ORIGINAL ARTICLE

Effect of Epidural Bolus Levobupivacaine and Lignocaine in Late Second Stage of Parturition in Combined Spinal Epidural Labor Analgesia

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Abstract

Background: Use of minimum local analgesic concentration in the epidural component of combined spinal epidural (CSE) effectively maintains analgesia in the first stage of labor. However, local anesthetic concentration needs to increase to achieve effective analgesia in the second stage as there are more recruitment of A-δ fiber occurs. This study compared the effect of epidural bolus of Levobupivacaine and Lignocaine in the late second stage of parturition in combined spinal epidural labor analgesia.

Methods: This multicenterd, open-label, randomized controlled trial was conducted under supervision of Department of Anesthesia, Analgesia, and Intensive Care Medicine of Bangabandhu Sheikh Mujib Medical University from July 2019 to June 2020 including 80 parturients of 18-35 years old, ASA status I and II, full-term, primiparous, who were randomized into two groups to receive either 10ml bolus of 0.0625% levobupivacaine with fentanyl 2µg/ml or 10ml bolus of 0.5% lignocaine with fentanyl 2µg/ml after CSE analgesia at first stage of labor. Level of analgesia, duration of second stage of labor, quality of pain relief, maternal satisfaction, mode of delivery and APGAR score of neonate were evaluated.

Results: During delivery, levobupivacaine group had a lower intensity of pain compared to lignocaine group (VAS score 1.89±0.67 vs 2.64±0.92, p = 0.001). Duration of second stage of labor in levobupivacaine group was significantly shorter compared to lignocaine group (48.4±16 minutes vs 63.5±28.4, p-value 0.007). Besides, quality of pain relief and maternal satisfaction were better in levobupivacaine group compared to lignocaine group. Moreover, instrumental delivery rate was high in lignocaine group. Fetal outcome measured as APGAR score was similar in both groups.

Conclusion: Epidural bolus of levobupivacaine-fentanyl produces more adequate analgesia than lignocaine-fentanyl in late second stage of labor and does not increase instrumental delivery rate with similar fetal outcome.

Keywords: Epidural, Levobupivacaine, Lignocaine, Combined spinal Epidural, Labor Analgesia.

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Introduction

Ensuring adequate analgesia without significant adverse labor outcome is the prime focus of obstetric anesthesia. Among all modalities of labor analgesia, use of local anesthetics along with adjuvents in neuroaxial techniques is considered as gold standard for labor analgesia[1]. To achieve effective analgesia in labor, some adverse events like instrumental delivery, prolong labor etc. can be encountered due to motor block from epidural component of local anesthetics. Use of lower concentration of local anaesthetic along with adjuncts e.g. opioids or choosing a local anaesthetic with high differential sensory:motor block ratio can minimize motor block[2]. One of the low concentration model of local anesthetics is use of minimum local analgesic concentration (MLAC). This concept was developed to estimate the median effective dose and to determine relative potency difference of local anesthetics in first stage of labor[3]. But in the second stage, recruitment of A-δ fiber along with C fibers occurs in the pain pathway of labor which dictates that more local anesthetics are needed as labor progresses[4,5,6]. Considering the nature of the differential block of nerve fiber, local anaesthetic concentration which is sufficient to produce effective analgesia in the first stage of labor may not be able to produce satisfactory analgesia in the second stage of labor. Therefore, in the second stage of labor concentration of local anesthetics need to be increased to block larger diameter A-δ fiber to achieve adequate analgesia.

In the present study, continuous epidural infusion of minimum local anesthetic concentration of levobupivacaine was continued till delivery of baby using combined spinal-epidural analgesia technique. In second stage of labor, when parturients complained of increased pain or pressure sensation on perineum epidural bolus of levobupivacaine– fentanyl or lignocaine–fentanyl were used to increment the concentration of anesthetics. The objective of the present study was to compare the efficacy of levobupivacaine and lignocaine in analgesia, duration of second stage of labor, quality of pain relief, maternal satisfaction, mode of delivery and neonatal outcome.

