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Original Research Article

Comparative Study of Hemodynamic Changes in Hyperbaric Bupivacaine and Hyperbaric Ropivacaine for Spinal Anesthesia in Patients Undergoing Cesarean Section

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Abstract

Background: Spinal anesthesia is crucial for anesthetic practice for cesarean sections, with bupivacaine being the predominant local anesthetic utilized. This study assesses the hemodynamic impacts of hyperbaric ropivacaine compared to hyperbaric bupivacaine for spinal anesthesia in cesarean sections.

Aim: This study aims to evaluate the hemodynamic stability, start time, duration of action, and safety profile of hyperbaric ropivacaine against hyperbaric bupivacaine in cesarean sections performed under spinal anesthesia.

Methodology: In a randomized, controlled experiment, 100 parturients undergoing elective cesarean section were allocated to receive either hyperbaric ropivacaine or hyperbaric bupivacaine for spinal anesthetic. Hemodynamic measures, such as systolic blood pressure, heart rate, and the occurrence of hypotension, were observed. The initiation and duration of sensory and motor blocks were documented, along with any detrimental effects seen.

Results: Ropivacaine exhibited enhanced hemodynamic stability relative to bupivacaine, characterized by a reduced occurrence of hypotension and decreased heart rate variability. The initiation of sensory and motor block was somewhat postponed with ropivacaine; nevertheless, its extended duration of action and decreased cardiovascular and central nervous system toxicity provided significant benefits for maternal safety and recovery.

Conclusion: Hyperbaric ropivacaine offers superior hemodynamic stability compared to hyperbaric bupivacaine, rendering it a safer and more efficacious option for spinal anesthesia in cesarean deliveries. These data endorse the utilization of ropivacaine as a recommended anesthetic agent to enhance maternal outcomes.

Keywords: Cesarean section, Hyperbaric bupivacaine, Hyperbaric ropivacaine, Hemodynamic stability, Spinal anesthesia

Introduction

Spinal anaesthesia (SA) is the predominant anesthetic method employed for cesarean births worldwide, having approximately eighty percent of parturients experiencing hypotension following its administration [1]. Given the elevated incidence of hypotension and the increasing global rate of cesarean births, a considerable segment of the parturient population is susceptible to severe consequences linked to hypotension, including nausea, vomiting, dizziness, fetal acidosis, and hypoxia [2-5]. A primary cause of SA-induced hypotension is iatrogenic obstruction of thoraco-lumbar sympathetic flow, leading to vasodilation and a subsequent reduction in cardiac preload and systemic vascular resistance (SVR) [6]. Moreover, pregnancy-associated haemodynamic changes may influence the incidence and severity of hypotension. Peripheral vasodilation during gestation is facilitated by increasing levels of hormones in circulation and vasodilatory agents such as progesterone, estrogen, prostaglandins, relaxin, and nitric oxides [7-9].

Cesarean section is increasingly the predominant mode of birth due to factors such as advanced maternal age and a decline in the overall number of deliveries [10,11]. Globally, SA is acknowledged as a secure technique for CS. It seems more appropriate than general anesthesia since it facilitates maternal-infant bonding and allows breastfeeding throughout the surgical procedure [12]. Among the several advantages of spinal anesthesia during a cesarean section are the ability to stay conscious, the mitigation of analgesic side effects, and the reduced risk of aspiration of gastrointestinal contents [13]. The fourth thoracic nerve root is the correct anesthetic level for caudal blocks (T4). Elevated levels of block are associated with maternal haemodynamic adverse effects and an increased risk of sympathetic paralysis [14]. Postoperative analgesia deficiency, headaches, vomiting, urinary retention, back pain, cardiac collapse, spinal canal hemorrhage with or without neurological complications, epidural abscess, and hemodynamic issues such as hypotension and bradycardia are some of the disadvantages linked to spinal anesthesia, especially with topical analgesics [15].

