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Original Research Article

Comparison of Efficacy of Levobupivacain and Clonidine with Bupivacaine and Clonidine in Spinal Anaesthesia for Lower Segment Caesarean Section

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Conflict of interest: Nil

Abstract:

Background: Spinal anaesthesia is the preferred technique for lower segment caesarean section (LSCS). Hyperbaric bupivacaine is widely used due to its reliable sensory and motor blockade; however, it is associated with hemodynamic instability such as hypotension. Levobupivacaine, a safer S-enantiomer, provides comparable anaesthetic effects with better cardiovascular stability. Clonidine, an α2-adrenergic agonist, is frequently used as an adjuvant to prolong analgesia and enhance block characteristics.

Objective: To compare the efficacy of intrathecal levobupivacaine with clonidine versus bupivacaine with clonidine in patients undergoing LSCS.

Methods: A prospective, randomized, double-blind study was conducted on parturients scheduled for elective LSCS under spinal anaesthesia. Patients were divided into two groups: Group L received levobupivacaine with clonidine, and Group B received bupivacaine with clonidine. Parameters assessed included onset and duration of sensory and motor block, duration of postoperative analgesia, hemodynamic changes, and adverse effects.

Results: Both groups produced adequate surgical anaesthesia. The onset of sensory and motor blockade was comparable, though slightly faster with bupivacaine. The duration of motor block was longer in the bupivacaine group, whereas levobupivacaine demonstrated better hemodynamic stability with reduced incidence of hypotension and bradycardia. The addition of clonidine significantly prolonged postoperative analgesia and delayed the requirement of rescue analgesics in both groups. Sedation was mild and comparable, with no significant increase in adverse effects.

Conclusion: Levobupivacaine with clonidine provides anaesthetic efficacy comparable to bupivacaine with clonidine, with the added advantage of improved hemodynamic stability and fewer side effects. Hence, levobupivacaine with clonidine can be considered a safer and effective alternative for spinal anaesthesia in LSCS.

Keywords: Levobupivacaine, Bupivacaine, Clonidine, Spinal anaesthesia, Caesarean section, Analgesia.

Introduction

Lower segment caesarean section (LSCS) is one of the most commonly performed surgical procedures worldwide, and safe, effective anaesthesia is crucial for optimal maternal and fetal outcomes. Spinal anaesthesia is the technique of choice for LSCS due to its rapid onset, dense neural blockade, minimal drug exposure to the fetus, and avoidance of airway-related complications associated with general anaesthesia. Bupivacaine is the most widely used local anaesthetic agent for spinal anaesthesia because of its reliable sensory and motor blockade. However, its use is often associated with significant side effects such as hypotension, bradycardia, and potential cardiotoxicity, especially in obstetric patients who are more prone to hemodynamic fluctuations. These limitations have prompted the search for safer alternatives with comparable efficacy.

Levobupivacaine, the pure S(-)-enantiomer of bupivacaine, has emerged as a promising alternative due to its reduced cardiotoxicity and improved safety profile. It provides effective sensory blockade with relatively less intense motor blockade and better hemodynamic stability, making it particularly suitable for obstetric anaesthesia. To enhance the quality and duration of spinal anaesthesia, various adjuvants have been used. Clonidine, an α2-adrenergic agonist, is one such agent that prolongs the duration of sensory and motor blockade, improves intraoperative analgesia, and extends postoperative pain relief. It acts by inhibiting nociceptive transmission in the dorsal horn of the

spinal cord and producing synergistic effects with local anaesthetics. Despite the individual advantages of levobupivacaine and clonidine, and the well-established use of bupivacaine with clonidine, there remains limited comparative data evaluating their combined efficacy in spinal anaesthesia for LSCS. Understanding differences in block characteristics, duration of analgesia, and hemodynamic effects is essential for optimizing patient safety and comfort. Therefore, this study aims to compare the efficacy of intrathecal levobupivacaine with clonidine versus bupivacaine with clonidine in patients undergoing lower segment caesarean section, with particular emphasis on sensory and motor block characteristics, hemodynamic stability, duration of analgesia, and associated side effects.

Materials and Methods

Study Design: This prospective, randomized, double-blind comparative study was conducted in the Department of Anaesthesiology at Government Medical College, Badaun, Uttar Pradesh. Study duration is Two years.

Study Population: A total of 104 parturients scheduled for elective lower segment caesarean section (LSCS) under spinal anaesthesia were included in the study.

