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ORIGINAL ARTICLE

Combined Spinal–epidural with Levobupivacaine or Ropivacaine with Fentanyl for Labor Analgesia: A Comparative Study

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ABSTRACT

Introduction: Combined spinal–epidural analgesia to provide pain relief in labor has become the technique of choice. It provides benefits of both spinal analgesia and flexibility of an epidural catheter. In this study, we compared levobupivacaine with fetanyl and ropivacaine with fentanyl in terms of onset and duration of sensory blockade.

Materials and methods: This was a double-blind randomized study on 60 parturients of American Society of Anesthesiologists status 1 and 2, all primipara with singleton pregnancy in active labor, were allocated randomly into two groups of 30 each. Group L received 3 mg of levobupivacaine intrathecally with 25 µg fentanyl followed by epidural top-ups of 14 mL levobupivacaine 0.125% with fentanyl 30 µg, whereas group R received 4 mg of ropivacaine intrathecally with 25 µg of fentanyl followed by epidural top-ups of 14 mL ropivacaine 0.2% with fentanyl 30 µg. Sensory and motor characteristics, hemodynamics, maternal and fetal outcomes, side effects, and complications were observed and analyzed statistically using Student's unpaired t-test and chi-squared test.

Results: A rapid onset of analgesia in group L (4.67 ± 0.35) as compared with group R (5.57 ± 0.27) was observed. Duration of analgesia was also prolonged in group B (116.83 ± 6.91) as compared with group R (88.87 ± 5.10). Patients remained hemodynamically stable, and side effects and complications were comparable in both groups.

Conclusion: Levobupivacaine with fentanyl combination was found to be more promising in terms of onset and duration of labor analgesia as compared with ropivacaine and fentanyl combination.

Keywords: Fentanyl, Labor analgesia, Levobupivacaine, Ropivacaine.

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INTRODUCTION

Labor pains have been designated as the most severe kind of pains.[1] The result is a stress response in the mother along with various disorders in the mother, such as maternal hypertension, dystocia, and meconium staining.[2] An effective labor analgesia benefits both the mother and neonate. The aim of the current obstetric analgesia is to provide effective pain relief while minimizing motor blockade. Lowering the bupivacaine concentration in epidural infusion has reduced the occurrence of motor blockade, but even with dilute infusions, moderate-to-severe motor blockade has been shown to occur in almost 44% of women,[3] which reduces maternal satisfaction too.[4] Bupivacaine has been used extensively, but concerns about its cardiac toxicity and incidence of motor blockade led to the development of newer drugs, such as levobupivacaine and ropivacaine.[5,6] Collis et al[7] popularized the combined spinal–epidural (CSE) technique of labor analgesia, which involved an initial intrathecal injection of opioid (fentanyl) and local anesthetic (bupivacaine) to establish analgesia, and subsequent top-ups to restore and maintain analgesia. Addition of opioid produces a synergistic effect directly on opioid receptors in the spinal cord. Thus, they reduce the dose of local anesthetics and chances of their toxicity.[8] The dose of drugs is kept such that ambulation during labor is possible. Intrathecal component provides rapid onset and the epidural component provides flexibility of providing unlimited duration of analgesia. Various opioids that have been used in labor analgesia include morphine, meperidine, sufentanil, and fentanyl.[9] Fentanyl has the advantage of low cost, rapid onset, and a relatively long duration of analgesia without significant motor blockade. However, addition of opioids can produce pruritus, nausea, vomiting, fetal bradycardia, urinary retention, and maternal respiratory depression.[10]

The aim of the present study was to compare primarily levobupivacaine and ropivacaine with fentanyl in terms of onset and duration of sensory and motor blockade after intrathecal dose, maternal and fetal outcomes, side effects and complications, and maternal satisfaction score. Sia et al[11] have found levobupivacaine to be 1.31 times more potent than ropivacaine.

MATERIALS AND METHODS

After permission from the research ethical committee, the study was carried out on 60 parturients in labor, requesting painless labor. All patients were American Society of Anesthesiologists health status 1 and 2 with singleton pregnancy and vertex presentation. All patients were in active stage of labor (cervical dilatation >3 cm). They were randomly allocated in two groups of 30 each generated by the computer, and informed consent was taken.

Group L: Received 3 mg of isobaric levobupivacaine with 25 µg of fentanyl intrathecally followed by epidural top-ups of 14 mL 0.125% isobaric levobupivacaine and 30 µg of fentanyl, making the total volume 15 mL.