Bupivacaine is the most often employed anesthetic agent for spinal anesthesia during cesarean birth, either administered alone or in combination with opioids [16]. This medication induces a durable, significant sensory blockade. Administering the advised dosage of bupivacaine in spinal anesthesia can provide the expecting lady with an appropriate level of spinal anesthetic while simultaneously reducing the risk of hypotension. Decrease in bupivacaine dose is strongly associated with a reduction in sympathetic nervous system activity after spinal anesthesia [17-19]. Previous studies have associated a significant incidence of hypotension and consequent hemodynamic problems with a high concentration of bupivacaine (0.75%), suggesting its usage at a dose of 0.5% [20-22]. Ropivacaine, akin in structure and pharmacodynamics to bupivacaine, is a prolonged-acting amide local anesthetic. Ropivacaine is employed to alleviate pain during labor or post-cesarean section because its enhanced dissociation between motor and sensory blockade compared to bupivacaine [23]. In the transversus abdominis plane block after a hysterectomy, the analgesic effectiveness of ropivacaine is not augmented by the addition of magnesium sulfate [24].

It has been associated with various toxicities, including cardiovascular damage, and reduced CNS function. Ropivacaine has been utilized intrathecally both obstetric and non-obstetric patients, as indicated by many articles. Numerous studies indicate that ropivacaine is less powerful than bupivacaine. The study aims to assess the anesthetic efficacy of ropivacaine and bupivacaine in spinal anaesthesia to elucidate their effects and give clinical reference. Furthermore, it examined the impact of various anesthetics on the vital signs and hemodynamics of women undergoing cesarean sections.

Methodology

Study Area

This randomized, double-blind controlled trial was done over two years in the Department of Anaesthesiology and Critical Care at Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India. Approval from the institutional ethics committee was secured prior to the initiation of the investigation.

Sample Size

This study had a total sample size of 100 patients.

Inclusion and exclusion criteria

The study encompassed patients categorized as American Society of Anaesthesiologists (ASA) Grade II, aged 20 to 35 years, in their 37th to 42nd week of gestation, and undergoing a cesarean section (CS) with spinal anesthesia (SA), contingent upon their provision of valid informed written consent. The exclusion criteria included individuals who declined participation, had a local site infection, coagulopathy, spine abnormalities, or were categorized as ASA Grade III or IV. Furthermore, individuals with allergies to local anesthetics, a history of seizures or neurological impairments, or those suffering from severe renal, hepatic, pulmonary, or cardiovascular conditions were excluded. Additionally, participants with a height under 150 cm have been excluded from the study.

Intervention

Group	Intervention
Group A	Received intrathecal 2.5 ml of 0.5 % Hyperbaric Ropivacaine.
Group B	Received intrathecal 2.5 ml of 0.5 % Hyperbaric Bupivacaine.

Procedure

The Patients included in this study were assessed and prepared using the preoperative protocol developed by the Department of Anaesthesiology at Darbhanga Medical College & Hospital. Upon entering the operating theater, basic vital signs (SBP, DBP, MAP, HR) were documented, and an 18G intravenous cannula was placed. 1000 mL of Ringer's Lactate was administered for a duration of 15 to 20 minutes prior to spinal anesthesia. Crucial monitoring, encompassing ECG, heart rate, non-invasive blood pressure, oxygen saturation, and respiration rate, was commenced. A lumbar puncture was conducted at the L3-4 interspace with a 26-gauge Quincke spinal needle, and the experimental medication was injected at a rate of 0.2 mL/sec upon the confirmation of unobstructed cerebrospinal fluid flow. Post-injection, patients were positioned supine, with continuous monitoring of heart rate, blood pressure, and oxygen saturation. Data were collected at baseline, thereafter at 2-minute intervals for the initial 10 minutes, 5-minute intervals for the following hour, and 10-minute intervals until transfer to recovery. Oxygen was delivered through a facemask at a rate of 5 L/min. Hypotension (20-30% reduction in SBP or MAP) and bradycardia (HR < 60 bpm) were addressed with IV ephedrine (6 mg) and atropine (0.6 mg) if required.

