



## Observational Study of Comparative Analysis of 0.5% Isobaric and 0.5% Hyperbaric Bupivacaine in Spinal Anaesthesia

### KEYWORDS

isobaric, hyperbaric, subarachnoid block.

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**ABSTRACT** *Background:*The ideal local anaesthetic solution for intrathecal use has rapid onset and reliable duration, with less incidence of the side effects. This study was aiming to compare the onset of anaesthesia and duration of action of isobaric and hyperbaric bupivacaine for subarachnoid block.

*Method:* Hundred patients undergoing lower abdominal surgeries were allocated into two groups. Group I received 0.5% isobaric bupivacaine 4cc and Group II received 0.5% hyperbaric bupivacaine 4cc. Injection was made intrathecally in the midline position at L3-L4 interspace in sitting position.

*Statistical analysis:* Mean and S.D. calculated and Z test applied for the clinical significance.

*Results:* Onset of analgesia was faster i.e. T10 level achieved with hyperbaric bupivacaine as compared to isobaric bupivacaine. But duration of block longer with the isobaric bupivacaine as compared to hyperbaric solution. In both groups haemodynamic changes were not significant.

### INTRODUCTION:

Local anaesthetic agent bupivacaine used for spinal anaesthesia mainly as hyperbaric solution and isobaric solution [1-3]. But controversies exist regarding the level of spread achieved, duration of analgesia, and incidence of the side effects with isobaric bupivacaine when compared with the hyperbaric bupivacaine [4-6]. It is known that addition of dextrose 8% makes the bupivacaine hyperbaric and alters its anaesthetic properties. [1,3,7,8]

Similarly position of patients, baricity or density, volume of the local anaesthetic injected during spinal anaesthesia are main determinants of the spread of the drug in the subarachnoid space. In our institute sitting position is frequently used for giving spinal anaesthesia. Hyperbaric solutions tend to spread caudally under influence of gravity. While isobaric solutions would be expected to move rostrally as its specific gravity is less than that of cerebrospinal fluid [2,9,10].

Density varies inversely with the temperature. The actual change in the density with temperature cannot be predicted with different solutions. The temperature of the local anaesthetic rapidly equilibrates with the core temperature of the cerebrospinal fluid [37-38°C]. Hence to determine baricity which is the determinant of the spread of local anaesthetic in the subarachnoid space, the baricity of cerebrospinal fluid and baricity of the local anaesthetic should be measured at [37-38°C] [8].

For spinal anaesthesia, commercial preparations of the isobaric and hyperbaric bupivacaine are available. Considering this, this study aimed to evaluate the onset of action, duration of action, incidence of the side effects, and effects of plain bupivacaine [glucose free] 0.5% versus 0.5% heavy bupivacaine [in 8% dextrose].

### MATERIAL METHODS:

This is the observational study.

### Inclusion criteria:

60 patients of ASA I AND II, for various operations including lower abdominal, perineal, lower limb surgeries scheduled for subarachnoid block with estimation of the duration no longer than 120 mins were enrolled in the study.

### Exclusion criteria:

Patients refusal, patients on anticoagulation therapy, presence of infection at planned puncture site, untreated hypovolaemia, patients with renal failure on dialysis, peripheral neuropathies, patients with autonomic dysfunction, history of lumbar surgery making lumbar puncture difficult, grossly deformed vertebral column, patients with gross ascitis, large intra-abdominal tumours, allergy to local anaesthetic agents were excluded from the study.

Preoperative evaluation done and routine laboratory investigations were noted. On arrival in the preoperative room all patients received 500 ml of RL.

After taking the patient in the operation theater, multipara monitor attached to the patient and base line value of blood pressure, pulse rate, SPO<sub>2</sub>, ECG noted.

All the patients were studied under two groups

Group I: Received 0.5% isobaric bupivacaine 4cc

Group II: Received 0.5% hyperbaric bupivacaine 4cc

Soon after proper aseptic precautions the lumbar puncture was performed in sitting position using the midline approach in L3-L4 interspace with 26 G Quincke's spinal needle. Clear free flow of CSF indicates the proper position of the needle tip in the subarachnoid space. After aspiration of CSF 4 ML of the study solution injected in subarachnoid space. Immediately after injection, patients were turned back to the supine position and a pillow was placed under the head.

The term analgesia defined as the loss of sensation to the pinprick beginning from the feet in a cephalade direction bilaterally. Onset of analgesia defined as the time to achieve loss of sensation to the pinprick at T10 dermatomal level. Assessment done at every 2 mins till the level to T10, and after every 5 mins till half an hour of the spinal block.

Motor blockade of the lower limb was assessed on the bromage scale [0= no paralysis ; i.e full flexion of the legs and feet; 1= inability to raise the extended legs; 2= inability to flex knee ; 3= inability to flex ankle joint ]. The onset of the motor blockade is the time to achieve bromage score 3; i.e inability to flex the ankle. The first assessment was done at the interval of 5 mins of the spinal block after the patient was placed in the supine position. And the subsequent assessments were done at the interval of the 5 mins interval till complete motor block.

Duration of analgesia is the period of regression of the sensory level at L1 dermatomal level.

Duration of the motor blockade is the duration of the bromage score 3 to 0.

Highest sensory level achieved is noted.