Group R: Received 4 mg isobaric ropivacaine and 25 µg fentanyl intrathecally followed by epidural top-ups of 14 mL of 0.2% isobaric ropivacaine and 30 µg fentanyl making total volume 15 mL.

A standardized technique was used. An intravenous infusion of 1 L of Ringer's lactate solution was started, and preloading was done with 10 mL/kg in 20 to 30 minutes. In sitting position, a no. 18 Tuohy needle was inserted at L2/3 or L3/4 intervertebral spaces. The epidural space was identified by loss of resistance to saline and a needle-through-needle (27G) technique was used to perform an intrathecal injection over 10 seconds. An epidural catheter was then passed leaving 3 cm in the epidural space. A single operator was involved in all cases (YKS) and position of catheter was checked by aspiration of blood or cerebrospinal fluid.

When cervical dilatation was more than 3 cm, basal heart rate, noninvasive blood pressure (BP), oxygen saturation, respiratory rate, elctrocardiogram, and fetal heart rate were recorded every 2 minutes for 10 minutes; thereafter, at every 5 minutes until 30 minutes; thereafter, every 15 minute until the end of study in both groups. The study period commenced after intrathecal injection. The time of first painless contraction was taken as the onset of analgesia. Epidural top-up bolus was given when the patient reported two consecutive contractions as being painful [visual analog scale (VAS) > 3]. Maternal hypotension was defined as the baseline fall of systolic blood pressure (SBP) of more than 20% and was treated by giving additional Ringer's lactate and, if necessary, injection ephedrine intravenously. Sensory testing to pinprick was performed at 2 minutes interval using a 22G blunt hypodermic needle for the first 20 minutes and every 5 minutes thereafter. Highest level of sensory block achieved was also noted. Motor blockade was assessed using modified Bromage scale at 5 minutes interval (0: full flexion of foot and knee, 1: just able to flex knees and free movement at hip, 2: able to move foot only, 3: unable to move foot or knee). Onset and duration of motor blockade were noted.

On indication of instrumental delivery, an epidural dose was repeated 15 minutes prior to the procedure in both the groups. In cases of the failed progress due to obstetric factors or fetal distress, cesarean section was performed by extending the block with 0.5% levobupivacaine in group L and 0.5% ropivacaine in group R.

Complications and side effects were documented. Obstetric outcome and Apgar score at 1, 5, and 10 minutes were recorded. Patient's satisfaction was also scaled at follow-up visits for 24 hours after the delivery (5: excellent, 4: very good, 3: good, 2: fair, 1: poor).

Statistical analysis was performed using "unpaired-*t*-test" for parametric data and "Chi-squared test" for nonparametric data; $p < 0.05$ was considered statistically significant and $p < 0.001$ was considered statistically highly significant.

RESULTS

Sixty patients were enrolled in the study. There was no technical problem with the administration of intrathecal study drugs or the placement of epidural catheter. All women commencing the study completed the study period successfully, and all were included in the subsequent statistical analysis. No statistical differences were detected with respect to demographic characteristics and baseline hemodynamic parameters (Tables 1 and 2). Sensory and motor blockade parameters were recorded (Table 3). Mean onset of analgesia was rapid in group L as compared with group B (Graph 1) and was statistically highly significant ($p < 0.001$). The highest sensory level reached by pinprick method was T5 in group L and T6 in group R ($p < 0.05$). The duration of analgesia after intrathecal dose (Graph 2) was longer in group L as compared with group R ($p < 0.001$). The mean number of epidural top-ups required in group L (1.20 ± 0.52) was significantly less as compared with group R (1.67 ± 0.44) ($p < 0.001$). The degree of motor blockade was assessed using modified

Table 1: Patient demographics

Variables	*Group L*	*Group R*	*p-value*	*Significance*
Age (years)	23.88 ± 2.13	23.88 ± 2.19	1.0000	NS
Height (cm)	152.70 ± 2.67	152.57 ± 2.47	0.8455	NS
Weight (kg)	64.02 ± 3.71	63.63 ± 3.76	0.6874	NS
Baseline VAS	8.93 ± 0.64	8.93 ± 0.69	1.0000	NS