Outcome Parameters

The outcome variables were haemodynamic parameters (heart rate and systolic, diastolic, and mean arterial blood pressure) assessed at 1, 3, 5, 10, 15, 30, 45, 60, 75, 90, and 120 minutes post-subarachnoid block. The sensory block was evaluated by determining the onset at the T4 dermatome level and the absence of pinprick sensation along the midclavicular line using a 27-gauge needle, accompanied by a visual analogue scale. The motor block was assessed according to the duration required to get a score of 3 on the modified Bromage scale (0-3). The length of motor block was defined as the period until a score of 0 was attained on the Bromage scale. Sensory and motor blocks were evaluated at follow-up intervals of 1, 2, and 2 minutes until surgical anesthesia was achieved.

Statistical Analysis

Data from patients receiving LSCS under SA were tabulated using Microsoft Excel 365 and analyzed with SPSS version 24. Continuous data (age, BMI, block onset and duration, SpO2, SBP, DBP, MAP, and heart rate) were presented as mean ± standard deviation (SD). The disparities between groups R (Ropivacaine) and B (Bupivacaine) were evaluated utilizing an unpaired t-test. Categorical data (age group, gender, complications) were presented as percentages and frequencies, with comparisons conducted using chi-square or Fisher's exact test. A p-value less than 0.05 was deemed statistically significant.

Results

Table 1 outlines the age distribution between Group R (Ropivacaine) and Group B (Bupivacaine). In the 20-25 age demographic, Group R comprises 19 patients (38.00%), whereas Group B consists of 17 patients (34.00%). In the 26-30 age, Group R comprises 26 individuals (52.00%), whereas Group B consists of 27 patients (54.00%). In the 31-35 age demographic, Group R comprises 5 individuals (10.00%), whereas Group B consists of 6 patients (12.00%). The p-value for this comparison is 0.9, signifying no statistically significant difference in age distribution between the two groups.

Table 1. Comparison of Age between Group R (Ropivacaine) and B (Bupivacaine)

Age Group	Number of Patients (%)		P Value (Chi-Square Test)
	Group R	Group B	
20-25	19 (38.00)	17 (34.00)	0.9
26-30	26 (52.00)	27 (54.00)	
31-35	5 (10.00)	6 (12.00)	

Table 2 analyzes the gestational age of Group R (Ropivacaine) in comparison to Group B (Bupivacaine). In the <40 weeks category, Group R comprises 41 patients (82.00%), whereas Group B consists of 43 individuals (86.00%). In the ≥40 weeks group, Group R comprises 9 patients (18.00%), whereas Group B consists of 7 individuals (14.00%). The p-value for this comparison is 0.79, signifying no statistically significant difference in gestational age distribution between the two groups.

Table 2. Comparison of Gestational Age between Group R (Ropivacaine) and B (Bupivacaine)			
Gestational Age	**Number of Patients (%)**		**P Value (Fisher's Test)**
	Group R	**Group B**	
<40 Weeks	41 (82.00)	43 (86.00)	0.79
≥40 Weeks	9 (18.00)	7 (14.00)	

Table 3 examines the anthropometric attributes of Group R (Ropivacaine) in comparison to Group B (Bupivacaine). The average weight for Group R is 62.33 ± 8.17 kg, whereas for Group B it is 64.09 ± 7.11 kg, with a p-value of 0.25, signifying no significant difference. The average height for Group R is 1.64 ± 0.13 meters, whereas for Group B it is 1.66 ± 0.12 meters, with a p-value of 0.43, indicating no significant difference. The average BMI for Group R is 23.32 ± 2.57 kg/m², whereas for Group B it is 23.04 ± 2.15 kg/m², with a p-value of 0.56, signifying no significant difference between the groups.

