cesarean Section: A Comprehensive Review of General and Regional Techniques. Uva Clinical Research Lab 2025© Uva Clinical Anaesthesia and Intensive Care ISSN 2827-7198. 2025.
3. Buren MA, Cil H. Anesthetic Considerations and Management of Spine Surgery Performed Under Neuraxial Anesthesia. Current Anesthesiology Reports. 2025;15(1):28. https://doi.org/10.1007/s40140-024-00671-8
4. Sharma TH, Jain J, Kishnani P, Tailor R, THOMAS S. Comparison of Hyperbaric 0.5% Levobupivacaine and Hyperbaric 0.75% Ropivacaine for Intrathecal Use in Infraumbilical Surgeries: A Randomised Clinical Study. Journal of Clinical & Diagnostic Research. 2025;19(2) UC01-UC05 https://doi.org/10.7860/JCDR/2025/76171.20565
5. Sivakumar B, Udatha SS. A Comparative Study between Ropivacaine with Dexmedetomidine and Bupivacaine with Dexmedetomidine in Brachial Plexus Block for Upper Limb Surgeries. European Journal of Cardiovascular Medicine. 2025;15(9)570 - 573.
6. Anand R, Nag DS, Patel R, Sharma P, Uppalapati VK, Singh UK. Comparative efficacy of hyperbaric bupivacaine vs hyperbaric ropivacaine in spinal anesthesia for cesarean section: a meta-analysis. World Journal of Methodology. 2025;15(2):99300. https://doi.org/10.5662/wjm.v15.i2.99300
7. Mohamed RM, Abdelbadie M, Anwar AG. Low-dose hyperbaric bupivacaine 0.5% with three different doses of dexmedetomidine for spinal anesthesia in transurethral resection of the prostate: A randomized, double-blind trial. Anaesth. pain intensive care 2025;29(3):384-391. https://doi.org/10.35975/apic.v29i3.2750
8. Arulpari TT, Ganapathysubramanian M, Chandrasekaran RP. Comparison of Fractionated Dose Versus Bolus Dose of Bupivacaine Hyperbaric (0.5%) with Buprenorphine in Spinal Anaesthesia for Lower Limb Surgeries. Apollo Medicine. 2024;22(2):92-97. https://doi.org/10.1177/09760016241284036
9. Qiao W, Yan B, Liu C, Zhu M, Wang L. Comparative Evaluation of the Efficacy and Safety Profiles of Various Ropivacaine Proportions in Cesarean Section. Altern Ther Health Med. 2025 Jan;31(1):464-469. PMID: 38607219.
10. Sng BL, Han NL, Leong WL, Sultana R, Siddiqui FJ, Assam PN, Chan ES, Tan KH, Sia AT. Hyperbaric vs. isobaric bupivacaine for spinal anaesthesia for elective caesarean section: a Cochrane systematic review. Anaesthesia. 2018;73(4):499-511. https://doi.org/10.1111/anae.14084
11. Dar FA, Nida S, Lone AH, Reshi FA. Comparative evaluation of intrathecal ropivacaine and bupivacaine in patients undergoing lower limb and hip surgery. Anesth Essays Res. 2013;7(3):381-385. https://doi.org/10.4103/0259-1162.123252
12. Kulkarni KR, Ambareesha M, Hosalli V, Prashanth S. Comparative study of intrathecal 0.5% hyperbaric ropivacaine and 0.5% hyperbaric bupivacaine for infraumbilical surgeries. J Clin Diagn Res. 2014;8(10): GC01-GC04.
13. Kallio H, Snäll EV, Tuomas CA, Rosenberg PH. Comparison of intrathecal plain solutions containing ropivacaine 20 mg, ropivacaine 15 mg,

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2231
Original Article

or bupivacaine 10 mg. Br J Anaesth. 2004;93(5):646-652. https://doi.org/10.1093/bja/aeh257

14. Gautier P, De Kock M, Van Steenberge A, Huberty L, Demir T, Izydorczic M, et al. Intrathecal ropivacaine for ambulatory surgery: a comparison between isobaric solutions of ropivacaine, levobupivacaine, and bupivacaine. Anesth Analg. 1999;89(5):1369-1373. https://doi.org/10.1097/00000542-199911000-00013
15. Malinovsky JM, Renaud G, Le Corre P, Charles F, Lepage JY, Cozian A, et al. Intrathecal bupivacaine in humans: influence of volume and baricity of solutions. Anesth Analg. 1999;88(5):1173-1179. https://doi.org/10.1097/00000542-199911000-00016
16. Chatterjee S, Biswas S, Rudra A, Sengupta S. Intrathecal ropivacaine versus bupivacaine for lower limb orthopedic surgery: a randomized double-blind study. Indian J Anaesth. 2014;58(3):312-318. https://doi.org/10.4103/0019-5049.138985
17. Malinovsky JM, Charles F, Kick O, Lepage JY, Cozian A, Pinaud M, et al. Intrathecal anesthesia: ropivacaine versus bupivacaine. Anesth Analg. 2000;91(6):1457-1460. https://doi.org/10.1097/00000539-200012000-00030
18. McNamee DA, Parks L, McClelland AM, Scott S, Milligan KR. Intrathecal ropivacaine for total hip arthroplasty: a double-blind comparison with bupivacaine. Br J Anaesth. 2002;89(5):702-706. https://doi.org/10.1093/bja/89.5.702
19. Fettes PD, Hocking G, Wildsmith JA. Comparison of plain and hyperbaric solutions of ropivacaine for spinal anaesthesia. Br J Anaesth. 2005;94(1):107-111. https://doi.org/10.1093/bja/aei008
20. Knudsen K, Beckman Suurküla M, Blomberg S, Sjövall J, Edvardsson N. Central nervous and cardiovascular toxicity of ropivacaine: a human volunteer study. Anesth Analg. 1997;85(2):317-323.

PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa