

# A Study Comparing Hemodynamic Effects of 0.5% Hyperbaric Levobupivacaine and Bupivacaine in Caesarean Section under Spinal Anaesthesia

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**Abstract:** ***Background:** Spinal anaesthesia is the preferred technique for caesarean section due to its rapid onset, reliability, and maternal safety profile. Hyperbaric Bupivacaine is commonly used but is associated with cardiovascular side effects. Levobupivacaine, the S(-)-enantiomer of Bupivacaine, offers similar anaesthetic efficacy with a better safety profile. **Aims:** To compare the hemodynamic stability, efficacy, and side effects of 0.5% Hyperbaric Levobupivacaine and 0.5% Hyperbaric Bupivacaine for spinal anaesthesia in caesarean section. **Study Design:** Prospective, randomized, double-blind, controlled clinical study. **Materials And Methods:** Sixty ASA I–II partuents undergoing elective caesarean section were randomly divided into two groups. Group B received 2.5 ml of 0.5% Hyperbaric Bupivacaine and Group L received 2.5 ml of 0.5% Hyperbaric Levobupivacaine intrathecally. Hemodynamic parameters, sensory and motor block onset and duration, and side effects were recorded and compared. **Results and Discussion:** Both groups achieved adequate surgical anaesthesia. Group L showed significantly better hemodynamic stability with fewer episodes of hypotension and bradycardia. Onset times for sensory and motor blocks were comparable. Duration of motor block was longer in Group B. Levobupivacaine was associated with fewer adverse effects like nausea and vomiting. **Conclusion:** Levobupivacaine is a safer and equally effective alternative to bupivacaine for spinal anaesthesia in caesarean sections, offering better hemodynamic stability and fewer side effects.*

**Keywords:** Spinal anaesthesia, levobupivacaine, bupivacaine, caesarean section, hemodynamic stability, regional anaesthesia

## 1. Introduction

Spinal anaesthesia has gained preference for caesarean sections over general anaesthesia due to reduced maternal morbidity and mortality. Bupivacaine, though widely used, has known cardiotoxic risks. Levobupivacaine, the pure S (–)-enantiomer of Bupivacaine, promises similar efficacy with a more favourable safety profile. This study evaluates the clinical performance and hemodynamic safety of both agents in obstetric spinal anaesthesia.

## 2. Objectives

- **Primary Objective:** To compare the efficacy and hemodynamic stability of 0.5% Hyperbaric Levobupivacaine versus 0.5% Hyperbaric Bupivacaine in caesarean sections.
- **Secondary Objective:** To assess the incidence of intraoperative and postoperative side effects including hypotension, nausea, and vomiting.

## 3. Materials and Methods

**Study Design:** Prospective, randomized, double-blind, controlled clinical trial.

**Study Setting:** Hi-Tech Medical College and Hospital, Bhubaneswar

**Study Period:** November 2021 to November 2023

**Ethical Clearance:** Approval obtained from the Institutional Ethics Committee. Written informed consent taken from all participants.

**Sample Size:** 60 parturients (30 in each group)

### Inclusion Criteria:

- ASA I–II
- Age 18–40 years
- Height 135–165 cm

### Exclusion Criteria:

- Refusal for regional anaesthesia
- Contraindications to spinal anaesthesia
- Known systemic illnesses or drug allergies

**Randomization:** Sealed opaque envelope method.

### Groups:

- **Group B:** 2.5 ml of 0.5% Hyperbaric Bupivacaine
- **Group L:** 2.5 ml of 0.5% Hyperbaric Levobupivacaine

**Procedure:** Standard monitoring and spinal block at L3–L4 using 25G Quincke needle. Hemodynamic parameters recorded every minute for 3 minutes, then every 5 minutes up to 15 minutes, and then every 15 minutes throughout surgery.

## 4. Results

Both groups provided adequate surgical anaesthesia. Group L had significantly fewer incidences of hypotension and bradycardia. Sensory onset and maximum levels were similar. Duration of motor block was longer in Group B. Side effects such as nausea and vomiting were less common in Group L.

- This study is conducted in the Department of Anesthesiology Hi-tech Medical College and Hospital

after the due approval from the Institutional Ethics Committee.

