DOI: 10.14260/jemds/2015/671

ORIGINAL ARTICLE

A COMPARATIVE STUDY BETWEEN 0.5% HYPERBARIC BUPIVACAINE AND 0.5% HYPERBARIC BUPIVACAINE WITH 25 mcg FENTANYL IN SPINAL ANAESTHESIA IN OBSTETRIC PATIENTS UNDERGOING ELECTIVE LSCS

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HOW TO CITE THIS ARTICLE:
A. V. Abhinav, Harshavardhan. "A Comparative Study Between 0.5% Hyperbaric Bupivacaine and 0.5% Hyperbaric Bupivacaine with 25 mcg Fentanyl in Spinal Anaesthesia in Obstetric Patients Undergoing Elective LSCS". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 27, April 02; Page: 4636-4643, DOI:10.14260/jemds/2015/671

ABSTRACT: Neuraxial administration of opioids along with local anesthetics improve the quality of intraoperative analgesia and also provides postoperative pain relief for longer duration. The present study was conducted to study and compare the effects of bupivacaine alone and its combination with fentanyl used intrathecallyin obstetric patients posted for elective LSCS. 50 ASA grade I and II patients were selected and divided into 2 groups as Group (I): Bupivacaine and Group (II): Bupivacaine-Fentanyl group. Haemodynamic variables like systolic and diastolic blood pressure, heart rate were recorded every 3 minutes up to delivery of baby and then every 5 minutes until end of surgery. Sensory block and motor block along with side effects were recorded. Pain was evaluated using visual analogue scale and neonatal outcome assessed using APGAR scoring. The highest sensory level achieved in bupivacaine-fentanyl group was higher than in the group receiving plain bupivacaine. The time taken for sensory regression to T12 and duration of analgesia was longer in the Bupivacaine-Fentanyl group. We conclude the combination group prolongs the duration of sensory spinal block, increases the duration of analgesia without increasing the duration of motor block, does not cause any significant side effects and provides stable haemodynamic conditions without fetal or maternal compromise.

KEYWORDS: Spinal Anaesthesia, bupivacaine, fentanyl, pregnancy.

INTRODUCTION: Spinal anaesthesia has been widely used for caesarean section in normal as well as pre-eclamptic parturients and has been found to be efficacious and safe. After the discovery of opioid receptors in spinal cord and direct opioid action at this level, possibility of synergism between opioids and local anaesthetics,, co administered intrathecally has been explored extensively in obstetric population undergoing caesarean delivery.[1,2,3,4] The presumed underlying mechanism is that spinal anesthetic blocks ascending somatosensory drive on to reticulo-thalamocortical projection pathways, thereby reducing their excitability and hence decreasing the arousal level of brain. Furthermore, muscle spindle activity regulates the excitability of brain and arousal system. Hence in Sub-arachnoid block the reduced muscle spindle afferent impulse will lower the level of consciousness and awakening.[5,6]

Although hypotension due to decrease in systemic vascular resistance resulting from the blockade of preganglionic sympathetic fibres remains a problem with all central neuraxial blocks; the synergistic action of local anaesthetics with opioid can be of great benefit in achieving adequate anaesthesia with lesser dose of local anaesthetics, thereby reducing chances and severity of hypotension.[6] Opioids and local anaesthetics administered together intrathecally have a potent synergistic analgesic effect Improving the quality of intraoperative analgesia and also provides postoperative pain relief for longer duration.[7,8]

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When surgeries are done under SAB, adequate sedation level is of prime importance not only for the comfort of the patient, but also for the success of the surgery. However, due to the inherent sedative effect of SAB, unmonitored use of sedative drugs at standard doses may potentially convert conscious sedation into hypnosis, thereby increasing the probability of adverse events [3]. Various techniques like clinical assessment (Ramsay scale, Observer's Assessment of Alertness/Sedation scale [OAA/S scale]) or electroencephalogram (EEG) based monitors (Bispectral [BIS] index and entropy) have been used to titrate the intravenous (i.v) drug given for sedation.[9,10]

Bupivacaine is the most popular local anaesthetic for spinal anaesthesia, in parturients undergoing elective LSCS. Bupivacaine is a long acting amide local anaesthetic with duration of action of 1 ½ -2 hours it produces adequate pain relief, without a major effect on motor fibers.[1,2,3]

Fentanyl is one of the most extensively used opioids for this purpose. It improves the quality of sensory blockade intra-operatively without increasing sympathetic or motor blockage, it also enhances the quality and duration of post-operative analgesia to a significant extent and has been found to be safe and effective both in terms of neonatal and maternal outcome not only in normal parturients but also in severely preeclamptic patients for labour analgesia and elective caesarean section.[11,12,13]

OBJECTIVES TO ASSESS:

1. Maximum spread of the intrathecal drug.
2. Duration of Analgesia.
3. Duration of Motor blockade and sensory.
4. Haemodynamic parameters in intraop and post op period.
5. Neonatal outcome in both the groups and to compare the results.

