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ORIGINAL ARTICLE

COMPARATIVE STUDY OF HYPERBARIC BUPIVACAINE AND PLAIN ROPIVACAINE WITH FENTANYL AS AN ADJUVANT FOR SPINAL ANAESTHESIA IN CEASAREAN SECTION

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ABSTRACT: Spinal anaesthesia is very popular for cesarean section and currently both hyperbaric and plain solutions of local anaesthesia along with opioids are used. Difference in the baricity can affect the intrathecal distribution of local anaesthetics. **AIM**: We compared the effects of intrathecal hyperbaric (heavy) 0.5% bupivacaine and isobaric (plain) 0.75%ropivacaine combined with 25micro grams fentanyl regarding the degree of sensory and motor block, quality of intraoperative anaesthesia, side effects and post-operative analgesia in patients undergoing cesarean section by doing a randomized controlled study. **MATERIALS AND METHODS**: Sixty women undergoing caesarean section were randomized into two groups, Group BF (n=30), group RF (n= 30). Group BF received 10 mg (2 ml) of 0.5% hyperbaric bupivacaine with 25µgs of preservative free fentanyl and Group RF received 15mgs (2ml) 0.75% plain Ropivacaine (isobaric) with 25µgs of fentanyl for spinal anaesthesia. In case of insufficient blocks both the groups were supplemented with analgesic dose of ketamine. **RESULTS**: No difference was observed in onset time, highest level and recovery of sensory block. Recovery of motor block was slightly prolonged in RF group. The incidence of insufficient block requiring ketamine supplementation and duration of postoperative analgesia was same in both groups. The side effects were also similar in both the groups except for hypotension lower systolic pressure in BF group. The neonatal outcome was unaffected. **CONCLUSION**: In this study we did not find any difference in the two groups despite difference in density suggesting that the spread of spinal solution is not dependent on density in patients undergoing caesarean section.

KEYWORDS: Spinal anaesthesia, Bupivacaine, Ropivacaine, Fentanyl, Density (hyperbaric, isobaric).

INTRODUCTION: Bupivacaine preparation with dextrose were often used in clinical practice for spinal anaesthesia. Commercially available bupivacaine in 8% dextrose is hyperbaric relative to CSF whereas dextrose free ropivacaine is isobaric. Baricity differences between spinal anaesthetic solutions are thought to produce differences in distribution of anaesthetics with - in subarachnoid space which may affect onset, extent and duration of sensory block as well as side effects. It is commonly believed that hyperbaric solutions may be more suitable to reach the higher thoracic dermatomes as opposed to their plain equivalents. But in the obstetric patients the height of spinal block may not differ when either plain or hyberbaric LA solution is used.

Although intrathecal bupivacaine alone offers blockade up to T5 dermatomes, a substantial no of patients still experience some pain or some discomfort and require some analgesic supplement during cesarean section. Addition of fentanyl not only improves intra operative analgesia but also enhances early postoperative analgesia.

The present study is designed to examine whether the choice of local anaesthetic solution could affect the block characteristic and also if one preparation had advantage over the other.

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MATERIALS & METHODS: Sixty women of ASA grade 1 and 2 scheduled for caesarean section under spinal anaesthesia were included in the study after approval from the institutional ethical committee and informed written consent was taken. Sixty women were randomly allocated into two groups 30 each Group BF (n=30) receives. 10 mg (2 ml) of 0.5% hyperbaric bupivacaine with 25µgs of preservative free fentanyl and Group RF received 15 mg (2ml) 0.75% plain Ropivacaine (isobaric) with 25µgs of fentanyl for spinal anaesthesia.

The patient received I.V. ranitidine and metoclopramide 30-45mins before operation. In the operation theatre an I.V. line was secured and 500 ml of Ringer lactate was infused over 15mins prior to spinal anaesthesia. Monitoring included pulse oximetry and noninvasive blood pressure measurement cycled at 5mins interval. Under strict aseptic precautions a 25 gauge Quincke needle was inserted in the sub-arachnoid space at L2-3 or L3-4 interspace with the patient in right lateral position and the study solution was injected over 20-30 seconds.

After the injection the patients were immediately turned to supine position with 30° left uterine tilt. The level of anaesthesia was tested with 27 gauge hypodermic needle as loss of sensation. The degree of motor block was assessed using modified Bromage scale:

0=able to lift legs,

1=able to flex knees but not hips

2=unable to flex knees but can move ankle

3=no movement in any leg.

Sensory and motor assessments were done at 1 and 2 min and subsequently at 2.5mins still the level stabilized. The operation was allowed to start when the upper dermatomal level of loss of sensation to pin prick was at or above T6. The patients who complained of moderate to severe pain were given I.V. bolus of 10mg of ketamine and repeated if pain was unrelieved after 5mins. For patients requiring two or more doses of ketamine the spinal anaesthesia was labeled as failure, but the data for the onset of spinal anaesthesia were included for the analysis.