Table 3. Comparison of Anthropometric Parameters between Group R (Ropivacaine) and B (Bupivacaine)			
Parameters	**Parameters in Mean ± SD**		**P Value (Unpaired t test)**
	Group R	**Group B**	
Weight in Kg	62.33 ± 8.17	64.09 ± 7.11	0.25
Height in meter	1.64 ± 0.13	1.66 ± 0.12	0.43
BMI in Kg/m2	23.32 ± 2.57	23.04 ± 2.15	0.56

Table 4 examines the heart rate (HR) between Group R (Ropivacaine) and Group B (Bupivacaine) at different time intervals. Prior to induction, Group R exhibited a mean heart rate of 77.25 ± 8.44 bpm, but Group B had a mean heart rate of 83.37 ± 9.58 bpm, with a statistically significant p-value of 0.0010. Comparable substantial differences were noted at later time intervals, with Group R continually exhibiting a lower heart rate than Group B. At 2 minutes, Group R exhibited a heart rate of 74.98 ± 5.62 bpm compared to 80.43 ± 5.62 bpm in Group B (p = 0.0009), and at 4 minutes, Group R recorded 75.15 ± 5.01 bpm vs 80.95 ± 9.03 bpm in Group B (p = 0.0001). The disparities continued throughout the whole 90-minute duration, with the minimum p-value recorded at <0.001 at 90 minutes. Group R demonstrated markedly lower heart rates at all assessed intervals in comparison to Group B.

Table 4. Comparison of Heart Rate between Group R (Ropivacaine) and B (Bupivacaine)			
Time	**HR (bpm) in Mean ± SD**		**P Value**
	Group R	**Group B**	
Before Induction	77.25 ± 8.44	83.37 ± 9.58	0.0010
2 Min	74.98 ± 5.62	80.43 ± 5.62	0.0009

4 Min	75.15 ± 5.01	80.95 ± 9.03	0.0001
6 Min	76.41 ± 9.62	81.89 ± 8.2	0.0028
8 Min	78.09 ± 7.4	82.46 ± 10.96	0.0215
10 Min	78.75 ± 8.92	84.08 ± 9.73	0.0053
15 Min	81.64 ± 7.81	88.4 ± 7.19	0.0000
20 Min	81.43 ± 10.09	86.28 ± 5.61	0.0037
25 Min	81.35 ± 4.49	87.43 ± 9.16	0.0001
30 Min	81.27 ± 8.42	87.77 ± 9.85	0.0006
35 Min	81.51 ± 11.33	86.78 ± 6.93	0.0061
40 Min	81.72 ± 8.37	88.19 ± 8.59	0.0002
45 Min	81.95 ± 8.98	85.12 ± 6	0.0406
50 Min	81.38 ± 9.36	87.9 ± 8.83	0.0005
55 Min	81.17 ± 10.2	87.53 ± 5.69	0.0002
60 Min	80.97 ± 9.65	86.45 ± 7.45	0.0020
70 Min	81.12 ± 7.96	86.11 ± 8.11	0.0025
80 Min	81.43 ± 9.47	87.82 ± 6.3	0.0001
90 Min	81.62 ± 4.14	89.18 ± 7.7	<0.001

Table 5 analyzes the systolic blood pressure (SBP) of Group R (Ropivacaine) in comparison to Group B (Bupivacaine) over various time intervals. Prior to induction, Group R exhibited a mean SBP of 126.32 ± 9.54 mmHg, whereas Group B displayed 123.1 ± 9.04 mmHg, with a p-value of 0.0863, indicating no significant difference. Marked differences were noted at 2 minutes ($p = 0.0120$), 4 minutes ($p = 0.0199$), 6 minutes ($p = 0.0104$), and at several subsequent time intervals, with Group R consistently exhibiting elevated SBP values relative to Group B. The p-values were significant at many time points: 15 minutes ($p = 0.0224$), 30 minutes ($p = 0.0072$), and 50 minutes ($p = 0.0033$). At 80 minutes, the p-value was 0.2367, showing no significant change; nevertheless, it became significant again at 90 minutes ($p = 0.0040$). Group R had persistently elevated SBP compared to Group B, with substantial disparities noted at the majority of time intervals.