Methods

Study design and setting

The present one was an open-labeled randomized controlled trial conducted in labor suits of Obstetrics and Gynaecology department of Bangabandhu Sheikh Mujib Medical University (BSMMU), Mohammadpur Fertility Services and Training Center and Institute of Child and Mother Health under supervision of Department of Anesthesia, Analgesia and Intensive Care Medicine, BSMMU from July 2020 to June 2021.

Patient

Parturients of age 18-35 years, ASA physical status I-II, primigravida with term pregnancy more than 36 weeks, vertex presenting singleton pregnancy, pelvimetry supporting normal vaginal delivery and cervical dilatation of 4 to 6 cm were included in this study. Parturients having weight > 90 kg or BMI >28, administration of any anesthesia before combined spinal epidural (CSE) anesthesia, known fetal abnormality, fetal distress, contraindication of neuraxial blocks like coagulation disorder, sepsis etc., hypersensitivity to local anesthetics and presence of any cardiac disease were excluded from the study.

Intervention

After obtaining informed written consent from each individual parturient, who fulfilled the inclusion and exclusion criteria were enrolled in this study. Intravenous (IV) access with 18G cannula connected with a Hartmann's solution was established on the upper limb. After IV preload with Hartmann's solution at the rate of 10-20ml/kg, combined spinal-epidural analgesia (CSE) was performed at the L2-3 or L3-4 intervertebral space with the patient in sitting position. For CSE, Spinocan needle: 27G ×5", Perican needle: 18G×3.5", Perifix-catheter: 20G (B BRAUN, Germany) sets were used. Epidural space was identified with an 18gauge Tuohy needle using loss of resistance to saline. A 27 gauge spinal needle was passed through the Tuohy needle and the correct position of the needle in the intrathecal space was confirmed by observation of free flow of cerebrospinal fluid (CSF). Then intrathecal injection of 0.5 ml of 0.5% plain levobupivacaine (2.5 mg) with 0.5 ml of fentanyl (25µgm) was given. Then the epidural catheter was inserted 3-5 cm into epidural

space and was secured without a test dose.

The parturient was then positioned supine with left lateral displacement and the head end of the bed was elevated to 20-30 degree. After 20 minutes of intrathecal dose, the level of sensory blockade was checked to ensure the sensory level at least reached at the level of T10. Then continuous epidural infusion of 0.0625% levobupivacaine with fentanyl 2µgm/ml at the rate of 10ml/hr through epidural catheter was started via syringe pump and continued till the delivery of the baby.

At the second stage of labor (cervical dilatation 10 cm), patients were randomized into two groups receiving either 10 ml epidural bolus injection of 0.0625% levobupivacaine with fentanyl 2µgm/ml or 10 ml epidural bolus injection of 0.5% lignocaine with Fentanyl 2µgm/ml. Epidural bolus was given only when patients were complaining of increased pain intensity (VAS > 3) or increased pressure sensation on perineum after confirming cervical dilatation 10 cm. Two parturients from levobupivacaine group three parturients from lignocaine group were excluded as they did not progress to the second stage of labor and underwent lower uterine caesarean section for delivery.

Monitoring

Demographic and clinical data including age, weight, height, gestational age and cervical dilatation were recorded for all parturients. All parturients had the standard monitoring including noninvasive blood pressure, pulse oximetry and cardiotocography for fetal monitoring (IOCARE, model no IC60). Before performing the CSE procedure, baseline measurement of pain intensity was made using a visual analog scale VAS (0= no pain, 10= worst imaginable pain) at the peak of uterine contraction, baseline arterial blood pressure (BP), heart rate (HR) and fetal heart rate (FHR) were measured.

Degrees of analgesia, motor block, fetal heart rate and blood pressure were assessed at 5, 15 and 30 minutes after the intrathecal dose and then hourly interval of throughout the labor. Any breakthrough pain was managed by 10ml bolus epidural infusion of 0.0625% levobupivacaine with fentanyl 2µgm/ml. Motor block was bilaterally evaluated according to Bromage scale (1= complete block; unable to move feet or knee, 2 = unable to flex the knee but can flex the ankle articulation 3= unable to perform the leg raise but can flex the leg on knee articulation, 4 = no motor block; able to perform a full straight leg raise over the bed). Cephalad level of the sensory block was determined by perceived temperature difference to alcohol swab. After 30 minutes of intrathecal dose, parturients with VAS score >3, Bromage scale <3 and sensory level above T6 were regarded as having excessive dense or high blocks and excluded from study. Progress of labor, cervical dilatation and fetal monitoring of all parturients were followed up until delivery on a partograph by an obstetrician along with assessment of pain, sensory and motor block, hemodynamic parameters and fetal monitoring.

