DOI: 10.7860/JCDR/2026/85273.22518

Original Article

Anaesthesia Section

Comparison of Hyperbaric Levobupivacaine and Hyperbaric Bupivacaine for Spinal Anaesthesia in Infraumbilical Procedures: A Double-blind Randomised Clinical Trial

PRATHAMESH JAGALE[1], RAMESH SUGANDH[2], DIPAKKUMAR HIRALAL RUPAREL[3], GITIKA PARDHI[4]

ABSTRACT

Introduction: Spinal anaesthesia remains a preferred technique for infraumbilical surgeries due to its simplicity, rapid onset, and stable perioperative profile. Levobupivacaine, the levo-enantiomer of bupivacaine, offers comparable anaesthetic efficacy with improved cardiovascular safety.

Aim: To compare the hyperbaric levobupivacaine and hyperbaric racemic bupivacaine in patients undergoing elective infraumbilical surgeries.

Materials and Methods: The present randomised, double-blind, clinical study conducted at a Tertiary Care Teaching Hospital Government Medical College, Gondia, Maharashtra, India. Hyperbaric levobupivacaine and hyperbaric racemic bupivacaine were compared in patients undergoing elective infraumbilical surgeries 62 American Society of Anaesthesiologists (ASA) I-II patients aged 18-60 years were randomly allocated into two groups (n=31 each) to receive 3 mL of 0.5% hyperbaric levobupivacaine (Group L) or 3 mL of 0.5% hyperbaric bupivacaine (Group B) intrathecally. Sensory and motor block characteristics, duration of anaesthesia, effective analgesia, ambulation time, and adverse events were analysed using the Independent t-test or Mann-Whitney U test for continuous variables and the Chi-square test for categorical variable, with $p<0.05$ considered significant.

Results: Demographic and surgical characteristics, including age, gender, weight, height, ASA grade, type, and duration of surgery, were comparable between Group B and Group L ($p>0.05$). The onset of sensory and motor block was significantly faster with bupivacaine (5.41±1.05 min and 3.09±0.83 min, respectively) than with levobupivacaine (6.29±1.27 min and 3.74±0.85 min; $p<0.01$). The durations of anaesthesia, motor block, and analgesia were significantly longer in Group B (165.3±13.8, 249.4±6.3, and 276.5±7.3 min, respectively) compared with Group L (140.96±11.6, 188.7±7.4, and 211.3±10.1 min; $p<0.001$). Time to ambulation was earlier with levobupivacaine (251.6±9.9 min vs. 347.1±13.3 min; $p<0.001$). Hypotension occurred more frequently with bupivacaine (45.1% vs. 9.6%; $p=0.002$). The quality of anaesthesia was excellent in all patients.

Conclusion: Hyperbaric levobupivacaine (0.5%, 3 mL) provides anaesthesia of comparable quality to racemic bupivacaine with the added advantages of faster motor recovery and greater haemodynamic stability. These features make levobupivacaine a favourable choice for ambulatory or short-duration infraumbilical surgeries.

Keywords: Anaesthetics, Analgesia, Postoperative complications, Recovery of function

INTRODUCTION

Spinal anaesthesia, achieved by blockade of nerves within the subarachnoid space, has been a cornerstone of regional anaesthesia for over a century. It is favoured for a wide range of surgical procedures due to its ease of administration, rapid onset, cost-effectiveness, and ability to allow patients to remain awake during surgery. In addition, spinal anaesthesia minimises the physiological stress response, has a low side-effect profile, and facilitates early postoperative recovery, making it particularly valuable in elective and day-care surgical settings [1].

Among local anaesthetics, hyperbaric racemic bupivacaine has long been preferred for spinal anaesthesia owing to its reliable sensory and motor blockade and prolonged duration of action. However, its use is associated with haemodynamic instability, including hypotension and bradycardia, which may be clinically significant following intrathecal administration. Moreover, racemic bupivacaine carries a risk of cardiotoxicity due to its potent affinity for cardiac sodium channels [2]. Chemically, racemic bupivacaine comprises equal proportions of its Dextro (D-) and Levo (L-) enantiomers. Levobupivacaine, the S(-)-enantiomer, demonstrates reduced cardiac sodium channel affinity and higher plasma protein binding, resulting in a lower risk of cardiotoxicity [3].

