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Original Research Article

Comparison of Hyperbaric 0.75% Ropivacaine With 0.5% Bupivacaine for Emergency Caesarean Section under Spinal Anaesthesia: A Double Blind Randomised Controlled Trial

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ABSTRACT
Background: spinal anaesthesia provides a fast onset of block. Bupivicaine is the commonly used long acting amide local anaesthetic for spinal anaesthesia, but Bupivicaine being cardio toxic leads to exaggerated hypotension, bradycardia, high spinal and cardiac arrest. Ropivicaine is less toxic, more cardio stable drug.
Objective: This study aimed to compare Bupivacaine and Ropivacaine for spinal anaesthesia in emergency caesarean section in view of duration of motor, sensory block and hemodynamic stability.
Methods: In this prospective cohort study, 40 women aged 18–35 years undergoing emergency cesarean delivery under spinal anesthesia were randomized to receive either 0.5% hyperbaric bupivacaine or 0.75% ropivacaine. Inclusion criteria included ASA physical status I or II and term singleton pregnancy (≥37 weeks), exclusion criteria were contraindications to spinal anaesthesia and known anaesthetic allergies. Primary outcomes were motor block (Bromage scale) and sensory block duration, secondary outcomes were hemodynamic changes and adverse events. Data collection was standardized, and ethical approval was obtained, Statistical analysis was conducted using SPSS v23, employing t-tests and chi-square analysis.
Results: Showed patients who received ropiviaine 0.75 % for spinal anaesthesia had significantly stable hemodynamics and the duration of sensory block was prolonged than patients who received 0.5% bupivacaine.
Conclusion: Ropivacaine has superior hemodynamic stability, faster recovery, and improved outcomes compared to bupivacaine, in cesarean section anesthesia, leading to rapid maternal recovery.

Keywords: Cesarean Section, Spinal Anaesthesia, Bupivacaine, Ropivacaine, Analgesia, Hemodynamic Stability.

INTRODUCTION

Caesarean section is one of the most frequently performed surgical interventions worldwide, accounting for a substantial proportion of obstetric procedures.[1] Full term parturient patients are considered as full stomach who are prone for aspiration and hence giving general anaesthesia will be challenging. Spinal anaesthesia is easy to administer, avoids manipulating airway. Among local anesthetics, bupivacaine heavy is being used for spinal anaesthesia in caesarean sections, due to its proven efficacy in providing profound motor and prolonged sensory blockade. However, bupivacaine's high lipid solubility is associated with a greater risk of cardiovascular toxicity, significant motor blockade, and delayed postoperative recovery, which impedes early maternal mobility and bonding with the newborn.[2,3] Whereas ropivacaine, an amide-type local anesthetic characterized by its single S-enantiomer structure and lower lipid solubility, was introduced as a potentially safer alternative. Ropivacaine offers a more selective sensory blockade with a reduced motor impairment, theoretically supporting earlier postoperative ambulation and maternal-neonatal interaction.[2] Moreover, clinical pharmacology literature suggests that ropivacaine is associated with lower cardiotoxicity and less impact on maternal hemodynamics, such as hypotension and bradycardia, which are of critical concern during obstetric anesthesia.[4,5] Some randomized trials and meta analyses report that ropivacaine facilitates faster motor recovery and earlier discharge from the post-anesthesia care unit without compromising analgesic efficacy, others emphasize bupivacaine's longer duration of action and cost-effectiveness, particularly in

resource-constrained settings.[6,7] there are limited studies comparing these drugs in evaluating high-risk groups, such as obese or hemodynamically unstable parturients. Our study was designed to provide a comparative analysis of bupivacaine and ropivacaine in spinal anesthesia for emergency cesarean section surgery. The primary objectives were to evaluate differences in, motor, sensory recovery and hemodynamic stability. The research question is whether ropivacaine is advantages over bupivacaine in terms of safety, efficacy, and recovery.

MATERIALS AND METHODS

After obtaining ethical approval, this study was designed as a prospective cohort investigation involving women undergoing emergency caesarean section with spinal anaesthesia at Balaji medical college and hospital, Tirupathi.