With the time noted ‘zero’ all the patients received epidural bolus according to the allocation and asked to indicate pain intensity using the VAS scale. Pain intensity of parturients was assessed at 10 minutes, 20 minutes after epidural bolus and at the time of delivery. After receiving each bolus, total duration of second stage, mode of delivery, assessment of neonate, quality of pain relief and maternal satisfaction were assessed. Parturients’ hemodynamic parameters including arterial blood pressure and heart rate were monitored at regular intervals throughout the labor. Maternal hypotension was defined as systolic blood pressure < 90 mm of Hg or > 20% decrease from baseline. It was treated by turning parturients to the left lateral position, and administration of maternal oxygen, intravenous fluid infusion, or vasopressor (ephedrine 6mg bolus) as indicated. Maternal bradycardia (heart rate less than 50 beats / min) was treated with atropine 0.6 mg increments. Pelvic examination to evaluate the progress of labor was performed at a regular interval as per labor management protocol.

Quality of pain relieved after epidural bolus was assessed by 4-point questions[7]. The parturients were asked a question which was formulated as –“How would you describe the quality of your pain relief at the time of delivery?” Answer was rated as 0= No pain, 1=Awareness of contraction but no pain 2=Awareness of pressure but tolerable discomfort, 3=Distressing pressure or pain.

Maternal satisfaction was assessed by 4 point questions[8]. The parturients were asked a question which was formulated as – "how would you describe the quality of your pain relief since the epidural bolus was given?" The answers were graded as excellent, good, fair and poor.

Endpoints

Intensity of pain by VAS scale at 10 and 20 minutes after epidural bolus and at the time of delivery was the primary endpoint of the study. Secondary endpoints were duration of second stage of labor, quality of pain relief, maternal satisfaction, mode of delivery and APGAR score of neonate at first and fifth minutes.

Statistical analysis

Statistical analyses were carried out by using the SPSS version 20.0. Qualitative variables were expressed as percentage. Quantitative variables were expressed as mean ± standard deviation. Fisher exact test was used to compare the categorical variables, student t-test was used to compare the continuous variables. P values <0.05 was considered as statistically significant.

Results

A total of 75 parturients (38 from levobupivacaine group and 37 from lignocaine group) were included in the analysis. The mean (SD) age of the participants was 22.1 (3.7) and 21.2 (3.1) years for levobupivacaine and lignocaine group respectively. No significant difference was observed in other baseline parameters except fetal heart rate which was slightly higher in the lignocaine group. Intensity of pain at baseline measured by VAS score was also similar in both groups (Table I).

Though intensity of pain at baseline was similar and gradually decreased over time, it was significantly lower in lignocaine group compared to levobupivacaine group at 10 minute (VAS score 3.16±0.89 vs 3.78±1.04, p = 0.007). However, during delivery, in contrast, levobupivacaine group had a lower intensity of pain compared to lignocaine group (VAS score 1.89±0.67 vs 2.64±0.92, p = 0.001) (Fig 1).

Table I: Baseline characteristics of the parturients

Characteristics	Levobupivacaine group (n = 38)	Lignocaine group (n = 37)	P value
Age in years	22.13 ± 3.67	21.24 ± 3.10	0.324
Height in cm	152.47 ± 3.44	152.78 ± 4.00	0.720
Weight in kg	60.34 ± 7.50	60.45 ± 7.58	0.953
Cervical dilatation(cm)	5.05 ± 0.89	5.09 ± 0.79	0.222
SBP (mm of hg)	113.94 ± 15.16	118.37 ± 8.9	0.129
DBP (mm of hg)	75.26 ± 7.9	74.59 ± 8.0	0.718
HR (beats/min)	78.24 ± 3.71	76.80 ± 2.51	0.115
FHR (beats/min)	139.84 ± 7.61	142.75 ± 3.41	0.037
Pain intensity by VAS	8.76 ± 1.26	8.59 ± 0.49	0.451
Duration of First stage after CSE	193.15 ± 64.24	201.75 ± 45.20	0.506

Values are expressed as Mean ± SD, Data were analyzed using student t-test, p value <0.05 is considered as significant, n = number of study population in each group, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, HR = Heart rate, FHR = Fetal heart rate, VAS = Visual analog scale.