For the purpose of the study, hypotension was defined as either a systolic blood pressure of less than90 mmHg or a decrease of more than 20% of baseline and was treated with I.V. fluids and I.V. ephedrine. All the patients received 4 lmin-1 of O2 by face mask until delivery of baby.

Statistical Analysis: Statistical analysis was done using, student 't' test and X2 test as appropriate. A 'p' value of less than 0.05 was considered to be significant.

RESULTS: The patients were similar in both the groups with respect to demographic data, baseline vitals and operative time (table-1). There was no significant difference in the two groups for speed of onset, time to highest sensory level and median highest block height ($p>0.5$) (table-2). In two patients in plain group and one patient in hyperbaric group the block extended to T1 level. There was no statistically significant difference in mean time for two segment regression or regression to T10 level or duration of post-operative analgesia ($p>0.05$).

The motor block that developed slowly, recovered also slowly in plain group but the difference was not statistically significant (table-2). Intraoperative supplementation of ketamine was required in 3 patients in BF and 5 patients in RF group. Hypotension was observed approximately in half the patients in each group but the systolic blood pressure recorded was lower in hyperbaric

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group (table-1). Incidence of nausea, vomiting and pruritus was similar in both the groups. There was no difference in APGAR score at 1 and 5 mins in the two groups.

DEMOGRAPHIC DATA		
Variables	**Group BF**	**Group RF**
Weight(KG)	59	58
Age (yrs)	25± 5	25±4
Height (cms)	161	162

HEMODYNAMIC DATA		
Variables	**Group BF**	**Group RF**
Baseline systolic B.P(mmHg)	118±9	117±8
Baseline diastolic B.P(mmHg)	75± 8	80±7
Baseline heart rate (beats/min)	84±8	83 ±8
Lowest heart rate (beats/min)	63±4	64±4
Insufficient block(number)	3	5
Duration of operation	56±10	59 ±12
Patients with hypotension (%)	52	46
Patients requiring ephedrine	11	7

(Data are in mean SD)

Block characteristics		
Variables	**Group BF**	**Group RF**
Sensory block Highest sensory level	T4(T1- T4)	T5 (T1 – T5)
Onset time (mins)	5.2± 2.8	4.9± 2.3
Recovery time 2 segment regression	87.8± 18.9	88± 23
Motor block Onset time (mins)	3.5± 2.1	5.2± 3.4
Recovery time	183.3± 56	206 ± 48.8
Time for rescue analgesic(mins)	377.5 ± 195	318.3 ± 147.5

Data are in mean (S.D)

DISCUSSION: The principal finding in this study was that, there was no clinically significant difference between the two groups regarding subarachnoid spread in spite of a large difference in the injected spinal solutions. Both the groups provided adequate surgical anaesthesia in majority of the patients. Speed of onset, time to reach highest level, time of regression and duration of post-operative analgesia were also comparable in both the groups.

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Degree of motor block was same in both the groups but recovery was slightly prolonged in plain group as also reported previously. Addition of fentanyl to bupivacaine has been shown to decrease it's density [6, 7].The characteristics of block after spinal anaesthesia are influenced by the interaction between position of patient during and after injection, physical properties of CSF, injection technique, dose and density of spinal solution. The baricity of the local anaesthetic solution (ratio of the density of the solution to the density of the CSF) is the primary determinant in non-obstetric patient.

But this is clearly not the case in obstetric subjects near the term.[1] Review of pertinent studies suggests the following regarding the behaviour of hyperbaric and hypobaric spinal bupivacaine in obstetric patients. When the patient is returned supine immediately after injection in lumbar region, a hyperbaric solution will spread under the influence of gravity down the slope created by lumbar spinal curvature. Therefore certain other factors must be responsible for the cephalad spread of isobaric ropivacaine.

It has been proposed that positional change after spinal injection plays a major role in promoting cephalad redistribution of isobaric solution, likely due to CSF dynamics associated with caval compression and epidural venous engorgement.[5] Distension of the veins of the vertebral plexus causes compression of the dura, reduces CSF volume and encourages greater bulk spread of the injected solution.

Plain solution being less viscous mixes rather freely with CSF and thus moves easily arachnoid space. This analysis accounts for the comparable level of block in both groups in our study. Both the plain and hyperbaric solutions with fentanyl provided satisfactory surgical anaesthesia and post-operative analgesia.

Addition of fentanyl to bupivacaine has been shown to decrease it's density[2] but it did not reliably alter the block height in our patients, a finding in agreement with other studies.[3,4] Motor block was slightly prolonged in plain group, but was of little significance. Risk of hypotension was marginally higher in hyperbaric group, but had no effect on neonatal outcome.

Incidence of other side effects and failure rate was also similar in both the groups. In conclusion, the clinical results suggest that the spread of spinal solution containing bupivacaine and fentanyl is not dependent on the baricity in full term pregnant patients. Also we failed to find any significant advantage of one preparation over the other.

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