Levobupivacaine also exhibits favourable pharmacodynamic properties for spinal anaesthesia. Being nearly isobaric with cerebrospinal fluid, it provides a more predictable spread in the subarachnoid space and is associated with a reduced incidence of hypotension and bradycardia [4-6]. Furthermore, levobupivacaine has been shown to facilitate faster motor recovery compared with racemic bupivacaine, which can enhance early ambulation and reduce postoperative immobilisation [7]. These characteristics position levobupivacaine as a promising alternative, particularly for infraumbilical procedures where haemodynamic stability and rapid recovery are clinically desirable.

Several studies have compared levobupivacaine and racemic bupivacaine in various surgical populations [8-11]. Although levobupivacaine has been found to be equally efficacious in terms of sensory blockade, it is consistently associated with quicker motor recovery and fewer cardiovascular effects as reported with earlier studies [8,9]. However, most existing studies have concentrated on obstetric cases or mixed surgical populations, which limits their relevance to adult patients undergoing elective infraumbilical surgeries [10,11].

Several randomised, double-blind trials have evaluated hyperbaric levobupivacaine versus hyperbaric bupivacaine for spinal anaesthesia

in infraumbilical procedures, demonstrating comparable sensory and motor block characteristics, with levobupivacaine often associated with more stable haemodynamics and earlier motor recovery [12-14]. However, many of these studies vary in study design, adjunct use, or patient populations, and comprehensive, procedure-specific data on onset, duration, quality of blockade, haemodynamic stability, and adverse effect profiles in adult patients undergoing elective infraumbilical surgeries remain limited. Addressing these gaps is important for generating evidence-based guidance on optimal spinal anaesthetic selection, balancing block quality, recovery, and safety outcomes [12-14].

The present study was therefore designed to compare hyperbaric levobupivacaine and hyperbaric racemic bupivacaine in patients undergoing elective infraumbilical surgeries. The primary objective was to assess the onset, duration, and quality of spinal anaesthesia with each agent. The secondary objectives included evaluation of haemodynamic stability, incidence of adverse effects, and postoperative recovery profiles, including the time to motor recovery and readiness for ambulation.

MATERIALS AND METHODS

The present randomised, double-blind, clinical study was conducted at a Tertiary Care Teaching Hospital Government Medical College, Gondia, Maharashtra, India, after obtaining approval from the Institutional Ethics Committee (GMC/GONDIA/PHARMACOLOGY/IEC/07/2023). The study period extended from August 2023 to December 2024. All procedures adhered to the principles of the Declaration of Helsinki (1975, revised 2024) and Good Clinical Practice (GCP) guidelines.

Sample size calculation: A total of 62 patients were enrolled. Formula used for sample size calculation:

$n=(Z_{\alpha/2}+Z_{\beta})2 \cdot (\sigma 12+ \sigma 02)/(u1-u0)2$

hence to calculate,

$n=Z_{\alpha/2}+Z_{\beta}=1.96+0.84=2.8\ (2.8)^2=7.84$

$(\mu 0-\mu 1)2=(2.92-2.86)^2=0.062=0.0036$

$n=0.00360.098\approx 27.2$

$n_{adjusted}=27.2\times 90100\approx 30.2\approx 31$ patients per group

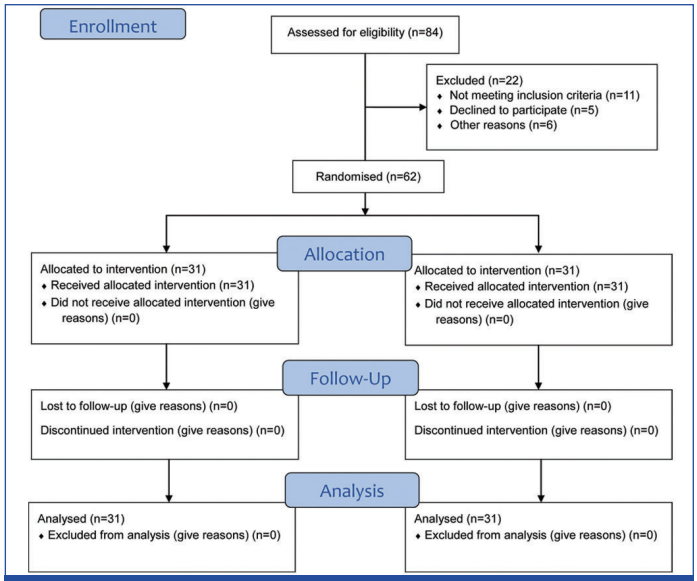
The sample size was calculated based on data from Singh A et al., assuming mean (±SD) quality of anaesthesia scores of 2.92±0.27 in the bupivacaine group and 2.86±0.40 sample size was 27 patients per group [15]. Considering a 10% attrition rate, the final sample size was 31 patients per group.