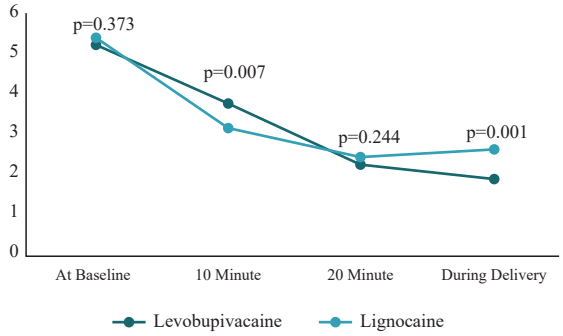

Fig. 1: VAS score during second stage of labor between two groups

Duration of second stage of labor in levobupivacaine group was significantly shorter compared to lignocaine group (48.4±16 minutes vs 63.5±28.4, p-value 0.007). Besides, quality of pain relief and maternal satisfaction were better in levobupivacaine group compared to lignocaine group. Moreover, instrumental delivery rate was high in lignocaine

group. Fetal outcome measured as APGAR score was similar in both levobupivacaine and lignocaine group. APGAR score ≤7 was observed in 3 and 5 neonates in levobupivacaine and lignocaine group respectively at first minute (p-value 0.431) and in 0 and 2 neonates in levobupivacaine and lignocaine group respectively at fifth minute (p-value 0.146) (Table II).

Table II: Secondary endpoints of the study

Secondary endpoints	Levobupivacaine group (n=38)	Ligncaine group (n=37)	P value
Duration of second stage of labor (min)	48.41 ± 16.03	63.51 ± 28.37	0.007
Quality of analgesia			
No pain	4 (10.5%)	1 (2.7%)	0.028
Awareness of contraction but no pain	25 (65.8%)	16 (43.2%)	
Awareness of pressure but tolerable discomfort	7 (18.4%)	11 (29.7%)	
Distressing pressure or pain	2 (5.3%)	9 (24.3%)	
Maternal satisfaction			
Excellent	21 (55.3%)	14 (37.8%)	0.022
Very good	10 (26.3%)	4 (10.8%)	
Good	5 (13.2%)	12 (32.4%)	
Poor	2 (5.3%)	7 (18.9%)	
Mode of delivery			
NVD	38 (100%)	11 (29.7%)	0.001
Instrumental	0 (0%)	26 (70.3%)	
APGAR score (At 1 minute)			
≤7	3 (7.9%)	5 (13.5%)	0.431
>7	35 (92.1%)	32 (86.5%)	
APGAR score (At 5 minute)			
≤7	0 (00)	2 (5.4%)	0.146
>7	38 (100%)	35 (94.6%)	

Values are expressed as number (%) & mean ± SD, p value <0.05 is considered as significant.

Discussion

The aim of current practice of labor analgesia is to balance between achieving optimal analgesia and possible lowest motor block by local anesthetics. To reduce motor block minimum local analgesic concentration of local anesthetics has been successfully achieve adequate analgesia in first stage of labor. But A-δ fiber recruitment in pain pathway,increases the requirement of local anesthetics to produce satisfactory analgesia in second stage of labor. In this study, to achieve satisfactory analgesia in second stage, local anaesthetic concentration was increased by epidural bolus of levobupivacaine–fentanyl and lignocaine–fentanyl in two groups. Analgesia and delivery outcome were assessed between the two groups to find out an effective method of labor analgesia in the second stage of labor.