Baseline measurements BP, PR, SPO2, ECG were measured noninvasively and continuously at the interval of the 5 mins till the completion of the surgery and at interval of 15 mins when the patients were shifted to the recovery unit.

Hypotension was defined as decrease in the blood pressure more than 30% of the baseline value and treated with the 5 mg of the ephedrine.

Bradycardia was defined when the HR < 50 beats/min, and treated with the inj. Atropine.

STATISTICAL ANALYSIS: Mean and S.D. calculated and Z test applied for the statistical significance. P < 0.05 considered to be significant.

**OBSERVATIONS AND RESULTS:**

**Table 1: On set of sensory block at T10**

Sr.No	Group I	GroupII
MEAN	8.34	4.8
RANGE	5 to 12 min	3 to 7 min
S.D.	1.644	1.095

Zs = 12.672 p < 0.01

**Table 2 : Table showing the onset of motor block to bromage Score 3**

Sr.No	Group I	GroupII
MEAN	16.34	10.74
RANGE	10 to 20 min	9 to 17 min
S.D.	1.911	7.082

Zm = 5.206 p < 0.001

GROUP I : The onset of sensory block at T10 was 8.34 min ranging from 5-12 min and onset of the motor block was

16.14 min ranging from 10 -20 min.

GROUP II : Onset of sensory block at T10 was 4.8 min ranging from 3 – 7 min. and onset of motor block was 10.74 ranging from 9- 17 min.

It indicates that the onset of sensory block was much earlier in both groups as compared to the motor block.

In Group II onset of sensory block to T10 was earlier than in GROUP I. Similarly onset of motor block was earlier in group II than in group I.

**TABLE :3**

Table showing the Duration of the sensory block

Sr.No	Group I	GroupII
MEAN	189.66 min	149.10 min
RANGE	170-210 min	124-170 min
S.D.	11.178	1.072

Zs = 25.541 p < 0.001

**Table 4 :**

**Table showing the duration of motor block in mins**

Sr.No	Group I	GroupII
MEAN	163.96 min	121.04 min
RANGE	150-205 min	100-145 min
S.D.	8.593	1.024

Zm = 35.070 p < 0.001

Group I: The mean duration of sensory analgesia was 189.66 min ranging from 170-210 min and mean duration of the motor block was 163.96 min. ranging from 150-205 min.

Group II: The mean duration of the sensory analgesia was 149.10 min ranging from 124-170 min. and mean duration of the motor block was 121.04 min. ranging from 100-145 min.

The sensory analgesia was of more duration than motor block in both groups. Sensory analgesia and motor block was significantly longer in group I than in group II. Hence clinically useful.

**TABLE 5:**

**Effects on blood pressure with group 1 and 2**

Sr. No	Fall in BP in MM of Hg.	Group I No.of pts	GroupII No.of pts
1	Upto 10 mm of hg	10(20%)	2(4%)
2	Upto 11-20 mm of hg	24(48%)	18(36%)
3	Upto 21-30 mm of hg	11(22%)	14(28%)
4	Upto 31-40 mm of hg	3(6%)	7(14%)
5	More than 40 mm of hg	2(4%)	9(18%)

**Effects on blood pressure**

GROUP I: Preoperative average systolic BP was 127 mm of Hg. with range 110-160 mm of Hg.

40 [80%] of patients had a fall of BP between 11-40 mm of Hg. Mean fall was 17.6 mm of Hg with S.D.=0.9759 mm of Hg.

GROUP II : Preoperative average systolic BP was 136 mm of Hg with range 110-160 mm of Hg.

48 [96%] of patients had fall of BP between 11-40 mm of Hg. Mean fall was 24.8 mm of Hg with S.D.=1.176 mm of Hg.

It shows that fall of BP was significantly more in GROUP II as compared to GROUP I.

#### Effects on pulse rate:

Group I : In this group no patients developed bradycardia.

Group II : In this group 5 patients developed bradycardia.

#### DISCUSSION :

The dose of 20 mg is used in our study because this dose is the basic dose to be used in daily practice as an academic hospital.

Similarly sitting position was preferred while giving the spinal anaesthesia so as to study the effects of the baricity on the spread of the drug

In our study the onset of analgesia i.e. T10 level was

achieved faster with the hyperbaric bupivacain as compared to the isobaric bupivacain. Similarly in our study the spread of analgesia was 3-4 segments higher with the hyperbaric solution than to the isobaric solution.[5,1] . It could be explained by the properties of two drugs in relation to the gravity and the movement of the CSF as a result of the postural changes.[1,11]. Gravity will tend to keep the hyperbaric solution to the lowest point of the thoracic curve T4/T5 in the supine position[2,8,11,13,18].

IN our study the onset of the motor block was earlier with the hyperbaric bupivacain as compared to the isobaric bupivacain [20]

Duration of analgesia was longer with the isobaric solution when compared to the hyperbaric solution.[21,22]

Hypotension and bradycardia are common side effects of the SAB due to the sympathetic blockade leads to the arterial vasodilatation, decrease in systemic vascular resistance and peripheral venous pooling hence fluid loading is beneficial to prevent hypotension[3,5]. Haemodynamic changes in two groups were not clinically significant i.e. they were reversible.

#### CONCLUSION:

Thus from present study it is concluded that both isobaric and hyperbaric solutions are reliable and safe. When higher blocks are required for the upper abdominal surgeries hy-

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