Inclusion and Exclusion criteria: A total of 62 patients, aged 18-60 years, of either gender, and belonging to the ASA physical status I or II, scheduled for elective infraumbilical surgeries under spinal anaesthesia, were enrolled. Exclusion criteria were: patient refusal, uncontrolled systemic disease, contraindications to spinal anaesthesia, known drug allergy, pregnancy, failure of spinal block, conversion to general anaesthesia, or surgery lasting more than two hours.

Study Procedure

Participants were randomly allocated into two equal groups (Group B and Group L) using a computer-generated randomisation [Table/Fig-1].

In this study, double blinding was implemented to minimise bias and ensure the reliability of results. Both the participants and the investigators assessing outcomes were unaware of the group allocations. The study drugs were prepared by an independent Anaesthesiologist who was not involved in patient care or data collection. Identical syringes with equal total volumes were used to maintain concealment. Thus, neither the patients nor the anaesthetists performing the block or recording data knew which dose was administered, preserving the study's objectivity. The investigator responsible for the random allocation and preparation of spinal anaesthetics was not present during surgery or postoperative evaluations.



[Table/Fig-1]: CONSORT flow diagram.

All patients underwent a detailed preanaesthetic evaluation, including history, clinical examination and investigations as per institutional protocol. The procedure was explained, and written informed consent was obtained. Patients were kept nil per oral for eight hours for solids and two hours for clear fluids. On arrival in the operating room, an intravenous (i.v.) line was secured with a 20G cannula, and Ringer's lactate (10 mL/kg) was infused over ten minutes for preloading. Standard monitors- Electrocardiogram (ECG), SpO_2, Non-Invasive Blood Pressure (NIBP), end-tidal CO_2, and temperature- were attached, and baseline parameters recorded.

Spinal anaesthesia was performed in the sitting position at the L2-L3 or L3-L4 interspace using a 25G Quincke spinal needle under strict aseptic precautions. After confirming free flow of cerebrospinal fluid, the study drug was injected slowly over 15 seconds as per group allocation:

- Group L (n=31): 3 mL of 0.5% hyperbaric levobupivacaine
- Group B (n=31): 3 mL of 0.5% hyperbaric bupivacaine (Singh A et al., [15]).

Patients were immediately placed supine. The blinded observer assessed the sensory and motor block characteristics. Surgery commenced once a T8 sensory level and a modified Bromage grade ≤2 were achieved within 20 minutes. Failure to achieve this was considered a failed block and managed with general anaesthesia.

Monitoring, management, and assessment of spinal anaesthesia: Haemodynamic parameters, including Heart Rate (HR) and NIBP, were recorded every minute for the first 10 minutes following spinal injection and every five minutes thereafter until the end of surgery. Hypotension, defined as a systolic blood pressure <90 mmHg or a ≥20% decrease from baseline, was treated with a 250 mL bolus of Ringer's lactate and 3 mg i.v. mephenteramine as required. Bradycardia, defined as HR <50 beats/min, was managed with 0.6 mg i.v. atropine. Sensory block characteristics were assessed by recording the onset of block to T8 dermatome (TT8), maximum block height (Hmax), and two-segment regression time (T_{reg2}). Motor block was evaluated using the modified Bromage scale, with onset to grade 2 motor block (T_{Brom2}) documented. The intraoperative quality of anaesthesia was graded as excellent (4) If the patient had no complaints, satisfactory (3) For mild discomfort requiring i.v. fentanyl (0.5 µg/kg bolus, maximum 4 µg/kg), inadequate (2) If pain necessitated conversion to general anaesthesia, and failure (1) If the sensory or motor block was insufficient (Singh A et al., [15]).

Postoperative assessment: Patients were monitored in the post-anaesthesia care unit with sensory and motor block levels assessed

every 10 minutes. Primary outcome measures included the duration of anaesthesia (Tanes: time from onset of sensory block at T8 to regression to L1), duration of motor block (TMB: time from Bromage grade 2 to grade 6), and duration of effective analgesia (Tanalg: time from intrathecal injection to first request for analgesia). Secondary outcome measures included time to ambulation once Bromage grade 6 was achieved, sensory and motor block characteristics, haemodynamic changes, and any adverse effects.

STATISTICAL ANALYSIS

Data were analysed using IBM Statistical Package for Social Sciences (SPSS) Statistics (IBM Corp., USA) for Windows, Version 20.0. Data are presented as number (%) or mean±SD as appropriate. Sensory and motor block characteristics, duration of anaesthesia, effective analgesia, ambulation time, and adverse events were analysed using the independent t-test or Mann-Whitney U test for continuous variables and the Chi-square test for categorical variable, with $p<0.05$ considered significant.