Table 5. Comparison of SBP between Group R (Ropivacaine) and B (Bupivacaine)			
Time	**SBP (mmHg) in Mean ± SD**		**P Value (Unpaired t test)**
	Group R	**Group B**	
Before Induction	126.32 ± 9.54	123.1 ± 9.04	0.0863
2 Min	120.4 ± 9.78	115.5 ± 9.36	0.0120
4 Min	114.42 ± 11.52	108.93 ± 11.68	0.0199
6 Min	109.4 ± 8.5	104.47 ± 10.29	0.0104
8 Min	111.12 ± 10.07	106.02 ± 11.17	0.0184
10 Min	112.23 ± 11.53	108.78 ± 10.36	0.1188
15 Min	112.52 ± 7.78	108.13 ± 10.89	0.0224
20 Min	113.09 ± 9.78	108.2 ± 10.27	0.0166
25 Min	113.97 ± 11.61	109.54 ± 11.2	0.0550
30 Min	114.95 ± 11.61	109.02 ± 10.92	0.0072
35 Min	116.13 ± 11.64	111.12 ± 10.69	0.0272
40 Min	117.69 ± 11.01	113.14 ± 9.5	0.0293
45 Min	118.85 ± 10.31	114.22 ± 10.45	0.0280
50 Min	119.75 ± 11.04	112.97 ± 11.46	0.0033
55 Min	120.59 ± 9.83	114.44 ± 11.4	0.0048
60 Min	121.05 ± 9.59	115.23 ± 11.12	0.0061
70 Min	123.91 ± 8.7	118.87 ± 11.65	0.0160
80 Min	123.22 ± 9.71	120.6 ± 12.16	0.2367
90 Min	123.82 ± 9.24	117.91 ± 10.73	0.0040

Table 6 contrasts the diastolic blood pressure (DBP) of Group R (Ropivacaine) with that of Group B (Bupivacaine) at multiple time intervals. Prior to induction, Group R exhibited a mean diastolic blood pressure of 79.76 ± 5.8 mmHg, but Group B demonstrated 76.95 ± 5.61 mmHg, with a

statistically significant p-value of 0.0155. Marked differences were noted at all following time intervals, with Group R continually exhibiting elevated DBP levels relative to Group B. Significant changes are seen at 2 minutes (p = 0.0004), 4 minutes (p = 0.0022), 6 minutes (p = 0.0004), and extending to 90 minutes (p = 0.0136). Group R consistently exhibited elevated DBP levels throughout all tested intervals, with statistically significant differences seen at virtually all time periods.

Table 6. Comparison of DBP between Group R (Ropivacaine) and B (Bupivacaine)

Time	DBP (mmHg) in Mean ± SD		P Value (Unpaired t test)
	Group R	Group B	
Before Induction	79.76 ± 5.8	76.95 ± 5.61	0.0155
2 Min	75.71 ± 7.56	71 ± 4.95	0.0004
4 Min	71.13 ± 6.43	67.06 ± 6.54	0.0022
6 Min	68.09 ± 5.68	63.88 ± 5.85	0.0004
8 Min	67.87 ± 6.05	63.14 ± 6.55	0.0003
10 Min	68.03 ± 5.9	63.77 ± 5.76	0.0004
15 Min	68.55 ± 5.13	65.14 ± 7.1	0.007
20 Min	69.17 ± 6.12	65.23 ± 5.24	0.0008
25 Min	69.86 ± 6.91	65.9 ± 6.54	0.0041
30 Min	70.27 ± 7.42	67.24 ± 4.38	0.0146
35 Min	70.58 ± 5.25	66.22 ± 5.39	0.0001
40 Min	71.09 ±6.62	68.26 ± 6.17	0.0293
45 Min	71.95 ± 5.61	67.89 ± 6.87	0.0017
50 Min	72.27 ± 6.98	68.39 ± 5.63	0.0043
55 Min	73.06 ± 5.81	68.39 ± 5.32	0.0001
60 Min	73.77 ± 6.92	69.68 ± 4.44	0.0007
70 Min	77.19 ± 4.84	73.08 ± 6.08	0.0003
80 Min	80.57 ± 6.43	77.26 ± 6.71	0.0134
90 Min	81.69 ± 6.94	78.55 ± 5.47	0.0136