NS: Non significant

Table 2: Baseline parameters

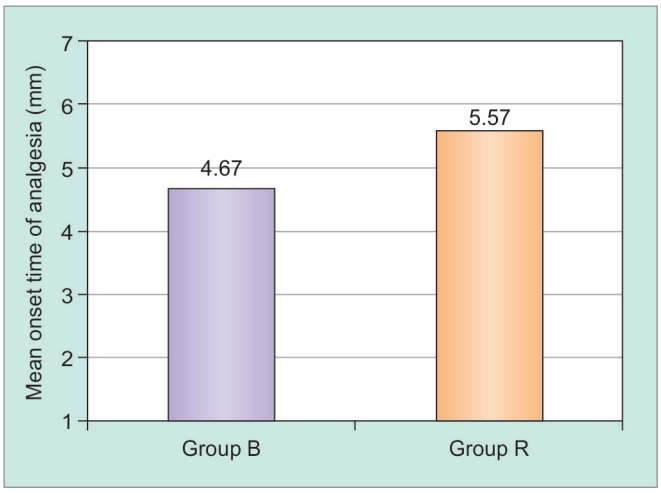
Parameters	*Group L*	*Group R*	*p-value*	*Significance*
Heart rate (beats/minute)	108.70 ± 5.55	107.70 ± 5.77	0.4966	NS
Respiratory rate (/minute)	22.37 ± 1.85	22.50 ± 1.72	0.7797	NS
SBP (mm Hg)	124.97 ± 3.33	124.73 ± 3.56	0.7884	NS
Diastolic BP (mm Hg)	77.23 ± 3.18	77.77 ± 4.19	0.5761	NS
SpO_2 (%)	98.73 ± 0.94	98.80 ± 0.89	0.7681	NS
Fetal heart rate (beats/minute)	134.63 ± 3.30	134.70 ± 3.80	0.9395	NS

NS: Non significant

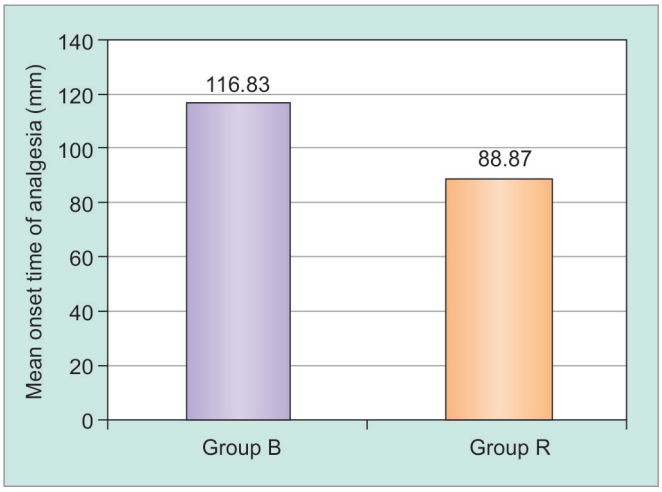
Table 3: Sensory and motor block parameters

Parameters	*Group L*	*Group R*	*p-value*	*Significance*
Onset of analgesia (minutes)	4.67 ± 0.34	5.57 ± 0.27	<0.0001	HS
Maximum sensory level achieved	T5	T6	0.03	S
Duration of analgesia after intrathecal dose (minutes)	116.83 ± 6.91	88.87 ± 5.10	<0.0001	HS
Motor block (Bromage >0)	5/30	4/30	0.76	NS
Number of epidural top-ups	1.20 ± 0.52	1.67 ± 0.44	<0.0001	HS

HS: Highly significant, NS: Non significant, S: Significant



Graph 1: Mean onset time of analgesia (minutes) in groups L and R



Graph 2: Mean duration of analgesia after intrathecal dose (minutes) in groups L and R

Table 4: Labor characteristics

Variable	*Group L*	*Group R*	*p-value*	*Significance*
Duration of first stage (minutes)	594.87 ± 39.74	595.80 ± 40.77	0.929	NS
Duration of second stage (minutes)	91.67 ± 15.45	95.70 ± 14.95	0.3088	NS
Duration of third stage (minutes)	6.58 ± 0.77	6.63 ± 1.12	0.8410	NS
Total duration (minutes)	698.50 ± 53.61	703.60 ± 40.22	0.6784	NS
Spinal delivery interval (minutes)	243.33 ± 21.42	252.43 ± 21.65	0.1071	NS

NS: Non significant

Bromage scale. Five patients in group L and four patients in group R developed grade I motor blockade ($p < 0.05$). Hemodynamic stability was observed in both groups. Table 4 describes labor characteristics. Instrumental delivery, cesarean delivery rate, and Apgar scores were noted and found to be similar in both the groups ($p > 0.05$). The incidence of side effects and complications were also comparable in the two groups (Table 5).

