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Original Research Paper

Anaesthesiology

A COMPARATIVE STUDY OF 0.1% LEVOBUPIVACAINE VERSUS 0.1% ROPIVACAINE WITH NALBUPHINE IN LABOR ANALGESIA

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ABSTRACT

Background And Aim: Levobupivacaine and ropivacaine are most widely used local anesthetics for the purpose of labor analgesia as it offers prolonged analgesia with minimal motor blockade. This study aimed to compare the onset, duration, efficacy, and safety of 0.1% levobupivacaine with nalbuphine versus 0.1% ropivacaine with nalbuphine in labor analgesia. **Methods:** A randomized controlled trial was conducted on 72 ASA II primigravida parturient aged 18–35 years. Patients were assigned to receive either 0.1% levobupivacaine with 5 mg nalbuphine (Group LN) or 0.1% ropivacaine with 5 mg nalbuphine (Group RN) via epidural route. Onset time, analgesia duration, pain scores (NRS), motor block (Modified Bromage Scale), maternal hemodynamics, neonatal Apgar scores, and adverse events were evaluated. **Results:** Group LN demonstrated a significantly faster onset of analgesia (4.6 ± 0.25 min vs 5.6 ± 0.24 min; $p < 0.01$) and longer analgesia duration (135.2 ± 12.5 min vs 120.8 ± 9.7 min; $p < 0.01$) than Group RN. Pain scores were consistently lower in Group LN ($p < 0.01$ from 15 min onward). Hemodynamic stability was superior in Group LN, while motor block, neonatal outcomes, and adverse events were comparable in both groups. **Conclusion:** Epidural levobupivacaine 0.1% with nalbuphine offers faster onset, longer and more effective analgesia, and better hemodynamic control than ropivacaine 0.1% with nalbuphine, with similar safety profiles.

KEYWORDS : Levobupivacaine, Ropivacaine, Nalbuphine, Labor analgesia

INTRODUCTION

Labor pain is a unique and intense physiological experience that demands effective pain management to improve maternal satisfaction and neonatal outcomes. Epidural analgesia remains the gold standard due to its superior efficacy and safety. Levobupivacaine and ropivacaine, both long-acting amide local anesthetics, provide sensory analgesia with minimal motor block and reduced cardiotoxicity compared to bupivacaine. Nalbuphine, a mixed kappa agonist and mu antagonist opioid, enhances analgesia while limiting opioid-related adverse effects. The current study aimed to compare levobupivacaine-nalbuphine and ropivacaine-nalbuphine combinations for labor analgesia.

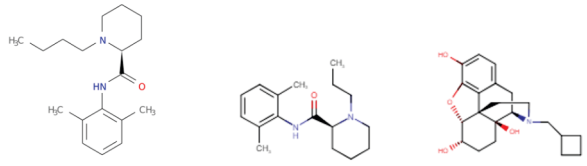

Fig 1. Chemical structure of (left) levo-bupivacaine, (centre) Ropivacaine, (right) Nalbuphine

METHODS

Study Design And Participants: This randomized controlled study was conducted at MGM Hospital, Navi Mumbai, from September 2022 to November 2023, after institutional ethics committee approval and written informed consent. Seventy-two ASA II primigravida parturient aged 18-35 years with term, uncomplicated pregnancies requesting epidural analgesia were enrolled.

Exclusion Criteria: Patients with previous cesarean section, allergy to study drugs, psychiatric disorders, spinal deformity, or refusal for labor analgesia were excluded.

Randomization And Interventions: Participants were randomized using sealed opaque envelopes into two groups of 36 each. Group LN received 10 ml solution containing 0.1% levobupivacaine with 5 mg nalbuphine, while Group RN received 10 ml solution containing 0.1% ropivacaine with 5 mg nalbuphine.

Procedure: Following standard monitoring, preload with Ringer's lactate was administered. Epidural catheterization was performed at L2-L3 or L3-L4 levels under aseptic precautions. Drug administration was done after confirming correct placement.