Table 7 outlines the complications observed in Group R (Ropivacaine) against Group B (Bupivacaine). Hypotension was seen in 4 patients (8.00%) in Group R and 13 patients (26.00%) in Group B, yielding a significant p-value of 0.03. Bradycardia occurred in 3 patients (6.00%) in Group R and 7 patients (14.00%) in Group B; however, the difference was not statistically significant (p = 0.32). No instances of respiratory depression occurred in any group, and the p-value for this comparison is not applicable (NA). Group B had a much greater frequency of hypotension than Group R, although bradycardia and respiratory depression demonstrated no significant differences between the groups.

Table 7. Comparison of Complications between Group R (Ropivacaine) and B (Bupivacaine)

Complications	Number of Patients (%)		P Value (Fisher's test)
	Group R	Group B	
Hypotension	4 (8.00)	13 (26.00)	0.03
Bradycardia	3 (6.00)	7 (14.00)	0.32
Respiratory Depression	0 (0.00)	0 (0.00)	NA

Discussion

This randomized double-blind controlled research compares the hemodynamic changes associated with hyperbaric ropivacaine and hyperbaric bupivacaine for spinal anesthesia in patients having cesarean section. The findings of this study demonstrated that ropivacaine exhibited greater hemodynamic stability, with no significant fluctuations in heart rate and a reduced incidence of hypotension. The "time of onset of sensory block and time to complete motor block" was marginally prolonged in the ropivacaine group, while the length of the block was extended in the same group. Anesthetic agents delivered during a cesarean section may impact both the pregnant woman and the growing fetus [25].

Ropivacaine is a L-amide anesthetic that has structural and physiological similarities to bupivacaine. Ropivacaine has the advantage of differentiated sensory and motor blockade, while demonstrating less toxicity to the cardiovascular and central nervous systems [26-28]. Numerous studies have shown that ropivacaine is more effective than lidocaine in achieving both sensory and motor block, however it is less effective than bupivacaine [29]. A cesarean section is often preferred in situations where normal labor is impeded by several circumstances. When selecting anesthesia for a cesarean section, several factors must be taken into account, including the indications for the procedure, the urgency of the situation, the requirements of the pregnant patient, and the recommendations of the anaesthetists [30].

The subarachnoid block is a recognized anesthetic method frequently employed in medical practice. General anesthesia is employed just when epidural block and local infiltrative anaesthesia are contraindicated. Contraindications may encompass maternal hemorrhage, coagulopathy, conditions jeopardizing fetal viability, or the rejection of local anesthesia by pregnant women. CSEA integrates the advantages of epidural and lumbar anaesthesia, often employed, with little dose, rapid onset, and efficient analgesia. Consequently, Combined Spinal-Epidural Anaesthesia (CSEA) is the optimal technique for conducting a cesarean section since it may efficiently mitigate pain and shorten the delivery process [31].

The aim of the research conducted by Olapour A et al. (2020) was to evaluate the efficacy and safety of spinal anaesthesia with ropivacaine 1% compared to bupivacaine 0.5% during cesarean section. Research shown that the administration of "15 mg of 1% ropivacaine" yielded a comparable and effective clinical outcome, accompanied by a shorter duration of both motor and sensory block, when contrasted with "10 mg of 0.5% hyperbaric bupivacaine" for elective cesarean sections. It is important to note that the onset period for both motor and sensory blockade with ropivacaine is suggestively longer than that of bupivacaine [31].