MATERIALS AND METHODS: This prospective, randomized, double-blind study was conducted after taking written (Mention ethical committee approval) informed consent from the patient. Sixty patients of age 21-31 years were included, American Society of Anesthesiologists (ASA) physical status I and II undergoing LSCS under SAB were enrolled for the study. Patients with singleton uncomplicated pregnancy were included.

Patients with any known allergy to study drugs, contraindication for central neuraxial block, obesity (Body mass index, [BMI]>35kg/m^2), neurological or psychiatric disease on concurrent medication and refusal were excluded from the study. Patients with eclampsia, coagulation abnormalities, thrombocytopenia, patients in labour and those with foetal distress requiring emergency caesarean section, any drug allergy, spinal deformity or any other standard contraindication to spinal anaesthesia were excluded from the study.

Patients were randomly allocated to 2 groups of 30 each.

Group I (n-30) subarachnoid block was administered with 2.5mL of 0.5% hyperbaric bupivacaine, which is the control group Group II (n-30) subarachnoid block was administered with 2 ml of 0.5% hyperbaric bupivacaine and 0.5mL (25µg) fentanyl, which is the study group. To maintain blinding, drug preparation and procedure of SAB was performed by an independent anesthesiologist blinded to the study, while the observation was done by the attending anesthesiologist.

ANAESTHETIC TECHNIQUE: Patients were shifted to the operating-room and routine monitoring like electrocardiogram, pulse oximetry and noninvasive blood pressure were established. An 18G i.v

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cannula was secured and patients were preloaded with 500 mL of Ringer Lactate solution. The SAB was administered under strict aseptic precautions in lateral position at L3-L4 or L4-L5 interspace using 23/25G spinal needle. A fixed volume of the drug was prepared, and was administered in the subarachnoid space as per randomized group. Sensory block level was evaluated by pin prick test every 2 min until the drug gets fixed (Block remains at the same level at three consecutive readings). Motor blockade was assessed using the Modified Bromage score.

The readings of MBP, HR, SpO_2 were taken every 3 min. The MBP was maintained within 20% of the baseline values. Episodes of hypotension, defined as MBP<20% of baseline or systolic blood pressure<90mm of Hg was managed initially by rushing Ringer Lactate solution, and then i.v mephentermine 6mg bolus as required. Bradycardia (HR<50 beats/min) was treated with i.v atropine 0.6mg bolus dose and repeated if required. Oxygen was given at the rate of 6 L/min by face mask. Time taken to move the lower limbs and/or feel the pain in operated site were noted. This was the recovery time. Any patient requiring general anesthesia at any point in the study period was excluded from the study.

RESULT: All the patients in the 2 groups were comparable with respect to age, weight, baseline SpO_2in the two groups.

Table 1: Comparison of Age and Weight and SpO2 of the Studied Parturients in Group I and Group II.

	Control (Group I)				Study (Group II)				p value
	Min	max	Mean	SD	min	Max	Mean	SD	
Age (Years)	22	31	26.8	2.8	21	31.0	26.3	2.7	0.538 (NS)
Weight (Kg)	57	82	68.6	6.2	61	80.0	69.8	6.3	0.485 (NS)
SpO2 (%)	94	98	96.6	1.2	94	98	96.5	1.1	0.771 (NS)

NS: Not-significant

An adequate surgical block was documented before start of surgery and the time taken to reach this level was comparable between the two groups. Although there was no significant difference in the onset of sensory block and height of maximum sensory blockage between the two groups.

There was a significant difference (p value 0-000) in the time to regression of sensory anaesthesia below T12 dermatome. It was 162.6 ±10.5 min in group I and 209.9 ±11.6 min. in group 2. Time to achieve maximum motor block and the degree of motor block was comparable. And all patients achieved motor block within 10 min. Time to complete resolution of motor block did not differ between the two groups.

