Original Research Article

Comparative evaluation of hyperbaric bupivacaine and levobupivacaine as spinal anesthesia agents in females undergoing cesarean section: A clinical study

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Abstract

Background: Anesthesia techniques used in obstetrics has a requisite of satisfactory muscle relaxation and adequate analgesia with no to minimal side effects concerning both fetal and maternal aspect related to the anesthetic agent used. **Aims:** The present study was conducted to comparatively evaluate the clinical outcomes with the use of intrathecal 2.5ml 0.5% hyperbaric bupivacaine with 2.5ml 0.5% isobaric levobupivacaine as a spinal anesthetic agent for LSCS (lower segment cesarean section). **Materials and Methods:** The study included a total of 130 subjects from both genders divided into two groups of 65 subjects each. The parameters recorded in the study were onset time of block from drug administration to L1 level sensation loss, sensory block, motor block, block duration and onset time, and Intraoperative analgesia. Also, quality, duration, pain intensity, and any encountered adverse effects. **Results:** Onset time was significantly lesser with bupivacaine ($p < 0.001$). Also, the maximum sensory block level was lower in Levobupivacaine along with the time taken by the sensory block to reach the maximum level with $p < 0.001$. In comparison between motor block and sensory block, the motor block has a faster onset and longer duration with o.5% hyperbaric bupivacaine with $p < 0.001$. Side effects were few and less severe with Levobupivacaine. **Conclusion:** The present study concludes that spinal anesthesia administered using either Levobupivacaine and bupivacaine acts as an effective and fast induced regional anesthesia for the Lower segment Caesarean section, where levobupivacaine was found to be the better agent with less motor block time.

Keywords: Bupivacaine, Caesarean section, hyperbaric bupivacaine, levobupivacaine, spinal anesthesia

Introduction

The use of spinal anesthesia in humans was introduced in 1898 by Dr. August Bier on August 15th. Quinke method was used by DR August Bier to enter the intrathecal space for incorporating spinal anesthesia. Since the introduction of spinal anesthesia, it has been advanced, using modern concepts concerning spinal anesthesia. Spinal anesthesia is a safe, effective, and simple method providing adequate peri-operative analgesia[1].

Anesthesia techniques used in obstetrics has a requisite of satisfactory muscle relaxation and adequate analgesia with no to minimal side effects concerning both fetal and maternal aspect related to the anesthetic agent used. Concerning these requirements and requisites, Bupivacaine is popular and accepted in Obstetrics for Caesarean delivery[2].

Presently, the most common anesthetic agent used in obstetrics is an amide local anesthetic agent, 0.5% Hyperbaric bupivacaine. 0.5% Hyperbaric bupivacaine is hyperbaric concerning Cerebrospinal Fluid (CSF) of humans and is commonly used in 8% glucose. For the clinical aspect, this is a median sensory block height that is unpredictable owing to large space varying from individual to individual.

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This is sometimes associated with block failure, in cases when spinal anesthesia has not reached enough height to conduct a cesarean section. The favored position is lateral. However, isotonic solutions compared to hyperbaric solutions are preferred in subjects with cardiovascular complications[3].

Another potent anesthetic agent, with less cardiotoxicity, is Levobupivacaine, which shows lesser motor blockage intensity than bupivacaine. However, despite being less potent than bupivacaine, owing to its lipid solubility, it has more potency than ropivacaine. In pregnant females, plain Bupivacaine is isobaric to CSF, allowing predictable and uniform spread. This can be utilized as an advantage in obstetrics[4].

These two agents are promising and potent agents that can be utilized in obstetrics for females undergoing cesarean section. However, the data concerning the comparison of these two agents in spinal anesthesia for cesarean section in literature is scarce and inconclusive.[5] Hence, the present study was conducted to comparatively evaluate the clinical outcomes with the use of intrathecal 2.5ml 0.5% hyperbaric bupivacaine with 2.5ml 0.5% isobaric levobupivacaine as a spinal anesthetic agent for LSCS (lower segment cesarean section).

Materials and methods

The present study was conducted to comparatively evaluate the clinical outcomes with the use of intrathecal 2.5ml 0.5% hyperbaric bupivacaine with 2.5ml 0.5% isobaric levobupivacaine as a spinal anesthetic agent for LSCS (lower segment cesarean section).

The study included a total of 130 subjects from both genders. The inclusion criteria for the study were subjects who had to undergo elective LSCS, subjects with ASA (American Society of Anesthesiologists) I and II status, and subjects who were willing to participate in the study. The exclusion criteria were subjects who allowed only general anesthesia, height more than 175cm, height less than 150 cm, weight >100kg, spinal anesthesia contraindicated, placenta previa, not willing to participate, abruption placenta, and confirmed fetal anomaly.