Wang et al. proved that ropivacaine is advantageous because to its little hemodynamic impact, shorter duration of sensory and motor blockade, and reduced incidence of side effects. These elements facilitate expedited recuperation and guarantee patient safety. Conversely, both low and high doses

of ropivacaine and bupivacaine cause pain [32]. Chung et al. established that the administration of 18 milligrams of 0.5 percent hyperbaric ropivacaine produced spinal anesthesia that was comparably effective however exhibited a shorter duration of sensory and motor blockade, in contrast to the administration of 12 milligrams of 0.5 percent hyperbaric bupivacaine during cesarean section [33].

A 2016 research showed that intrathecal ropivacaine diminishes the extent of motor block, has a similar start of sensory block, and does not influence the occurrence of maternal hypotension [34]. Consequently, ropivacaine is a more appropriate option for conducting cesarean sections because to its enhanced conductivity, which leads to more pleasure and expedited motor recovery. It can function as a viable alternative to bupivacaine during cesarean sections [35]. The present study revealed variations in SBP and DBP over time, with the injection of ropivacaine exerting no influence on these metrics. The heart rate of the bupivacaine group demonstrates a significant elevation relative to the ropivacaine group. Bupivacaine, owing to its significant cardiotoxicity, may elevate heart rate in some pregnant women [36].

Ropivacaine demonstrates lower lipid solubility than bupivacaine, leading to a decreased risk of cardiovascular and cardiac damage. Anaesthetics used during a cesarean section may affect both the pregnant lady and the fetus [37]. Ropivacaine is a L-amide anesthetic with a chemical structure similar to bupivacaine. Nonetheless, bupivacaine has a significant potential to adversely affect the heart and may lead to difficulties in specific pregnant women. Conversely, ropivacaine provides the advantage of exerting distinct effects on sensory and motor activities, while exhibiting less toxicity to the cardiovascular and central nervous systems [38]. Furthermore, ropivacaine ensures steady hemodynamics with negligible effects on heart rate and blood pressure, while simultaneously offering an extended period of motor blockade.

Research has shown that ropivacaine exhibits reduced lipid solubility relative to bupivacaine. This suggests that ropivacaine is less prone to induce adverse effects on hemodynamics and the cardiovascular system. Furthermore, ropivacaine is more efficacious in inhibiting sensory and motor activities; yet it is less powerful than lidocaine yet more potent than bupivacaine [39]. The research has shown that "ropivacaine (0.5%)" is applicable in Combined Spinal-Epidural Anaesthesia for cesarean sections. It exhibits a reduced occurrence of shivering compared to bupivacaine at equal doses. Both modest and high dosages of ropivacaine might induce pain in postpartum mothers [40,41].

Foreign literature indicates that the advised dosage of ropivacaine for lumbar anesthesia after cesarean section is generally between 15 and 20 mg. Nonetheless, it is crucial to acknowledge that this dosage may be unsuitable for Asians owing to their distinct physiological traits [42]. Consequently, it is essential to diligently pursue the ideal anesthetic dose and method particularly customized for persons of Indian heritage. Consequently, ropivacaine exerts a diminished effect on hemodynamics. The experimental group had a significantly prolonged initial duration for the sensory block relative to the control group, while the durations of both the sensory and motor blocks remained reduced.

Conclusion

This study illustrates the hemodynamic advantages of hyperbaric ropivacaine over hyperbaric bupivacaine for spinal anesthesia in cesarean deliveries. Ropivacaine demonstrated superior hemodynamic stability, characterized by a reduced incidence of hypotension and diminished heart rate variability, in comparison to bupivacaine. Despite a little extended start time for sensory and motor block with ropivacaine, its extended duration of action and decreased cardiovascular and central nervous system toxicity provide considerable therapeutic advantages. The results endorse the utilization of ropivacaine as a more secure substitute for bupivacaine in spinal anesthetic during cesarean sections, enhancing mother safety and recovery results.

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