- The study was carried out by explaining all the study details to the patients and after obtaining their expressed (written) consent for the study.
- 60 patients were included in this study who are divided into two groups as per the study profile.
- All 60 patients in two groups completed the study without any exclusion. Intergroup analysis was done.
- Of the 60 patients, 30 belonged to Group B (Hyperbaric Bupivacaine) and other 30 categorized as Group L (Hyperbaric Levobupivacaine).
- Data was presented as range, mean, standard deviation. The probability value 'P' of less than 0.05 considered statistically significant.
- The Intergroup analysis & results were as follow

**Table 1: The Comparison of Age between the Two Groups**

Age	Number of cases (B)	Number of cases (L)	Mean		SD		P Value
			(B)	(L)	(B)	(L)	
< 20 years	4	2	25.90	24.36	9.87	2.99	0.419
21-30 years	24	28					
>31 Years	2	0					
Total	30	30					

**Table 2: Comparison of Weight between Two Groups**

Age	Number of cases (B)	Number of cases (L)	Mean		SD		P Value
			(B)	(L)	(B)	(L)	
60-70 KGS	19	14	71.00	71.43	6.41	5.45	0.779
71-80 KGS	7	12					
81-90 KGS	4	4					
Total	30	30					

**Table 3: Comparison of Height Between the Two Groups**

Age	Number of cases (B)	Number of cases (L)	Mean		SD		P Value
			(B)	(L)	(B)	(L)	
< 160CMS	20	15	159.10	160.10	6.445	6.922	0.161
>161CMS	10	15					
Total	30	30					

**Table 4: Comparison of Duration of Surgery (Minutes) between the Two Groups**

Parameter	Group B	Group L
Range	45-60 Min	50-60 Min
Mean	52.10	52.73
SD	4.11	4.32
P Value	0.563 Not Significant	

**Table 5: Comparison of PR between Two Groups at Various Intervals**

Pulse Rate	Group	Mean	SD	P Value
Baseline	B	93.33	8.59	0.512
	L	83.76	7.7	
2 Min	B	86.4	9.82	0.475
	L	84.73	8.04	
5 Min	B	77.7	11.46	0.067
	L	83.66	8.74	
10 Min	B	84.33	9.81	0.542
	L	80.1	5.89	
15 Min	B	89.16	7.68	0.088
	L	84.66	6.69	
30 Min	B	88.43	8.81	0.265
	L	83.03	6.68	
45 Min	B	94.93	9.06	0.124
	L	83.76	7.7	

**Table 6: Comparison of Map between two Groups at Various Intervals**

MAP	Group	Mean	SD	P Value
Baseline	B	85.78	5.34	0.356
	L	87.1	7.24	
2 Min	B	90.06	6.09	0.0258
	L	88.26	6.11	
5 Min	B	70.56	9	0.0001
	L	87.53	10.23	
10 Min	B	68.4	6.47	0.0001
	L	84.1	7.35	
15 Min	B	69.4	5.72	0.0001
	L	84.53	6.72	
30 Min	B	71.7	6.22	0.0001
	L	83.46	4.5	
45 Min	B	74.76	4.68	0.0001
	L	86.66	3.53	

**Table 7: Comparison of SPO2 between Two Groups at Various Intervals**

Parameter	Group	Mean	SD	P Value
Baseline	B	99.03	1.84	0.428
	L	99.36	1.35	
2 Min	B	100	0	N/A
	L	100	0	
5 Min	B	100	0	N/A
	L	100	0	
10 Min	B	99.16	0.94	0.425
	L	99.4	1.27	
15 Min	B	99.8	0.48	0.577
	L	99.86	0.43	
30 Min	B	99.73	0.44	0.177
	L	99.5	0.82	

45 Min	B	99.83	0.46	0.074
	L	99.53	0.77	

**Table 8:** Comparison of Time of Onset of Sensory Block (Min) between the Two Groups

Parameter	Time of Onset of Sensory Block in Minutes	
	Group B	Group L
Range	1-3 MIN	1-2 MIN
Mean	1.83	2.03
SD	0.37	1.73
P Value	< 0.082 Not Significant	