RESULTS

There was no statistically significant difference between the two groups in demographic variables such as age, gender distribution, weight, height, or ASA physical status (all $p>0.05$). The types of surgeries and mean duration of surgery were comparable between Group B and Group L ($p=0.112$) [Table/Fig-2].

Variables	Group B (Mean±SD)	Group L (Mean±SD)	p-value
Age in years	37.74±13.67	39.12±13.54	0.53
Gender			
Male n (%)	23 (74.1)	24 (77.4)	0.76
Female n (%)	8 (25.9)	7 (22.6)	
Weight (in kg)	62.90±9.97	61.25±8.36	0.96
Height (in cms)	154.2±3.1	152.4±2.9	0.17
ASA grade			
I n (%)	24 (77.4)	25 (80.6)	0.75
II n (%)	7 (22.6)	6 (19.4)	
Type of surgery			
Hernioplasty n(%)	11 (35.5)	10 (32.2)	0.94
Hydrocele sac eversion n (%)	10 (32.2)	12 (38.7)	
Tubal ligation n (%)	4 (12.9)	5 (16.1)	
others n (%)	6(19.4)	4(13)	
Duration of surgery in minutes	61.0±9.97	56.09±13.73	0.11

[Table/Fig-2]: Patients' characteristics and duration of surgery.
Values are expressed as mean±standard deviation or number (percentage). p-values were calculated using the independent samples t-test for continuous variables and the Chi-square test or Fisher's-exact test for categorical variables. $p<0.05$ was considered statistically significant

The onset times for both sensory and motor blockade were significantly shorter in Group B compared with Group L. The duration-related parameters showed a consistent and highly significant prolongation in Group B. The time to two-segment regression (duration of anaesthesia, duration of motor block, and duration of analgesia were all significantly longer in Group B than in Group L. Consequently, the time to walk unaided was also prolonged in Group B [Table/Fig-3].

The HR was generally comparable between Group B and Group L at all-time points, with most p-values showing no significant difference. Although a few isolated intervals (minutes 7, 25, and 60) reached statistical significance, these were inconsistent and not sustained. Overall, both groups exhibited similar intraoperative heart-rate trends without meaningful haemodynamic differences [Table/Fig-4].

Mean Arterial Pressure (MAP) values were comparable between Group B and Group L throughout all pre- and intraoperative time points. All p-values were above 0.05, indicating no statistically significant differences at any interval. Both groups demonstrated similar MAP trends over time, with no meaningful haemodynamic variation between them [Table/Fig-5].

Parameters	Group B (Mean±SD)	Group L (Mean±SD)	p-value
Onset of sensory block in minutes T_8	5.41±1.05	6.29±1.27	0.005
Onset of motor block in mins T_{Brom2}	3.09±0.83	3.74±0.85	0.003
Time to two segment regressionT_{reg2}	108.06±9.88	68.80±5.72	<0.001
Duration of anaesthesia (min)Tanaes	165.32±13.78	140.96±11.57	<0.001
Duration of motor block TMB	249.35±6.29	188.71±7.41	<0.001
Duration of analgesia T_{Analg}	276.45±7.32	211.29±10.08	<0.001
Time to walk unaided T_{walk}	347.09±13.27	251.61±9.86	<0.001

[Table/Fig-3]: Characteristics of sensory and motor block.
Values are expressed as mean±standard deviation. p-values were calculated using the independent samples t-test. $p<0.05$ was considered statistically significant

Time points for pre and intraoperative (in minutes)	Heart Rate (HR) (beat/minute)		p-value*
	Group B Mean±SD	Group L Mean±SD	
Preoperative	91.8±3.90	88.4±3.78	0.93
1	92.5±3.82	89.0±4.45	0.82
2	94.3±3.78	87.5±3.62	0.73
3	94.4±3.61	87.6±4.29	0.64
4	89.9±3.73	85.3±4.75	0.82
5	85.7±3.32	84.6±5.24	0.72
6	82.2±2.85	82.7±4.16	0.63
7	79.0±3.25	81.7±4.62	0.02
8	77.4±3.01	82.2±3.38	0.43
9	74.6±3.05	81.2±3.19	0.73
10	72.0±2.61	79.3±3.04	0.39
15	69.0±3.73	79.1±4.26	0.63
20	66.5±3.18	78.1±3.18	0.73
25	65.2±2.90	78.5±2.82	0.02
30	66.6±2.66	79.0±3.17	0.20
40	67.2±3.14	78.5±3.11	0.73
50	67.4±3.56	79.6±3.5	0.73
60	66.9±2.89	79.2±3.09	0.03
70	68.2±3.17	79.3±3.00	0.58
80	69.8±3.32	80.6±3.00	0.41
90	70.9±3.66	81.7±3.23	0.24