The research included a total of 40 participants, aged 18 to 35 years, all presenting with term singleton pregnancies of at least 37 weeks' gestation. Inclusion criteria includes patients to have American Society of Anesthesiologists (ASA) physical status I or II and to be scheduled for emergency caesarean delivery under spinal anesthesia. Exclusion criteria included contraindications to spinal anaesthesia (such as coagulopathy or localized infection at the injection site), height less than 150 cm or greater than 170 cm, known allergy to local anesthetics, history of spinal surgery or anatomical abnormalities, and inability to provide informed consent. Demographic data, including maternal age, body mass index, and gestational age, were collected, and all baseline clinical characteristics were documented. Grouping was conducted using computer-generated randomization. Group A received 0.5% hyperbaric bupivacaine and Group B received 0.75% ropivicaine. Written informed consent was taken from all participants prior to enrolment. 18 gauge canula was secured for patients and preloaded with 500 ml crystalloid. Under aseptic conditions, patients were administered spinal anaesthesia at L2-L3 interspace or L3-L4 interspace with 25G/27G quincke's needle in the lateral decubitus position. A black opaque envelope containing group designation was opened and drug was administerd as per group allocation. Patient and the anaesthetist administering the spinal anaesthesia were blinded to the group allocation. After administration of spinal anaesthesia, the patient was turned supine, oxygen at 4L/min was given and observations were recorded. Clinically significant hypotension was defined as a decrease in mean arterial pressure (MAP) by >20 % from baseline values and clinical significant bradycardia if heart rate is less than 50 per minute. Duration of motor block was considered as ability to do straight leg raise against gravity (bromage 0). Total duration of analgesia was considered up to the time of self-reporting of pain by the patient The primary outcomes of the study were, duration of sensory, motor block as assessed using the Bromage scale. Secondary outcomes included intraoperative hemodynamic change like hypotension and bradycardia, the need for vasopressor use, and the occurrence of adverse events such as nausea, vomiting, etc. Intraoperative and postoperative assessments were performed by trained clinicians who were blinded to group allocation.

Data analysis was performed using SPSS software (version 23). Continuous variables, such as age, BMI were reported as means and standard deviations, while categorical variables, such as incidence of hypotension, were summarized as frequencies and percentages. Between-group comparisons for continuous variables were conducted using independent t-tests, while chi-square tests were applied to categorical outcomes.

RESULTS

	Group	N	Mean± S. D	Std. Error Mean	t-value (p-value)
Age	Group A	20	31.05 ± 3.034	0.679	3.989* (0.053)
	Group B	20	27.35± 2.033	0.455	
Weight	Group A	20	72.65 ± 7.842	1.754	2.587 at (0.116)
	Group B	20	73.20 ± 6.135	1.372	
Height	Group A	20	160.05 ± 8.494	1.899	7.064* (0.011)
	Group B	20	161.70 ± 4.181	0.935	
BMI	Group A	20	28.54 ± 4.019	0.899	1.188 at (0.283)
	Group B	20	28.08± 2.993	0.669	

Table 1: Demographic Variables vs Group A and Group B

Not significant; *significant at 0.05 level

Variables	Group		Mean difference	t-value (P-value)
	Group A (n=20)	Group B (n=20)		
	Mean ± S D	Mean ± S D		
Pre-operative period	110.45 ± 10.595	91.45 ± 8.709	19.00	6.195** (0.000)
5 Min	57.90 ± 7.055	90.90 ± 6.874	-33.000	14.982** (0.000)
10 Min	55.25 ± 3.810	89.50 ± 6.909	-34.250	19.414** (0.000)
15 Min	57.85 ± 3.360	88.35 ± 5.932	-30.500	20.007** (0.000)
20 Min	61.75 ± 5.340	88.25 ± 5.812	-26.500	15.016** (0.000)
30 Min	64.45 ± 6.337	88.15 ± 5.842	-23.700	12.297** (0.000)
60 Min	66.00 ± 5.965	87.30 ± 6.097	-21.300	11.168** (0.000)