DISCUSSION

"Maternal request is a sufficient justification for pain relief during labor" was the joint statement issued by the American College of Obstetricians and Gynecologists and American Society of Anesthesiologists in the year 2004.[12] Advantages of both spinal and epidural techniques are included in CSE technique and it is being increasingly

Table 5: Side effects and complications

Side effects and complications	*Group L (%)*	*Group R (%)*	*p-value*
Maternal hypotension	6.67	6.67	1.00 (NS)
Pruritus	60.0	53.33	0.60 (NS)
Nausea/vomiting	13.33	10.0	0.67 (NS)
Respiratory depression	0	0	–
Shivering	13.33	10.0	0.67 (NS)
Dural puncture	0	0	–
Urinary retention	6.67	3.33	0.75 (NS)
Postdural puncture headache	3.33	3.33	1.00 (NS)

NS: Non significant

used for labor analgesia. In the past, the safety of ambulation in labor without intact dorsal column function and proprioception was questioned,[13] with implication for allowing parturients to mobilize freely after CSE analgesia. Recently, a minimum change in balance function has been demonstrated following CSE analgesia even in the presence of clinical dorsal column sensory loss.[8] Use of low-dose local anesthetics selectively blocks the painful stimulus and preserves motor function at the same time.[14]

Levobupivacaine and ropivacaine were developed in response to cardiotoxicity reports associated with accidental intravenous bupivacaine administration.[15] In our study, we have assumed levobupivacaine to be 1.31 times more potent than ropivacaine based on the study of Sia et al.[11] Mean onset of analgesia in groups L and R were 4.64 ± 0.31 and 5.57 ± 0.27. Onset of analgesia was earlier in group L ($p < 0.0001$) and was statistically highly significant. Our results are in accordance with observations of Mehta et al,[16] which showed mean onset of sensory blockade to be 4.30 ± 1.53 minutes with levobupivacaine and 5.45 ± 1.00 minutes with ropivacaine. Duration of analgesia after intrathecal dose in groups L and R in our study was 116.83 ± 6.91 and 88.87 ± 5.10 respectively. Kim et al[17] compared 3 mg of ropivacaine and levobupivacaine mixed with 20 µg of fentanyl as part of CSE technique and found ropivacaine offered shorter analgesia (87 ± 41 minutes) as compared with intrathecal bupivacaine (122 ± 56 minutes).

In addition to providing pain relief, neuraxial analgesia can cause motor blockade that can lead to inability to bear down by the parturient. Low-dose local anesthetics have reduced such incidences of undesired motor blockades.[14] In our study, no parturient had any motor impairment before the anesthetic procedure. On modified Bromage scale,[11] 25 parturients (83.33%) in group L and 26 parturients in group R (86.66%) had no motor blockade. A total of 5 parturients in group L (16.66%) and 4 parturients in group R (13.33%) developed only grade I motor blockade with statistically insignificant difference ($p > 0.05$). Difference in side effects and complications between the two groups did not reach statistical significance ($p > 0.05$). Two parturients in group L and two parturients in group R (6.67%) developed hypotension, which responded well to fluid administration only, and intravenous ephedrine was not required. Nausea and vomiting occurred in 4 parturients in group L (13.3%) and 3 parturients in group R (10%), which responded to injection ondansetron 4 mg intravenously. In our study, Apgar score was noted at 1, 5, and 10 minutes. At 1 minute, one baby each in both the groups showed Apgar score 7 and no baby had Apgar score <8 at 5 and 10 minutes in both the groups ($p > 0.05$). Hence, the difference in groups was statistically nonsignificant. Babies with Apgar score of 7 were resuscitated by suction and oxygen in both the groups. Purdie and McGrady[18] had compared epidural bolus administration of 0.1% ropivacaine and 0.1% levobupivacaine with 0.0002% fentanyl for labor analgesia and found the mean Apgar score to be 9 at 1 minute in both groups.

CONCLUSION

Thus, we conclude that there was effective labor analgesia in both the groups but group L (levobupivacaine group) was found to be better in terms of early onset and longer duration of analgesia in comparison to the ropavicaine group.

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