During second stage of labor, the two groups differed in regard to pain scores over time. Better analgesia was achieved earlier in lignocaine group compared to levobupivacaine group though the difference became non-significant after 20 minutes and reversed during delivery. With the VAS score, total duration of second stage was also significantly increased in Lignocaine group in comparison to Levobupivacaine group, which might be influenced by failure to achieve satisfactory analgesia in lignocaine group resulting in impairment in the ability of the parturients to coordinate with their expulsive force,. though total duration of second stage is acceptable in both group according to American college of obstetrics and Gynaecology statement[9]. Chestnut et al.(1990), found that continuing epidural infusion of 0.0625% bupivacaine resulted in no effect on the duration of labor (mean duration 53 min, range 5 - 283 min) versus the duration who received saline infusion (mean 63 min, range 16-181 min)[10]. Shen et al. (2017) also found that maintaining the infusion of epidural medication had no effect on the duration of the second stage of labor compared with a placebo (Epidural 52 ± 27 minutes compared with saline 51 ± 25 minutes, p = 0.52)[11]. Similar to these studies we found epidural bolus at second stage on the background of continuous infusion does not affect the duration of labor.

Mode of delivery is an important determinant of the

success of labor analgesia which was assessed in a number of trials of epidural analgesia. It was found difficult to assess motor block and sensory level after giving epidural bolus at late second stage. But mode of delivery especially rate of instrumental or operative delivery is an indirect measure of motor block as relaxation of abdominal wall musculature due to motor block reduces the effectiveness of maternal expulsive efforts and also decreases maternal ability to coordinate with uterine contraction which ultimately contribute in increasing the instrumental delivery rate[1]. In the present study a significantly increased rate of instrumental vaginal delivery was observed in the lignocaine group. Instrumental delivery rate was higher in a previous study compared to ours (20% with 0.25% bupivacaine group, 35% with 0.1% lignocaine group and 15% with saline group)[8]. However, in our study, anesthetics were used at a lower dose, which might facilitate higher rate of NVD[12]. Some other studies[7,13] using higher doses of levobupivacaine reported increased rates of instrumental delivery which also supports the hypothesis.

In our study, APGAR score of neonates at first and fifth minutes was identical in levobupivacaine and lignocaine group without any significant statistical difference which resembles to the findings of a previous study conducted by Hosagoudar et al. (2018) where they found APGAR score of neonates was similar in epidural analgesia group and in opioid group[15].

Pain perception is a subjective complex phenomenon which is undoubtedly influenced by physiological, psychological and cultural factors. Quantification of pain on a visual analogue scale is considered as the gold standard for assessment of pain[16]. But in the context of labor it is difficult to interpret the quality of analgesia and maternal satisfaction. Individual satisfaction also depends on the feeling that the quality of care she got or overall care met the individual's expectations. Halpren et al. (2003) compared epidural bupivacaine and levobupivacaine for labor in nulliparous women. In his large sized study, pain relief quantification of both groups valued between 66 and 77 out of 100. But overall satisfaction with pain relief was higher (81out of 100)[17]. Cultural tolerance to pain during childbirth also has a great influence on indulgence of the patient about the quality of analgesia[18]. In the context of our country, where people believe that labor pain is an eternal thing to bear, labor analgesia itself is a great challenge to accept as treatment modality. So interpretation of maternal satisfaction in this regard is difficult. Rather from the experience of the current study, many parturients confuse increased pressure sensation during the second stage of labor as pain perception. In the present study, the quality of pain relief was compared after epidural bolus at the second stage of labor. Quality of pain relieved was not similar in between two groups (p=0.028).Also more parturients in Group A were satisfied regarding pain relief after epidural bolus at second stage of labor (p=0.022).

The present study has several limitations. Multiple obstetric and anesthetics factors play a role regarding managing individual labor pain management. Different confounding factors that influence delivery outcome like early severe labor pain, obstetrician's skill and decision making, total anesthetic consumption etc. Association of these factors on delivery outcome was not analyzed.

Conclusion

Epidural bolus of levobupivacaine-fentanyl produces more adequate analgesia than lignocaine-fentanyl in late second stage of labor and does not increase instrumental delivery rate with similar fetal outcome.

Declaration

Ethics approval

The ethical permission of the study was obtained from the Institutional Review Board (IRB) of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.

Author contributions

Conception and development of the idea *SS, AKMA*
Data collection *SS, MMR, MM*
Data analysis *MMK, MSR*
Writing - Original Draft Preparation *SS, MSR*
Review & Editing *SS, MMK, AKMA*

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Conflict of interests None

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