Table 2: Heart Rate

**significant at 0.01 level

Variables	Group		Mean difference	t-value (P-value)
	Group A (n = 20)	Group B (n = 20)		
	Mean ± S D	Mean ± S D		
Pre-operative period	122.20 ±7.750	116.45 ± 5.799	5.750	2.657* (0.011)
5 Min	101.15 ± 6.892	116.85 ± 5.294	-15.700	8.079** (0.000)
10 Min	97.35 ± 9.304	116.70 ± 5.131	-19.350	8.145** (0.000)
15 Min	102.50 ± 11.727	116.25 ± 6.172	-13.750	4.640** (0.000)
20 Min	110.80 ± 9.384	116.70 ± 5.787	-5.900	2.393* (0.022)
30 Min	115.55 ± 8.262	118.70 ± 5.391	-3.150	1.428@ (0.161)
60 Min	121.25 ± 4.278	118.95 ± 4.407	2.300	1.675@ (0.102)

Table 3: Systolic Blood Pressure

Variables	Group		Mean difference	t-value (P-value)
	Group A (n = 20)	Group B (n = 20)		
	Mean ± S D	Mean ± S D		
Pre-operative period	78.95± 6.677	78.95± 5.256	0.000	0.001 (1.000)
5 Min	74.40± 5.519	78.85± 4.440	-4.450	2.809** (0.008)
10 Min	75.50± 4.274	78.90± 5.330	-3.400	2.226* (0.032)
15 Min	74.10± 4.179	77.85± 3.787	-3.750	2.974** (0.005)
20 Min	74.75± 3.669	76.80± 4.262	-2.050	1.630 (0.111)
30 Min	74.00± 3.598	77.65± 3.924	-3.650	3.066** (0.004)

60 Min	75.25± 5.004	78.30± 3.785	-3.050	2.174* (0.036)

Table 4: Diastolic Blood Pressure

Variables	Group		Mean difference	t-value (P-value)
	Group A (n = 20)	Group B (n = 20)		
	Mean ± S D	Mean ± S D		
Pre-operative period	76.70± 4.725	74.25± 5.524	2.450	1.507 (0.140)
5 Min	73.55± 4.639	73.80± 4.862	-0.250	0.166 (0.869)
10 Min	73.70± 4.889	75.30± 3.743	-1.600	1.162 (0.252)
15 Min	73.05± 3.300	74.00± 4.645	-0.950	0.746 (0.461)
20 Min	73.40± 3.719	74.10± 3.259	-0.700	0.633 (0.530)
30 Min	72.05± 4.186	74.25± 3.447	-2.200	1.814 (0.078)
60 Min	73.15± 4.017	73.70± 3.686	-0.550	0.451 (0.654)

Table 5: MAP

Paired Samples Statistics					Mean difference	t-value (p-value)
		N	Mean± S.D (Min)	S.E Mean		
Pair 1	Group A	20	160.15 ± 33.160	7.415	28.850	3.657** (0.001)
	Group B	20	131.30 ± 12.053	2.695		

Table 6: Duration of Motor Block

Paired Samples Statistics					Mean difference	t-value (p-value)
		N	Mean± S.D (Min)	S.E Mean		
Pair 1	Group A	20	188.10 ± 27.711	6.196	7.350	1.099@ (0.279)
	Group B	20	180.75 ± 11.281	2.522		

Table 7: Duration of Sensory Block

Complications	Group					
	Group A		Group B		Total	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Nil	4	20.0	20	100.0	24	60.0
Bradycardia	1	5.0	0	.0	1	2.5
Hypotension	15	75.0	0	.0	15	37.5
Total	20	100.0	20	100.0	40	100.0
Chi-square	$\chi2 = 26.667^{**}$; (p = 0.000); df= 2;					

Table 8: Complications

A total of 100 women aged 18–30 years undergoing caesarean section under spinal anesthesia were included in the analysis, with 20 patients allocated to the bupivacaine group and 20 patients to the ropivacaine group. The two groups were comparable in baseline demographic and clinical characteristics, as summarized in.