[Table/Fig-4]: Comparison of Heart Rate (HR) between the groups at different time points.
Values are expressed as mean±standard deviation. p-values were calculated using the independent samples t-test. $p<0.05$ was considered statistically significant

The distribution of sensory block levels was similar between Group B and Group L, with no statistically significant difference ($p=0.0639$). Although Group B had a higher proportion of blocks at T2-T6 and Group L showed more blocks at T8, these variations were not significant. Overall, both groups achieved comparable sensory block levels [Table/Fig-6].

The incidence of perioperative adverse events is shown in [Table/Fig-7]. Hypotension occurred significantly more frequently in Group B compared to Group L (45.1% vs. 9.6%, $p=0.002$), indicating a higher haemodynamic impact in Group B. Although bradycardia was observed only in two patients (6.4%) in Group B and none in Group L, the difference was not statistically significant ($p=0.246$). Other side-effects such as shivering (12.9% vs. 29.0%, $p=0.135$), nausea (25.8% vs. 19.3%, $p=0.563$), and vomiting (16.1% vs. 9.6%, $p=0.481$) were comparable between the two groups.

All patients in both groups achieved an excellent quality of anaesthesia (score 4). No cases of satisfactory, inadequate, or failed anaesthesia were observed. As there was no variability, the mean and standard deviation are both 4 and 0, respectively [Table/Fig-8].

Time points for pre and intraoperative MAP (min)	MAP in mmHg		
	Group B Mean±SD	Group L Mean±SD	p-value*
Preoperative	94.7±2.46	95.8±2.39	0.73
1	93.4±2.21	94.9±2.15	0.53
2	93.4±2.08	95.0±2.46	0.93
3	92.9±2.24	94.1±2.24	0.83
4	90.4±2.19	90.9±3.34	0.26
5	88.1±2.06	90.4±1.27	0.74
6	86.2±1.94	87.2±2.96	0.53
7	85.3±2.16	85.9±1.49	0.74
8	83.7±1.25	84.7±1.83	0.21
9	82.3±1.82	82.3±1.9	0.10
10	80.9±1.34	81.9±1.6	0.41
15	78.7±1.84	80.8±1.93	0.94
20	80.7±1.89	82.2±1.48	0.48
25	79.8±1.98	82.0±1.62	0.38
30	81.1±1.64	83.3±1.38	0.94
40	83.7±1.44	86.1±2.31	0.67
50	85.5±1.62	87.6±1.81	0.57
60	88.2±1.87	89.5±1.39	0.58
70	89.4±1.81	91.4±1.19	0.84
80	91.1±1.60	93.0±1.93	0.68
90	92.9±1.74	94.5±1.98	0.48

[Table/Fig-5]: Comparison of Mean Arterial Pressure (MAP) between the groups.
Values are expressed as mean±standard deviation. p-values were calculated using the independent samples t-test. p<0.05 was considered statistically significant

Level of sensory block	Group B Number (%)	Group L Number (%)	p-value*
T2	3 (9.6)	1 (3.3)	0.06
T4	6 (19.3)	3 (9.6)	
T6	18 (58.0)	14 (45.1)	
T8	4 (12.9)	13 (42.0)	
Total	31 (100.0)	31 (100.0)	

[Table/Fig-6]: Distribution of participants according to highest level of sensory block.
Values are expressed as mean±standard deviation. p-values were calculated using the independent samples t-test. p<0.05 was considered statistically significant

Event	Group B (n=31)	Group L (n=31)	p-value
Hypotension	14 (45.1)	3 (9.6)	0.002
Bradycardia	2 (6.4)	0 (0)	0.24
Shivering	4 (12.9)	9 (29.0)	0.13
Nausea	8 (25.8)	6 (19.3)	0.56
Vomiting	5 (16.1)	3 (9.6)	0.48

[Table/Fig-7]: Adverse events.
p-values were calculated using Chi-square or Fisher's-exact test as appropriate. Values <0.05 were considered statistically significant

Score for quality of anaesthesia	Group B Number (%)	Group L Number (%)
Excellent (4)	31 (100.0)	31 (100.0)
Satisfactory (3)	0 (0)	0 (0)
Inadequate (2)	0 (0)	0 (0)
Failure (1)	0 (0)	0 (0)
Mean±SD	4±0	4±0
Total	31 (100.0)	31 (100.0)

