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Original Research Article

Comparison of Intrathecal 0.5% Hyperbaric Bupivacaine with 0.5% Hyperbaric Ropivacaine in Infraumbilical Surgeries

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Abstract:

Introduction: A 0.5% hyperbaric bupivacaine has been extensively used for spinal anaesthesia. It provides an intense motor block, of longer duration which is usually not needed for perineal and lower limb surgeries. Ropivacaine is a relatively new amino-amide local anaesthetic that appears to be less potent and gives less intense motor block of shorter duration as compared to bupivacaine. Ropivacaine also has less cardiovascular and central nervous system toxicity than bupivacaine. It is well established that addition of dextrose to local anaesthetic increases the specific gravity there by providing more reliable block as compared to isobaric solutions. This improves their anaesthetic profile by giving higher cephalad spread and good muscle relaxation. Hyperbaric solutions give more predictable block with greater spread in the direction of gravity.

Methods: The present study was conducted in a Tertiary health centre for 18 months amongst 150 patients posted for infra umbilical surgeries. The study population was divided into two groups of 75 each, Group B and Group R. Group B: Group of 75 patients received 3 ml of 0.5% hyperbaric bupivacaine. Group R: Group of 75 patients received 3ml of 0.5% hyperbaric Ropivacaine. Assessment of sensory and motor blockade was done using pin prick and Bromage scale respectively.

Results: The demographic parameters like age, sex, weight, ASA grading and duration of surgery were comparable. The onset time of sensory blockade to T10 dermatome was significantly earlier in group B than group R. The mean time for onset of Peak sensory blockade T6 dermatome in group B (6.05±1.05min) than in group R (10.05±2.06min) and difference between them was statistically significant. The mean time for onset of maximum motor blockade T6 dermatome in group B (10±0.15min) than in group R (10.75±1.30min) and difference between them was statistically significant. The total duration of motor block in group B was 150 ± 35.09 min and in group R was 120 ± 30.09 min. Maximum motor blockade was achieved significantly earlier in group B than group R. The total duration of sensory blockade in group B was significantly prolonged in group B than in group R.

Conclusion: Finally, we conclude that freshly prepared hyperbaric 0.5% Ropivacaine is a better alternative to hyperbaric 0.5% Bupivacaine for undergoing infraumbilical surgeries with faster onset of motor block, better haemodynamic stability, lower incidence of adverse effects and early recovery of sensory and motor block.

Keywords: Bupivacaine, Ropivacaine, Hyperbaric, Motor Block, Dextrose.

Introduction

Spinal anaesthesia (sub-arachnoid block (SAB)), is a regional anaesthesia involving injection of local anaesthetic into the cerebrospinal fluid (CSF) through a fine needle. [1] A total 5% hyperbaric lignocaine was a drug of choice for intrathecal anaesthesia but it has been associated with transient radicular irritation. It provides an intense motor block, of longer duration which is usually not needed for perineal and lower limb surgeries. Ropivacaine is a relatively new amino-amide local anaesthetic that appears to be less potent and gives less intense motor block of shorter duration as compared to bupivacaine. Ropivacaine also has less cardiovascular and central nervous system toxicity than bupivacaine. [2]

There is very limited data on the characteristics of intrathecal use of ropivacaine. Amongst which the studies done on hyperbaric ropivacaine are much less as compared to isobaric ropivacaine. [3]

It is well established that addition of dextrose to local anaesthetic increases the specific gravity there by providing more reliable block as compared to isobaric solutions. This improves their anaesthetic profile by giving higher cephalad spread and good muscle relaxation. Hyperbaric solutions give more predictable block with greater spread in the direction of gravity. It helps to achieve block height as per the requirement. [4]

The present study was aimed to compare the safety and efficacy of bupivacaine and ropivacaine with respect to onset, duration of sensory and motor blocks haemodynamic parameters and adverse effects if any.

Materials and Methods:

The present study was conducted in a Tertiary health centre for 18 months amongst 150 patients belonging to ASA physical status I and II aged 18 to 65 years who underwent infra umbilical surgeries selected after thorough history taking and clinical examination. Written valid Informed consent was taken from the patients for the procedure. The study population was divided into two groups of 75 each, Group B and Group R. **Group B**: Group of 75 patients received 3 ml of 0.5% hyperbaric bupivacaine. **Group R**: Group of 75 patients received 3ml of 0.5% hyperbaric Ropivacaine. Pre anaesthetic evaluation was done. Basic laboratory investigations like complete blood count, blood sugar level, blood urea, serum creatinine, liver function test, chest X-ray, Electrocardiography (ECG), and urinary investigations were carried out.

Data Collection Tool: Multipara Monitors in OT record pulse rate, non-invasive Blood pressure, ECG, pulse oximetry (SpO2).

Inclusion Criteria: ASA-I or II, Age of patients: 20-65 years, Written and informed consent given by the patient and Patients undergoing elective infra-umbilical surgeries.

Exclusion Criteria: Patient refusal, History of allergy to local anaesthetic or opioids, Septicaemia, ASA- III to V, Pre-existing system diseases, Deformed spine, Patient with a history of bleeding disorder or anticoagulant disorder, Patient with psychiatric disorder and Local infection at the site of injection.

Pre-Operative investigations: Complete blood count, Urine examination (urine albumin, sugar, and microscopy), Kidney function test, Liver function test, Electrocardiography, Chest X-ray, Blood sugar level, Patient demographic details were noted.

B) Drugs: Inj.0.5% hyperbaric bupivacaine, Inj.0.5% Hyperbaric Ropivacaine, 25% Dextrose.

General information and socio-demographic data: Baseline demographic variables were collected: age, weight, height, BMI, education, occupation, religion, income, address, type of family, socioeconomic status, and co-morbidities.