After the final inclusion of the subjects based on inclusion and exclusion criteria, all subjects underwent pre-anesthetic checkups. After explaining the detailed study design, informed consent was taken verbally and in written format. After a thorough pre-anesthetic evaluation, the subjects were undertaken for the surgery (LSCS). Subjects were laid in a left-lateral position, and vitals and ECG findings were recorded throughout. Using a face mask, at 5liter/min, supplementary oxygen was administered.

Using strict aseptic conditions, 2.5 ml of the levobupivacaine/ bupivacaine was administered to the subject by an experienced anesthesiologist into L3-L4 subarachnoid space. The subject was blinded to the drug used. The drug was administered after being assured of free CSF flow using a spinal needle. Immediately after drug administration (considered as 0 minutes), subjects were shifted to the supine position from the left lateral, and for left uterine displacement, 15^0 wedges were inserted below the right buttock. To confirm anesthesia efficacy, T6 level loss of pinprick sensation was considered. After confirming efficacy, surgery was conducted.

The parameters recorded in the study were onset time of block from drug administration to L1 level sensation loss, sensory block: subjective sensation loss, motor block: assessed every 1 minute till complete blockade, and every 15 minutes until motor function recovery, evaluated using Bromage scale, block duration and onset time for motor block assessed using modified Bromage scale, Intraoperative analgesia quality using four-point modified Belzarena scale, and sensation at sensory duration assessed as the duration between drug administration and L1 level recovery.

Hemodynamic changes were also assessed in the present study including mean arterial pressure, oxygen saturation, and systolic blood pressure. These were assessed every 5 minutes till birth, and every 10 minutes till the end of the surgery. Oxytocin (20 units) was infused at 2ml/min. The pediatrician recorded Apgar scores at 1 minute and 5 minutes. General anesthesia was administered in cases of failed/inadequate block. All subjects were monitored at 2 hours and 6-hour intervals to assess quality, duration, pain intensity, and any encountered adverse effects. Postdural puncture headache (PDPH) was also evaluated, and if encountered, subjects were followed 3 to 4 days post-identification of PDPH.

The collected data were subjected to the statistical evaluation using SPSS software version 22.0. Armonk, NY: IBM Corp and ANOVA. The data were expressed in terms of percentage and number, and the results were fabricated. The level of significance was kept at p-0.05.

Results

The present study was conducted to comparatively evaluate the clinical outcomes with the use of intrathecal 2.5ml 0.5% hyperbaric bupivacaine with 2.5ml 0.5% isobaric levobupivacaine as a spinal anesthetic agent for LSCS (lower segment cesarean section). The study included a total of 130 subjects from both genders divided into two groups of 65 subjects each. The demographic characteristics of the study subjects are described in Table 1.

Table 1: Demographic characteristics of the study subjects

Characteristic	Group I (Levobupivacaine) (Mean±S.D)	Group II (Bupivacaine)	P-value
Mean age (years)	23.75±4.03	24.02±11.10	0.8540
Age Range (years)	19-28	20-31	
Gestational age (weeks)	39.08±0.42	38.91±0.59	0.06
Weight (kg)	60.15±4.03	60.59±2.30	0.446
Height (cm)	160.31±4.06	161.01±2.79	0.2541
Surgery Duration (min)	48.68±2.91	48.22±2.72	0.3536

The results showed that the demographics of the two groups did not vary significantly. For mean age, gestational age, weight, height, and surgery duration varied insignificantly between the two groups with the p-values of 0.8540, 0.06, 0.446, 0.2541, and 0.3536 respectively. Also, equal and comparable levels of analgesia and anesthesia were seen in both the groups, with both the drugs.

On assessing the parameters concerning sensory and motor block seen after administration of Levobupivacaine and bupivacaine, it was seen that Onset time was significantly lesser with bupivacaine ($p < 0.001$). Also, the maximum sensory block level was lower in Levobupivacaine along with the time taken by the sensory block to reach the maximum level with $p < 0.001$. Complete sensory recovery time and sensory regression time were significantly lesser with Levobupivacaine compared to bupivacaine. Onset time was shorter with Bupivacaine than Levobupivacaine ($p < 0.001$). In comparison between motor block and sensory block, the motor block has a faster onset and longer duration with o.5% hyperbaric bupivacaine with $p < 0.001$ (Table 2).