[Table/Fig-8]: Distribution of participants according to quality of anaesthesia (n=62).
Values are expressed as number (percentage) or mean±standard deviation. p-value calculated using the independent samples t-test. p<0.05 was considered statistically significant

DISCUSSION

In the present study, hyperbaric bupivacaine produced a faster onset of sensory and motor block compared with hyperbaric levobupivacaine, while the overall quality of anaesthesia remained excellent in both groups. These findings are consistent with those of Singh A et al., who reported comparable anaesthesia quality despite slight differences in block characteristics [15]. Similar observations were made by Şahin AS et al., Glaser G et al., and Cuvas O et al., all of whom demonstrated that both bupivacaine and levobupivacaine provide reliable and satisfactory anaesthesia across a wide range of surgical procedures [7,16,17]. This reinforces that although minor variations in onset may occur, both agents maintain consistently high anaesthetic efficacy.

In the current study, bupivacaine resulted in a significantly longer duration of sensory block, motor block, and overall anaesthesia, which subsequently contributed to delayed ambulation compared with levobupivacaine. This finding is supported by Singh A et al., who noted earlier motor recovery and faster ambulation with levobupivacaine [15]. Guler G et al., and Şahin AS et al., similarly reported shorter durations of surgical anaesthesia and motor block with levobupivacaine [6,7]. The more rapid offset of levobupivacaine is likely due to its faster clearance of the unbound drug, as supported by the pharmacokinetic findings of Kopacz DJ et al., [18]. This pharmacological characteristic promotes earlier return of motor function and may be especially beneficial in surgical contexts where early postoperative mobilisation is desired.

The current study also found that levobupivacaine produced a shorter duration of effective analgesia compared with bupivacaine. This observation is consistent with previous findings by Guler G et al., and Gautier P et al., who similarly reported shorter analgesic duration with levobupivacaine [6,19]. While this may require earlier postoperative analgesic supplementation, the benefit of quicker sensory and motor recovery supports earlier ambulation. As such, levobupivacaine may be particularly advantageous in ambulatory or short-stay procedures where rapid recovery is prioritised.

With respect to haemodynamic stability, levobupivacaine demonstrated a clear advantage in the present study, with significantly fewer episodes of hypotension (9.6%) compared with bupivacaine (45.1%). This finding aligns with the results of Singh A et al., [15], who also observed lower rates of hypotension with levobupivacaine. Erdil F et al., reported similar outcomes, noting hypotension in 10% of patients receiving levobupivacaine versus 30% with bupivacaine [5]. The greater incidence of hypotension associated with bupivacaine may be attributed to its higher potency and stronger sympathetic blockade [19]. Together, these findings underscore levobupivacaine's favourable cardiovascular profile, making it a safer alternative for patients at risk of haemodynamic fluctuations.

The current study's findings are further supported by ASS A et al., who compared hyperbaric bupivacaine 10 mg with hyperbaric levobupivacaine 10 mg (supplemented by fentanyl) in elective caesarean sections [20]. They similarly found that both drugs produced comparable onset of sensory and motor block with similar maternal haemodynamic outcomes. However, consistent with the current study, they reported shorter durations of sensory and motor blockade with levobupivacaine, while bupivacaine provided a longer-lasting analgesic effect.

Additional support for the favourable recovery profile of levobupivacaine comes from Bidikar M et al., who compared levobupivacaine 10 mg with levobupivacaine 7.5 mg (supplemented by fentanyl). Their results showed that reduced dosing of levobupivacaine contributed to shorter motor block duration and earlier ambulation, without compromising haemodynamic stability [21]. This aligns with present study's findings that levobupivacaine tends to facilitate a faster return of motor function.

Bremerich DH et al., also compared hyperbaric bupivacaine and levobupivacaine and found that levobupivacaine consistently

produced shorter and less intense motor blockade while still providing adequate sensory anaesthesia for surgery [22]. Notably, none of the participants in their study experienced pain during surgery, indicating that the shorter motor block associated with levobupivacaine does not compromise anaesthetic effectiveness. Their findings further highlight the tendency of levobupivacaine to support earlier motor recovery, a trend that is reflected in the present study.

Taken together, these findings indicate that while hyperbaric bupivacaine offers longer-lasting anaesthesia and postoperative analgesia, levobupivacaine provides superior haemodynamic stability and more rapid postoperative recovery. Both agents demonstrate excellent efficacy for anaesthesia for infraumbilical surgeries; however, the choice of agent may be guided by clinical priorities- whether prolonged analgesia (favouring bupivacaine) or early ambulation and improved cardiovascular safety (favouring levobupivacaine) is desired.