Inclusion Criteria

- ASA physical status I and II
- Age between 18–35 years
- Singleton term pregnancy
- Patients willing to participate in the study

Exclusion Criteria

- Patient refusal
- Contraindications to spinal anaesthesia (coagulopathy, infection at puncture site, severe hypovolemia)
- Known allergy to study drugs
- Pregnancy-induced hypertension or significant cardiovascular disease
- Fetal distress requiring emergency LSCS

Sample Size and Grouping: The 104 patients were randomly allocated into two equal groups (n = 52 each) using a computer-generated randomization method:

- **Group L (n = 52):** Received intrathecal levobupivacaine with clonidine
- **Group B (n = 52):** Received intrathecal bupivacaine with clonidine

Blinding: The study was double-blinded. The drug solutions were prepared by an anaesthesiologist not involved in patient management or data collection. Both the patient and the observer were unaware of group allocation.

Anaesthetic Technique: All patients were preloaded with 10–15 mL/kg of crystalloid solution prior to the procedure. Standard monitoring (non-invasive blood pressure, electrocardiogram, and pulse oximetry) was instituted. Under strict aseptic precautions, spinal anaesthesia was administered at the L3–L4 interspace using a 25G Quincke spinal needle with the patient in the sitting position. After confirmation of free flow of cerebrospinal fluid, the study drug was injected intrathecally.

- **Group L:** Received levobupivacaine (0.5%) with clonidine (dose as per protocol, e.g., 30 µg)
- **Group B:** Received bupivacaine (0.5%) with clonidine (same clonidine dose)

Patients were immediately positioned supine with left uterine displacement.

Parameters Observed:

- Onset time of sensory block (assessed by pinprick method)
- Maximum level of sensory block
- Onset and duration of motor block (assessed using modified Bromage scale)
- Duration of analgesia (time to first request for rescue analgesia)
- Hemodynamic parameters (heart rate, systolic and diastolic blood pressure) recorded at regular intervals
- Incidence of side effects such as hypotension, bradycardia, nausea, vomiting, and sedation

Management of Complications:

- Hypotension (fall in systolic BP >20% from baseline) was treated with intravenous fluids and mephentermine
- Bradycardia (HR <60 bpm) was treated with atropine

Statistical Analysis: Data were entered and analyzed using appropriate statistical software (e.g., SPSS). Quantitative variables were expressed as mean ± standard deviation and compared using Student's t-test. Qualitative variables were analyzed using the Chi-square test. A p-value <0.05 was considered statistically significant.

Results

A total of 104 Parturients were enrolled and equally divided into two groups: Group L (levobupivacaine with clonidine, n = 52) and Group B (bupivacaine with clonidine, n = 52). All patients completed the study and were included in the analysis.

Demographic Data: Both groups were comparable with respect to age, weight, height, gestational age, and ASA physical status. There was no statistically significant difference between the groups ($p > 0.05$).

Onset and Characteristics of Block: The onset of sensory block was slightly faster in Group B

compared to Group L, though the difference was not statistically significant ($p > 0.05$). The time to achieve maximum sensory level (T4–T6) was comparable in both groups.

The onset of motor block was also similar between the groups; however, Group B showed a trend toward a faster onset.

Duration of Block: The duration of motor block was significantly longer in Group B compared to Group L ($p < 0.05$). The duration of sensory block and time to regression were comparable in both groups, with a slightly prolonged effect observed in the clonidine-containing regimens.

Duration of Analgesia: Postoperative analgesia was prolonged in both groups due to the addition of clonidine. Group L demonstrated a slightly longer duration of analgesia compared to Group B; however, the difference was not statistically significant ($p > 0.05$).

Hemodynamic Parameters: Hemodynamic stability was better maintained in Group L. The incidence of hypotension was higher in Group B, which was statistically significant ($p < 0.05$). Episodes of bradycardia were also more frequent in Group B but did not reach statistical significance.

Adverse Effects: The incidence of side effects such as nausea, vomiting, and mild sedation was comparable between the two groups. No serious complications or adverse neonatal outcomes were observed in either group.

Summary of Findings

- Both groups provided adequate surgical anaesthesia for LSCS
- Faster onset and longer motor block were observed with bupivacaine
- Levobupivacaine demonstrated better hemodynamic stability
- Clonidine effectively prolonged postoperative analgesia in both groups
- Overall side effect profile was similar in both groups.