Outcome Measures:

1. Onset of analgesia (time from injection to Numerical Rating Score (NRS) ≤3). Refer Fig 1.
2. Duration of analgesia (onset of analgesia to first request for rescue analgesia)
3. Pain scores (NRS 0-10) at predefined intervals: 1min, 15min, 30min, 45min, 60min, 75min, 90min.
4. Motor block (Modified Bromage Scale). Refer Table 1.
5. Hemodynamic parameters (Blood Pressure (BP), Heart Rate (HR) every 15 min till 90min)
6. Adverse events

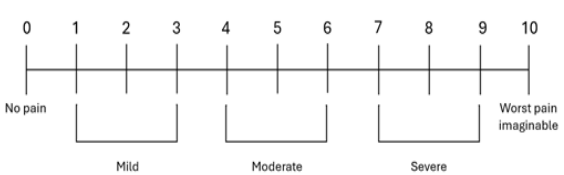

Fig 2: Numerical Rating Score

Statistical Analysis: Data were analyzed using appropriate statistical tests. A p-value <0.05 was considered significant.

Table 1: Modified Bromage Score

Bromage 0	Patient is able to move hip, knee and ankle
Bromage 1	Patient is unable to move hip, but able to move knee and ankle
Bromage 2	Patient unable to move hip and knee, but able to move ankle
Bromage 3	Patient unable to move knee, hip and ankle

RESULTS

In terms of demographic data there was no significant difference between both the groups as displayed in Table 2.

Table 2: Demographic data (Mean ± SD)

Parameters	Group RN	Group LN	t-stat	p-value
Height (cm)	161.8 ± 3.4	159.4 ± 4.2	2.67	0.21
Weight (kg)	70.1 ± 8.8	73.4 ± 7.7	1.69	0.06
Age (years)	28.3 ± 4.2	27.9 ± 5.0	0.37	0.20
Gestational Age (weeks)	38.5 ± 2.0	38.4 ± 2.1	0.21	0.61

The onset time of analgesia between the two groups (4.6 minutes for Group LN versus 5.6 minutes for Group RN), suggests that the onset time is significantly shorter in the Group LN compared to Group RN. Refer Fig 3.

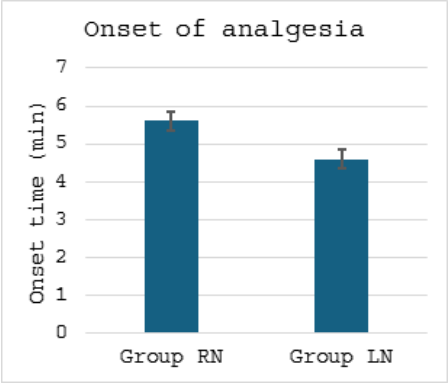

Fig 3: Onset of analgesia

The mean duration of analgesia for Group LN (135.3 ± 12.5 minutes) and Group RN (120.8 ± 9.7 minutes) indicates that levobupivacaine provides a longer duration of analgesia. Refer Table 3.

Table 3 : Duration Of Analgesia

Group	Mean ± SD	t-stat	p-value
Group RN	120.8 ± 9.7	-5.46	< 0.01
Group LN	135.2 ± 12.5		

The pain scores at different intervals (Fig 4) between both the groups suggest that initially at 1 minute there was no significant difference between both the groups. But at subsequent time intervals (15min to 90min) the pain scores were consistently lower for Group LN. As time progressed, pain score decreased in both the groups, but the decrease was more pronounced in Group LN, suggesting that levobupivacaine provides superior analgesia.

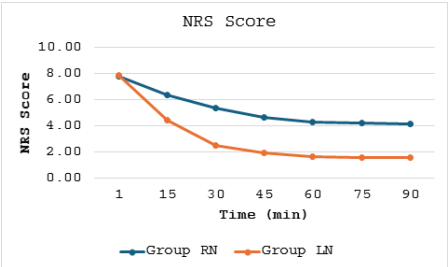

Fig 4: Numerical Rating Score (NRS)

The systolic and diastolic blood pressure measurements (Fig 5 and Fig 6) at various time intervals in both the groups suggest that initially at 1 minute both the groups had similar values, but at subsequent time intervals, Group RN shows drastic decline while Group LN exhibits steady and gradual reduction in values. This suggests that Group LN has a better hemodynamic response.