Limitation(s)

The study was conducted at a single centre, which may limit the generalisability of the findings to broader populations, despite adequate sample size for the intended comparisons. Follow-up was restricted to the immediate postoperative period, preventing assessment of long-term recovery outcomes or late complications. Sensory and motor block assessments, although standardised, involve subjective clinical judgment and may introduce observer bias. Finally, the inclusion of only ASA I-II patients limits the applicability of the results to higher-risk populations, such as elderly or medically compromised individuals.

CONCLUSION(S)

In the present study, both hyperbaric bupivacaine and hyperbaric levobupivacaine provided effective spinal anaesthesia for infraumbilical surgeries, with comparable onset of sensory and motor blockade. However, bupivacaine produced a significantly longer duration of sensory block, motor block, and postoperative analgesia. In contrast, levobupivacaine offered superior haemodynamic stability and quicker recovery of motor function, enabling earlier ambulation. These findings suggest that levobupivacaine may be particularly advantageous in short-duration or ambulatory infraumbilical procedures where rapid recovery is desirable, while bupivacaine remains a strong choice for surgeries requiring prolonged postoperative analgesia. Overall, both agents demonstrated reliable efficacy and safety within the context of infraumbilical surgical anaesthesia.

REFERENCES

[1] Wilson JP, Bonin B, Quinones C, Kumbhare D, Guthikonda B, Hoang S. Spinal anesthesia for awake spine surgery: A paradigm shift for enhanced recovery after surgery. J Clin Med. 2024;13:5326.
[2] Chinachoti T, Tritrakarn T. Prospective study of hypotension and bradycardia during spinal anesthesia with bupivacaine: Incidence and risk factors, part two. J Med Assoc Thai. 2007;90:492-501.
[3] Morrison SG, Dominguez JJ, Frascarolo P, Reiz S. A comparison of the electrocardiographic cardiotoxic effects of racemic bupivacaine, levobupivacaine, and ropivacaine in anesthetized swine. Anesth Analg. 2000;90:1308-14.
[4] McLeod GA. Density of spinal anaesthetic solutions of bupivacaine, levobupivacaine, and ropivacaine with and without dextrose. Br J Anaesth. 2004;92:547-51.
[5] Erdil F, Bulut S, Demirbilek S, Gedik E, Gulhas N, Ersoy MO. The effects of intrathecal levobupivacaine and bupivacaine in the elderly. Anaesthesia. 2009;64:942-46.
[6] Guler G, Cakir G, Ulgey A, Ugur F, Bicer C, Gunes I, et al. A comparison of spinal anesthesia with levobupivacaine and hyperbaric bupivacaine for cesarean sections: A randomized trial. Open J Anesthesiol. 2012;2:84-89.
[7] Şahin AS, Türker G, Bekar A, Bilgin H, Korfalı G. A comparison of spinal anesthesia characteristics following intrathecal bupivacaine or levobupivacaine in lumbar disc surgery. Eur Spine J. 2014;23:695-700.
[8] Gupta R, Agrawal J, Goyal P, Putta S, Tarachandani B. To compare the efficacy of hyperbaric levobupivacaine (0.5%) versus hyperbaric bupivacaine (0.5%) in the subarachnoid block for infraumbilical surgeries. Asian Journal of Medical Sciences. 2024;15(12):45-50. https://doi.org/10.71152/ajms.v15i12.4311.
[9] Alley EA, Kopacz DJ, McDonald SB, Liu SS. Hyperbaric spinal levobupivacaine: A comparison to racemic bupivacaine in volunteers. Anesth Analg. 2002;94(1):188-93, table of contents. doi: 10.1097/00000539-200201000-00036. PMID: 11772826.
[10] Oraon P, Hembrom B, Kumar M, Ram B, Lakra L. Comparative study between intrathecal 0.5% isobaric levobupivacaine, 0.5% isobaric ropivacaine, and 0.5% hyperbaric bupivacaine in elective lower segment cesarean section: A randomized clinical study. Anesth Essays Res. 2022;16(2):238-43. Doi: 10.4103/aer.aer_60_22. Epub 2022 Oct 7. PMID: 36447919; PMCID: PMC9701329.