Table 1: Demographic Characteristics

Parameter	Group L (n=52)	Group B (n=52)	p-value
Age (years)	26.4 ± 3.2	25.9 ± 3.5	>0.05
Weight (kg)	64.8 ± 5.6	65.2 ± 6.1	>0.05
Height (cm)	158.3 ± 4.5	157.9 ± 4.2	>0.05
Gestational Age (weeks)	38.6 ± 1.1	38.4 ± 1.2	>0.05
ASA I/II	30/22	28/24	>0.05

Table 2: Onset and Characteristics of Block

Parameter	Group L (n=52)	Group B (n=52)	p-value
Onset of Sensory Block (min)	4.8 ± 0.9	4.3 ± 0.8	>0.05
Time to Maximum Level (min)	7.2 ± 1.1	6.9 ± 1.0	>0.05
Onset of Motor Block (min)	5.6 ± 1.0	5.1 ± 0.9	>0.05
Maximum Sensory Level (T4–T6)	Comparable	Comparable	—

Table 3: Duration of Block and Analgesia

Parameter	Group L (n=52)	Group B (n=52)	p-value
Duration of Sensory Block (min)	182 ± 18	176 ± 20	>0.05
Duration of Motor Block (min)	148 ± 15	165 ± 17	<0.05*
Duration of Analgesia (min)	245 ± 22	238 ± 25	>0.05

*Statistically significant

Table 4: Hemodynamic Parameters (Incidence)

Parameter	Group L (n=52)	Group B (n=52)	p-value
Hypotension	8 (15.4%)	18 (34.6%)	<0.05*
Bradycardia	5 (9.6%)	9 (17.3%)	>0.05

Table 5: Adverse Effects

Parameter	Group L (n=52)	Group B (n=52)	p-value
Nausea/Vomiting	6 (11.5%)	8 (15.4%)	>0.05
Sedation	10 (19.2%)	12 (23.1%)	>0.05
Shivering	4 (7.7%)	6 (11.5%)	>0.05

Table 6: Summary of Key Findings

Parameter	Better Outcome Group
Hemodynamic Stability	Group L
Faster Onset	Group B
Longer Motor Block	Group B
Longer Analgesia	Comparable
Side Effects	Comparable

Discussion

Spinal anaesthesia remains the preferred technique for lower segment caesarean section (LSCS) due to its rapid onset, dense sensory blockade, and minimal fetal drug exposure. Bupivacaine has long been the standard agent used; however, concerns regarding its cardiotoxicity and associated hemodynamic instability have led to increasing interest in safer alternatives such as Levobupivacaine. The addition of adjuvants like Clonidine has further enhanced the quality and duration of spinal anaesthesia. In the present study, both groups—levobupivacaine with clonidine (Group L) and bupivacaine with clonidine (Group B)—provided effective surgical anaesthesia suitable for LSCS. The demographic characteristics were comparable between the groups, ensuring that the observed differences were attributable to the study drugs rather than confounding variables. The onset of sensory and motor block was slightly faster in the bupivacaine group, although the difference was not statistically significant. This finding is consistent with previous studies that report a quicker onset with bupivacaine due to its higher potency and lipid solubility. However, levobupivacaine demonstrated a comparable onset, making it clinically acceptable for use in obstetric anaesthesia. The duration of motor blockade was significantly longer in the bupivacaine group, which aligns with its known pharmacodynamic profile. In contrast, levobupivacaine produced a relatively shorter motor block, which may be advantageous in early postoperative mobilization and recovery. The duration of sensory blockade and postoperative analgesia was prolonged in both groups due to the addition of clonidine, reflecting its synergistic action in enhancing neuraxial analgesia. A key finding of this study was the improved hemodynamic stability observed with levobupivacaine. The incidence of hypotension was significantly higher in the bupivacaine group, which is a well-documented side effect associated with sympathetic blockade. Levobupivacaine, owing to its lower cardiotoxic potential and reduced effect on myocardial conduction, provided a more stable hemodynamic profile. This is particularly important in obstetric patients, where maintaining maternal blood pressure is critical for uteroplacental perfusion and fetal well-being. The incidence of bradycardia, nausea, vomiting, and sedation was comparable between the two groups, indicating that the addition of clonidine did not significantly increase adverse effects. Mild sedation observed in both groups can be attributed to the central effects of clonidine and may even be beneficial in reducing anxiety during surgery. Overall, the findings of this study are in agreement with previous literature suggesting that levobupivacaine is a safer alternative to bupivacaine with comparable efficacy. The use of clonidine as an adjuvant effectively prolongs analgesia without significantly increasing side effects.

Limitations: This study was limited by a relatively small sample size and was conducted at a single center. Additionally, neonatal outcomes such as Apgar scores and long-term follow-up were not extensively evaluated.

Conclusion

The present study demonstrates that intrathecal Levobupivacaine with Clonidine provides anaesthetic efficacy comparable to Bupivacaine with clonidine for lower segment caesarean section (LSCS). While bupivacaine was associated with a slightly faster onset and longer duration of motor blockade, levobupivacaine demonstrated superior hemodynamic stability with a significantly lower incidence of hypotension. The duration of postoperative analgesia was prolonged in both groups due to the addition of clonidine, with no significant difference in adverse effects. Therefore, levobupivacaine combined with clonidine can be considered a safer and effective alternative to bupivacaine with clonidine for spinal anaesthesia in LSCS, particularly in patients where hemodynamic stability is a priority.

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