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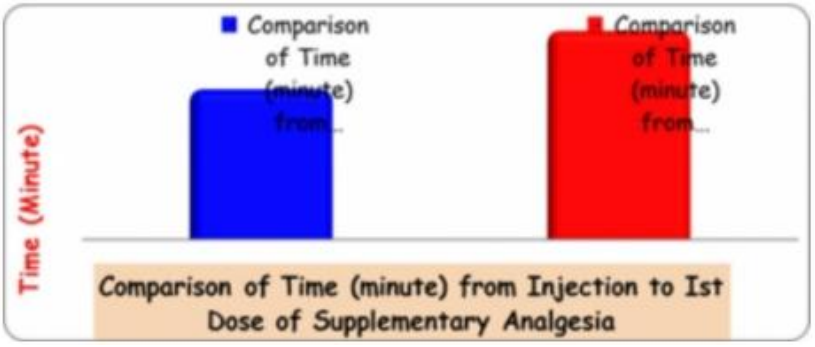
Table 2: Spinal Block Characteristics.

	Control Group	Study Group
Time to sensory block to T4 (min)	6.5 ± 1.5	6.3 ± 1.5
Time to complete motor block (min)	7.3 ± 3	7.7 ± 2.2
Time taken for sensory regression to T12 (min)	162.6 ± 10.5	209.9 ± 11.6
Time to complete regression of motor block (Bromage 0)	170.0 ± 19.7	170.0 ± 13.9
Time from injection to 1st dose of supplemental analgesia	234.7 ± 32.9	326.1 ± 50.0



There were no significant changes in BP in the two groups till 4 min. after giving spinal block. Thereafter there was a fall in BP in both the groups at 4 and 6min. However this was not < 20% of baseline in all patients. The fall was comparable between the two groups and did not vary significantly between the two groups. (Table 3).

The total requirements of mephentermine and i. v. fluids were similar in the two groups. One patient in the study group and three in the control group required mephentermine.

Table 3: Hemodynamic data.

Blood Pressure (mmHg)	Control Group	Study Group
Highest Systolic (Pre- operative)		
Mean Systolic	138.9 ± 9.7	136.4 ± 10.1
Absolute Systolic	156	154.0
Highest Diastolic (Pre- operative)		
Mean Diastolic	91.3 ± 4.9	88.4 ± 6.9
Absolute Diastolic	100	100
Lowest Systolic (Intra operative)		
Mean Systolic	119.7 ± 12.4	123.8 ± 5.7
Absolute Systolic	90	88
Lowest Diastolic (Intra operative)		
Mean Diastolic	77.1 ± 5.6	79.0 ± 3.2
Absolute Diastolic	50	60

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Duration of postoperative analgesia measured by the time to first dose of diclofenac was significantly longer in study group (326.1min.) compared to control group (234.7 32.9min.) [p=0-000].

Two patients in the control group and one in the study group had bradycardia. The statistical difference being insignificant. None of the patients complained of pruritis, respiratory/cardiac complications (maternal / neonatal) or urinary retention.

Table 4: Comparison of Side Effects in Group I and Group II.

	Control (Group I)		Study (Group II)		p value
	N	%	N	%	
Hypotension	3	12.0	1	4.0	0.302 (NS)
Bradycardia	2	8.0	1	4.0	0.556 (NS)
Pruritis	0	0.0	0	0.0	1.000 (NS)
Nausea/ Vomiting	3	12.0	1	4.0	0.297 (NS)
Shivering	1	4.0	0	0.0	0.312 (NS)
Respiratory Depression (Maternal)	0	0.0	0	0.0	1.000 (NS)
Urinary Retention	0	0.0	0	0.0	1.000 (NS)
Respiratory Depression (Neonatal)	0	0.0	0	0.0	1.000 (NS)

NS: *Not-significant*

Similarly when feto-maternal characteristics were compared a non-significant difference was observed in neonatal birth weight between the two groups. 9 neonates in control and 8 in the study group had a 1minute Apgar score of ≤ 7. However both the neonatal groups achieved Apgar score of > 7 at 5 minutes.