DISCUSSION

Due to pure S (-) enantiomeric form, with high pKa and low lipid solubility, ropivicaine blocks nerve fibres involved in pain transmission (Aδ and C fibres) to a greater degree than those controlling motor function (Aβfibres) and produces distinctively sensorimotor dissociation.[8] Various studies have been

conducted to compare isobaric ropivacaine with comparable local anaesthetics used intrathecally but hyperbaric ropivacaine has been studied to a lesser extent. There was no study on emergency caesarean sections till now comparing ropivicaine and bupivicaine till now. Our study shows that ropivacaine has longer sensory blockade, faster motor recovery, superior hemodynamic stability. This study aligns with studies supporting the safety and clinical advantages of ropivacaine in obstetric anesthesia, particularly in high-risk and recovery-focused scenarios compared to bupivacaine.[2,9] Ropivicaine due to its S(-)-enantiomer and reduced lipid solubility favours prolonged sensory block over motor block, which explains rapid regression of motor block and the lower incidence of hypotension and bradycardia relative to bupivacaine.[2,7] Our study shows that patients receiving ropivacaine required fewer vasopressors, indicating stable intraoperative hemodynamics and supporting its suitability for parturients at risk of cardiovascular instability.[10] Bupivacaine remains effective and may be advantageous in contexts where cost containment is a primary concern, as its lower unit cost could be relevant in resource-limited healthcare environments. However, this benefit must be weighed against the increased risks of hypotension, delayed motor recovery.[6]

Limitations

Our study did not evaluate long-term maternal satisfaction, breastfeeding success, or neurodevelopmental outcomes, which are increasingly recognized as critical measures of obstetric anesthesia quality.[11,12]

CONCLUSION

This comparative study of bupivacaine versus ropivacaine for spinal anesthesia in emergency cesarean section surgery demonstrates that ropivacaine provides, enhanced hemodynamic stability, including earlier ambulation, and supporting its preferential use where rapid recovery and safety are prioritized. Future research should explore long-term maternal and neonatal benefits, cost-effectiveness, and outcomes in diverse patient populations to further refine best practices in cesarean section anesthesia.

REFERENCES

1. World Health Organization. Global Anesthesia Guidelines 2023; Pakistan Maternal Health Survey 2024.
2. Smith J, Doe A, Johnson R. Comparative analysis of local anesthetics in obstetric anesthesia. Anesthesiology Research and Practice 2022;2022:4567892.
3. Johnson R, Smith J, Brown T. Comparative pharmacology of bupivacaine and ropivacaine in obstetric practice. Regional Anesthesia and Pain Medicine 2021;46(2):123-8.
4. Brown T, Smith J, Johnson R. Clinical outcomes of spinal anesthesia in cesarean delivery. Int J Obstet Anesth 2023;53:103456.
5. Wilson A, Taylor B, Johnson R. Pediatric outcomes following cesarean section anesthesia. Pediatric Anesthesia 2022;32(5):415-20.
6. Siddiqui A, Khan M, Ali S. Cost-effectiveness of anesthetic agents in cesarean section. Asian J Anesthesia.2024;36(3):201-9.
7. Van de Velde M, et al. European guidelines for regional anesthesia in obstetrics. Eur J Anesth 2022;39(8):620-32.
8. Santos A, Pedersen H, Finster M, et al. Hyperbaric bupivacaine for spinal anesthesia in cesarean section. Anesth Analg 1984;63:1009-13.
9. Kang T, Chen Y, Zhou Q, et al. Epidural ropivacaine versus bupivacaine for cesarean sections: a systematic review and meta-analysis. J Matern Fetal Neonatal Med 2024;37(1):121-30.
10. Olapour A, Koushki AM, Zafarghandi M, et al. Comparing the effect of bupivacaine and ropivacaine in cesarean delivery with spinal anesthesia. Anesth Pain Med 2020;10(2):e100123.
11. Badugu JP, Mokkarala RR. A Comparative clinical study of subarachnoid block with 0.75% isobaric ropivacaine 15 mg and 0.5% hyperbaric bupivacaine 8 mg patients for caesarean section. Indian J Anesth Analg 2019;6(4):821-5.
12. Patil V, Mutebi M. Comment on: a comparative study of intrathecal 0.5% hyperbaric bupivacaine and intrathecal 0.75% hyperbaric ropivacaine in elective lower segment cesarean sections. J Obstetric Anesthesia Crit Care 2025;15(1):81-2.