**Table 9:** Comparison of Time to Reach Maximum Sensory Level (Min) between the Two Groups

Parameter	Group B	Group L
Range	9-20 min	8-15 min
Mean	13.46	11.43
SD	1.47	1.75

**Table 10:** Comparison of Maximum Level of Sensory Block (Min) between the Two Groups

Peak level of Sensory Block	Group B		Group L	
	No of cases	%	No of cases	%
T2	6	20%	2	7%
T4	12	40%	8	27%
T6	12	40%	20	66%
Total	30	100%	30	100%

**Table 11:** Comparison of Time to Two Segment Regression (MIN) between the Two Groups

Parameter	Group B	Group L
Range	70-80	60-70
Mean	74.53	65.17
SD	0.52	0.87

'p' value <0. 0001

### Significant

**Table 12:** Comparison of Time of Onset of Motor Block (Min) between the two Groups

Parameter	Group B	Group L
Range	2-4 min	2- 6 min
Mean	2.93	4.51
SD	0.52	0.87

P value <0. 0001 Significant

**Table 13:** Comparison of Time to Maximum Motor Block Level between two Groups

Parameter	Group B	Group L
Range	4-10 min	5-15 min
Mean	6.43	11.66
SD	1.13	2.12

**Table 14:** Comparison of Duration of Motor Block Level between two Groups

Parameter	Group B	Group L
Range	125-155	90-115
Mean	135.03	101.06
SD	4.81	9.42

'p' value <0. 0001 Significant

**Table 13:** Comparison of Adverse Effects between Two Groups

Adverse Effects	Group B No	Group B %	Group L No	Group L %
Hypotension	7	23	2	7
Bradycardia	2	7	1	3
Shivering	2	7	2	7
Vomiting	1	3	2	7
Total cases with adverse effects	12*	40	7*	23
Total cases without adverse effects	18**	60	23**	77
Total	30***	100	30***	100

## 5. Discussion

Intrathecal neuraxial anaesthesia, particularly spinal anaesthesia, is the preferred technique for lower segment caesarean section (LSCS) due to reduced maternal morbidity and mortality compared to general anaesthesia (Bogra et al., 2005) [59]. It allows intraoperative maternal awareness and communication, which is an added advantage.

However, spinal anaesthesia carries inherent risks, including drug-related toxicity and high spinal block levels. The use of titrated intrathecal doses and improved drug formulations has minimized such complications (Albright GA, 1986) [60].

This randomized, double-blind study compared 12.5 mg of intrathecal Hyperbaric Levobupivacaine (Group L) with 12.5 mg Hyperbaric Bupivacaine (Group B) in 60 parturient undergoing caesarean section. Both groups were demographically matched.

While Group B achieved faster and higher sensory levels (T2–T4), Group L achieved adequate levels (T6) with better hemodynamic stability, aligning with findings from Guler et al. (2012) [46] and Goyal et al. [52]. Motor block onset and duration were longer in Group B, while Group L showed shorter motor block and analgesia duration, consistent with Gautier et al. [13].

Levobupivacaine was associated with significantly lower incidences of hypotension and bradycardia, requiring fewer vasopressors, corroborating studies by Glaser et al. [1], Mantouvalou M [56], and Fattorini et al. [37]. Coppejans et al. [30] also reported better systolic blood pressure stability with Levobupivacaine.

In summary, while both drugs provided effective spinal anaesthesia for caesarean section, Levobupivacaine offered superior hemodynamic stability and a more favourable side effect profile, making it a evidence based, safe & appropriate alternative to Bupivacaine in obstetric anaesthesia.

## 6. Conclusion

This randomized, double-blind study demonstrated that both Hyperbaric Levobupivacaine and Hyperbaric Bupivacaine provide fast and effective induction of surgical anaesthesia for elective cesarean section deliveries with no adverse effects on neonates. Based on the findings it was observed that 0.5% Hyperbaric Levobupivacaine 12.5 mg for

intrathecal injection of caesarean section produces adequate sensory and motor blockade and stable hemodynamic parameters with minimum adverse effects at higher sensorial block levels than 0.5% Hyperbaric Bupivacaine 12.5 mg.

It is concluded that, clinically, Hyperbaric Levobupivacaine is a more favorable local anesthetic agent for caesarean section in terms of safety with similar pharmacokinetic profile of Hyperbaric Bupivacaine.

The present study has been conducted in a sample of 60 parturient. It is acknowledged that a larger sample would have achieved more conclusive results.

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