Table 2: Motor and sensory variables in the study subjects

Parameters	Group I (Levobupivacaine)	Group II (Bupivacaine)	P-value
Motor Block			
Onset Time (min:sec)	4:24±0.32	3.30±0.26	<0.001
Duration Time (min)	119.35±11.29	141.35±9.33	<0.001
Sensory Block			
Onset Time (min:sec)	1:53±0.11	1:42±0.09	<0.001
Two segment regression time (min)	70.29±5.67	76.15±6.53	<0.001
Complete Sensory recovery time (min)	156.95±16.58	167.62±10.23	<0.001

The present study also recorded the side effects seen after administration of Levobupivacaine and Bupivacaine as a regional anesthetic agent in females undergoing LSCS. It was seen that no bradycardia or itching was reported by any subject administered Levobupivacaine, whereas, with bupivacaine, 7.69% (n=5) and 3.07% (n=2) subjects reported bradycardia and itching respectively. Headache was reported by lesser subjects (3.07%, n=2) in subjects taking Levobupivacaine, and by 4.61% (n=3) subjects administered with Bupivacaine. Vomiting was reported by 4.61% (n=3) subjects from the Levobupivacaine group and 10.76% (n=7) subjects in the Bupivacaine group. Nausea was seen in 10.76% (n=7) of subjects receiving Levobupivacaine and 20% (n=13) subjects with Bupivacaine (Table 3).

Table 3: Side effects encountered with the two drugs in the study subjects

Adverse Effects	Group I (Levobupivacaine)% (n)	Group II (Bupivacaine)%(n)
Bradycardia	0 (0)	7.69 (5)
Itching	0 (0)	3.07 (2)
Headache	3.07 (2)	4.61 (3)
Vomiting	4.61 (3)	10.76 (7)
Nausea	10.76 (7)	20 (13)

Side effects were few and less severe with Levobupivacaine.

Discussion

The present study was conducted to comparatively evaluate the clinical outcomes with the use of intrathecal 2.5ml 0.5% hyperbaric bupivacaine with 2.5ml 0.5% isobaric levobupivacaine as a spinal anesthetic agent for LSCS (lower segment cesarean section). The study included a total of 130 subjects from both genders divided into two groups of 65 subjects each. It was seen that the demographics of the two groups did not vary significantly. For mean age, gestational age, weight, height, and surgery duration varied insignificantly between the two groups with the p-values of 0.8540, 0.06, 0.446, 0.2541, and 0.3536 respectively. Also, equal and comparable levels of analgesia and anesthesia were seen in both the groups, with both the drugs. These demographics were comparable to the characteristics used by the studies of Fattorini F et al[6] in 2006 and Dar F et al[7] in 2015 where authors used similar demographic characteristics.

The study results also showed that Onset time was significantly lesser with bupivacaine ($p < 0.001$). Also, the maximum sensory block level was lower in Levobupivacaine along with the time taken by the sensory block to reach the maximum level with $p < 0.001$. Complete sensory recovery time and sensory regression time were significantly lesser with Levobupivacaine compared to bupivacaine. Onset time was shorter with Bupivacaine than Levobupivacaine ($p < 0.001$). In comparison between motor block and sensory block, the motor block has a faster onset and longer duration with o.5% hyperbaric bupivacaine with $p < 0.001$. These results were in agreement with the results of Sathitkarnmanee T et al[8] in 2011 and Guler G et al[9] in 2012 where authors reported that motor block with levobupivacaine was of higher duration.

The present study also recorded the side effects seen after administration of Levobupivacaine and Bupivacaine as a regional anesthetic agent in females undergoing LSCS. It was seen that no bradycardia or itching was reported by any subject administered Levobupivacaine, whereas, with bupivacaine, 7.69% (n=5) and 3.07% (n=2) subjects reported bradycardia and itching respectively. Headache was reported by lesser subjects (3.07%, n=2) in subjects taking Levobupivacaine, and by 4.61% (n=3) subjects administered with Bupivacaine. Vomiting was reported by 4.61% (n=3) subjects from the Levobupivacaine group and 10.76% (n=7) subjects in the Bupivacaine group. Nausea was seen in 10.76% (n=7) of subjects receiving Levobupivacaine and 20% (n=13) subjects with Bupivacaine. Side effects were few and less severe with Levobupivacaine. These findings were consistent with the results of Shriyan DR et al[10] in 2016 and Goyal A et al[11] in 2015 where similar side effects were reported by authors in their study with the use of Levobupivacaine and bupivacaine.

Conclusion

Within its limitations, the present study concludes that spinal anesthesia administered using either Levobupivacaine and bupivacaine acts as an effective and fast induced regional anesthesia for the Lower segment Caesarean section, where levobupivacaine was found to be the better agent with less motor block time. However, the study had few limitations including smaller sample size, cross-sectional design, geographical area biases, and single-institution nature. Hence, more longitudinal and prospective studies with a larger sample size, and longer monitoring period are needed to reach a definitive conclusion.

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