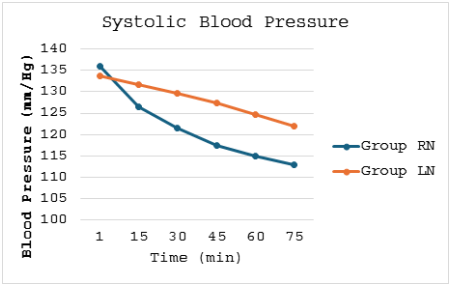

Fig 5: Systolic Blood Pressure measurements

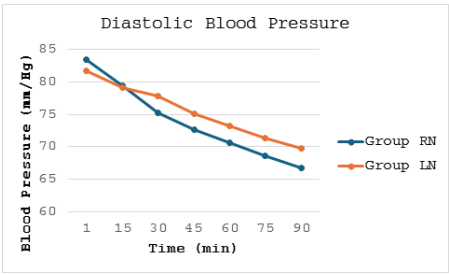

Fig 6: Diastolic Blood Pressure measurements

The heart rate measurements (Fig 7) initially at 1 minute show no significant difference, but at subsequent time intervals the heart rate consistently decrease in both the groups. But Group LN has better control over heart rate during labor implying that it is more effective in maintaining cardiovascular stability.

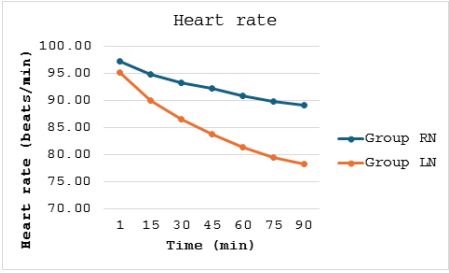

Fig 7: Heart rate measurements

The data distribution suggests that higher level of motor blockade were observed in Group LN as compared to Group RN (Fig 8). Group LN had higher number of individuals with complete/severe motor blockade (Bromage 2 and 3); while Group RN had more individuals with partial/no motor blockade (Bromage 0 and 1).

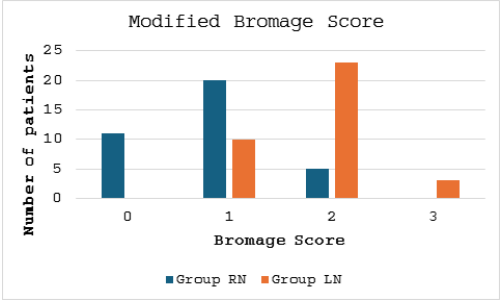

Fig 8: Modified Bromage Score measurement for Motor Blockade

Group RN tends to have higher incidence of adverse effects listed in Table 4.

Table 4: Adverse Effects In Group LN And Group RN

Adverse Effect	Group RN	Group LN
Hypotension n (%)	7 (19.4)	4 (11.1)
Nausea/vomiting n (%)	3 (8.3)	1 (2.8)
Pruritus n (%)	2 (5.5)	0
Urinary retention n (%)	6 (16.7)	2 (5.6)
Postpartum Hemorrhage n (%)	4 (11.1)	1 (2.8)

DISCUSSION

The present study demonstrated that 0.1% levobupivacaine with nalbuphine offers superior analgesic efficacy compared to 0.1% ropivacaine with nalbuphine. Faster onset and longer duration of analgesia observed with levobupivacaine may be attributed to its pharmacological profile, including higher lipid solubility and protein binding. Nalbuphine's kappa agonism contributed to effective visceral pain control while minimizing opioid-induced side effects.

Ropivacaine, though effective, exhibited slightly delayed onset and shorter duration of analgesia. Hemodynamic fluctuations were more pronounced with ropivacaine, possibly due to its differential nerve block and systemic absorption characteristics. Both groups maintained motor function, neonatal well-being, and demonstrated excellent safety profiles.

In the study by Kaur et al, the onset of analgesia was significantly shorter with levobupivacaine (11.16 ± 1.86 min) than ropivacaine (12.24 ± 1.30 min; $p < 0.05$). The duration of analgesia was also longer in the levobupivacaine group (172.16 ± 21.25 min vs 158.52 ± 25.58 min; $p < 0.05$).

Similar study conducted by Atienzar et al, observed that Advent of adverse effects were reduced in Group LN as compared to Group RN. 8.8% of the total patients in Group RN developed nausea and pruritus as compared to none in Group LN.

These findings are consistent with previous studies reporting comparable efficacy of levobupivacaine and ropivacaine but suggest a clinical advantage of levobupivacaine in terms of faster onset and prolonged analgesia when combined with nalbuphine.

CONCLUSION

Epidural administration of 0.1% levobupivacaine with nalbuphine provides superior onset, extended duration of analgesia, better pain relief, and improved hemodynamic stability compared to 0.1% ropivacaine with nalbuphine for labor analgesia, without compromising maternal or neonatal safety.

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