[11] Piacherski V, Muzyka L. Comparison of the efficacy of 0.5% isobaric bupivacaine, 0.5% levobupivacaine, and 0.5% hyperbaric bupivacaine for spinal anesthesia in lower limb surgeries. Sci Rep. 2023;13(1):2736. Doi: 10.1038/s41598-023-29711-9. PMID: 36792639; PMCID: PMC9932064).
[12] Mathanagopal PK, Sekaran PK, Theresa MJ, Subramanian S, Ravi B, Anoumandane A. A comparative evaluation of hyperbaric levobupivacaine versus hyperbaric bupivacaine for elective infraumbilical surgeries under spinal anaesthesia. Natl Board Examin J Med Sci. 2025;3(11):1392-402. Doi: 10.61770/NBEJMS.2025.v.
[13] Nayak K, Nigam RK, Tiwari Y. To compare the clinical efficacy and safety of 0.5% hyperbaric levobupivacaine with 0.5% hyperbaric bupivacaine in elective infraumbilical surgeries under spinal anaesthesia. Int J Dent Med Sci Res. 2025;7(3):266-77. Doi: 10.35629/6018-0703266277.
[14] Kalbande JV, Kukanti C, Karim HM, Sandeep G, Dey S. The efficacy and safety of spinal anesthesia with hyperbaric ropivacaine 0.75% and bupivacaine 0.5% in patients undergoing infra-umbilical surgeries: A randomized, double-blind study [Internet]. Cureus. 2024 Mar 26 [cited 2025 Dec 06];16(3):e57005.
[15] Singh A, Gupta A, Datta PK, Pandey M. Intrathecal levobupivacaine versus bupivacaine for inguinal hernia surgery: A randomized controlled trial. Korean J Anesthesiol. 2018;71(3):220-25. Doi: 10.4097/kja.d.18.27191. Epub 2018 Apr 24. PMID: 29684982; PMCID: PMC5995016.
[16] Glaser C, Marhofer P, Zimpfer G, Heinz MT, Sitzwohl C, Kapral S, et al. Levobupivacaine versus racemic bupivacaine for spinal anesthesia. Anesth Analg. 2002;94:194-98.
[17] Cuvas O, Gulec H, Karaaslan M, Basar H. The use of low dose plain solutions of local anaesthetic agents for spinal anaesthesia in the prone position: Bupivacaine compared with levobupivacaine. Anaesthesia. 2009;64:14-18.
[18] Kopacz DJ, Allen HW, Thompson GE. A comparison of epidural levobupivacaine 0.75% with racemic bupivacaine for lower abdominal surgery. Anesth Analg. 2000;90(3):642-48. Doi: 10.1097/00000539-200003000-00026.
[19] Gautier P, De Kock M, Huberty L, Demir T, Izydorczic M, Vanderick B. Comparison of the effects of intrathecal ropivacaine, levobupivacaine, and bupivacaine for Caesarean section. Br J Anaesth. 2003;91:684-89.
[20] ASS A, V TK, Alalamath S. Comparative efficacy of intrathecal hyperbaric levobupivacaine with fentanyl versus hyperbaric bupivacaine with fentanyl in elective cesarean section. Cureus. 2024;16(9):e70476. Doi: 10.7759/cureus.70476.
[21] Bidikar M, Mudakanagoudar MS, Santhosh MC: Comparison of intrathecal levobupivacaine and levobupivacaine plus fentanyl for cesarean section. Anesth Essays Res. 2017;11:495-98. Doi: 10.4103/aer.AER_16_17.
[22] Bremerich DH, Fetsch N, Zwissler BC, Meininger D, Gogarten W, Byhahn C. Comparison of intrathecal bupivacaine and levobupivacaine combined with opioids for caesarean section. Curr Med Res Opin. 2007,23:3047-54. Doi: 10.1185/030079907X242764.

PARTICULARS OF CONTRIBUTORS:
1. Resident, Department of Anaesthesia, Government Medical College, Gondia, Maharashtra, India.
2. Associate Professor, Department of Anaesthesia, Government Medical College, Gondia, Maharashtra, India.
3. Associate Professor, Department of Anaesthesia, Government Medical College, Gondia, Maharashtra, India.
4. Senior Resident, Department of Anaesthesia and Pain, Government Medical College, KTS Hospital, Gondia, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Dipakkumar Hiralal Ruparel,
GMC and KTS Hospital, Nehru Chowk Gondia, Maharashtra, India.
E-mail: drdruparel@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Nov 10, 2025
- Manual Googling: Dec 08, 2025
- iThenticate Software: Dec 10, 2025 (11%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Nov 07, 2025**
Date of Peer Review: **Nov 25, 2025**
Date of Acceptance: **Dec 12, 2025**
Date of Publishing: **Mar 01, 2026**