Neonatal outcome

	Control Group	**Study Group**
Birth Weight (gms)	3218 ± 393	3282 ± 408
1 min Apgar Score ≤ 7	9/25 (36%)	8/25(32%)
5 min Apgar Score > 7	25/25 (100%)	25/25 (100%)

DISCUSSION: Efficacy and safety of spinal anaesthesia with Bupivacaine has been studied by various investigators in obstetric patients.[2] Intrathecal opioids have been used for labour analgesia and for caesarean section in combination with varying doses of bupivacaine.[6,7,8] Opioids and local anaesthetics administered together intrathecally have a potent synergistic analgesic effect.[13,14] Improving the quality of intraoperative analgesia and also provides postoperative pain relief for longer duration.

An increased dose of fentanyl 0.5-0.75 mcg /kg intrathecally was associated with increased incidence of adverse effects in patients undergoing cesarean delivery. In our study, the dose of 25μg fentanyl has been chosen because it is in mid-range for doses quoted in the literature.[9,10]

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1 patient in the study group and 2 in the control developed bradycardia (HR<50bpm), the incidence on comparison being insignificant. The findings being in accordance with similar studies.[11,12,13,14]

Parturients in both our groups showed a significant fall in MAP by 4-6 minutes, this fall was less than 20% of the baseline and was comparable in both the groups. Hypotension was defined as a decrease in mean arterial blood pressure by ≥ 20% and treated with mephenteramine 3mg boluses.

One patient in study and 3 in control group developed hypotension, the incidence was insignificant as found by study by B. N. Biswas.[7] Similarly when diastolic blood pressure and mean arterial blood pressure were compared at all-time intervals the results were statistically insignificant p value. >0.05.[15,16]

Wallace etal[2] used higher dosage of Bupivacaine (11.25mg) as compared to our study but their patients had a greater fall in MAP (25%). This may be due to the inclusion of laboring patients, who have pain and a relatively elevated MAP which produce exaggerated apparent decrease in BP after spinal anaesthesia. We excluded laboring patients from our study. It has been observed that haemodynamic stability is unaffected by the addition of fentanyl to intrathecal bupivacaine. Experimental work and clinical activity after spinal anaesthesia is dose related to the bupivacaine, and that intrathecal fentanyl by itself nor in combination with bupivacaine causes further depression of sympathetic efferent activity.[17,18]

The highest sensory level achieved was compared between the two groups and found to be statistically significant with a p value of 0.011. In the study group 16 patients while in the control group 7 patients achieved T_4 sensory level. Similar observations were recorded by B. N. Biswas[7] S. Goel et al [15] Time taken to reach the highest sensory level was comparable between the two groups and correlate well with other studies who showed no statistically significant difference regarding the latency of sensory block.

The time taken for sensory regression to, T_{12} in study group was 209.9±11.6 min while in control group it was 162.6±10.5 min. This significant difference in p value <0.000 (S) was consistent with studies by Harbhej Singh et al.[8] Ben-David, et al[16]in Onset of motor block and regression of motor blockade were comparable in both the groups.

Various studies have found median effective dose of intrathecal fentanyl for labour analgesia to be approximately 14µg. This preemptive and synergistic action of fentanyl may be responsible for lower analgesic requirement in study group as compared to control group. Time to first analgesic requirement was longer in the study group as compared to control group.[18,19]

The side effect profile of this study revealed nausea and vomiting in 3 patients of control and 1 in study group. Many studies on the use of intrathecal fentanyl have demonstrated decreased incidence of intraoperative nausea and vomiting. No incidence of pruritis, maternal and fetal respiratory depression or urinary retention was reported in our study. Other studies using higher doses of fentanyl (>25mcg) have demonstrated increasing side effects on administration of intrathecal opoids.[20,21]

Although studies have shown poor correlation between the degree of hypotension during regional anaesthesia and neonatal umbilical acid-base status and uteroplacental perfusion, one of the limitations of this study was that umbilical pH and blood gas status could not be done for evaluation of fetal outcome.[21,22]

CONCLUSION: The spinal fentanyl- bupivacaine mixture produces a significant prolongation of sensory block, prolongs the duration of analgesia and achieves a higher quality of sensory block as compared to bupivacaine alone. This combination does not hasten the onset of sensory or motor block and does not prolong the duration of motor block. Fentanyl–bupivacaine combination does not produce haemodynamic instability, or adversly effect foetal outcome.

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FINANCIAL OR OTHER COMPETING INTERESTS: None

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Date of Submission: 29/10/2014.
Date of Peer Review: 30/10/2014.
Date of Acceptance: 18/03/2015.
Date of Publishing: 31/03/2015.