Methodology: (For Data Collection): Under all aseptic precautions a Lumbar puncture was performed using the midline technique at the L2-L3 Or L3-L4 interspace in sitting position with legs extended **and a A 27-gauge Quirke spinal needle.**

The ropivacaine solution was prepared aseptically immediately before injection using 2 ml of 0.75% isobaric ropivacaine and 1 ml of glucose 25%. All the 3 ml (15 mg) was injected intrathecally. The heavy bupivacaine solution was available in our hospital. The following parameters were assessed concerning sensory anaesthesia by pinprick at 2-minute intervals - onset of sensory block, time of highest level of sensory block and duration of sensory block. Motor block characteristics were assessed in terms of onset of motor block, degree of motor block using a modified boomage scale and total duration of motor block. Surgery was allowed to start after an adequate level of anaesthesia was obtained. Intraoperative hemodynamic parameters like heart rate, systolic, diastolic and MAP were assessed at 1min, 2min, 5min, 10min, 15min, 20min, 30min, 45min and 60min. Assessment of sensory and motor blockade was done using pin prick and Bromage scale respectively. The point of completion of injection of study drug was taken as the starting time. Block characteristics observed were Time of onset of sensory block to T10, Maximum Level of sensory blockade, Time of onset of peak level of sensory blockade, Time for onset of maximum motor block, Total duration of sensory blockade, Total duration of motor blockade.

Degree of Sensory response was assessed by pin prick (Hollmen scale).

1. Normal sensation of pin prick
2. Pinprick is felt as sharp pointed but weaker as compared with same area in another upper limb
3. Pin prick recognized as touch with blunt object
4. No perception of pin prick

Degree of motor block assessed by modified Bromage scale:

Grade 0. None

Grade 1. Just able to move the knee but not hip.

Grade 2. Able to move the foot only

Grade 3. Unable to move knee or foot.

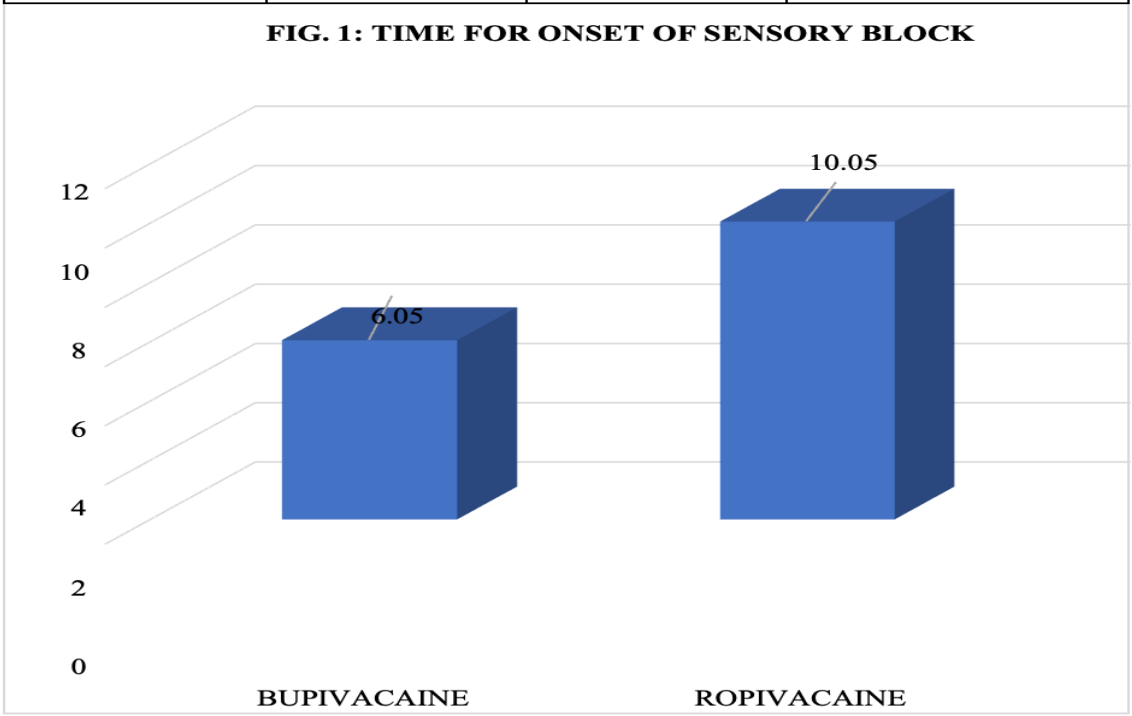
Results

The present study was successfully conducted on 150 adult patients with no protocol deviation. All patients were co-operative with the subsequent assessment. The demographic profile of this patients in terms of their age, sex, weight, height, BMI, surgery duration and ASA grade were as follows:

TABLE 1: TIME FOR ONSET OF SENSORY BLOCK.

TIME OF ONSET OF SENSORY BLOCK. (MIN)	GROUP B	GROUP R	P- Value
Number of Cases	75	75	
Mean ± SD	5±0.5	7.5±0.5	0.0321

FIG. 1: TIME FOR ONSET OF SENSORY BLOCK



The table no.1 shows that the average time to reach sensory block. On average it took 5 ±0.5 minutes for the Group B to achieve this level, whereas the Group R took significantly longer at 7.5 ± 0.5 minutes. $P < 0.05$ indicates a statistically significant difference.

Table 2: Time for onset of peak sensory block.

Time of Onset of Sensory Block. (Min)	Group B	Group R	P- Value
Number of Cases	75	75	
Mean + SD	6.05 + 1.05	10.05 + 2.06	0.034

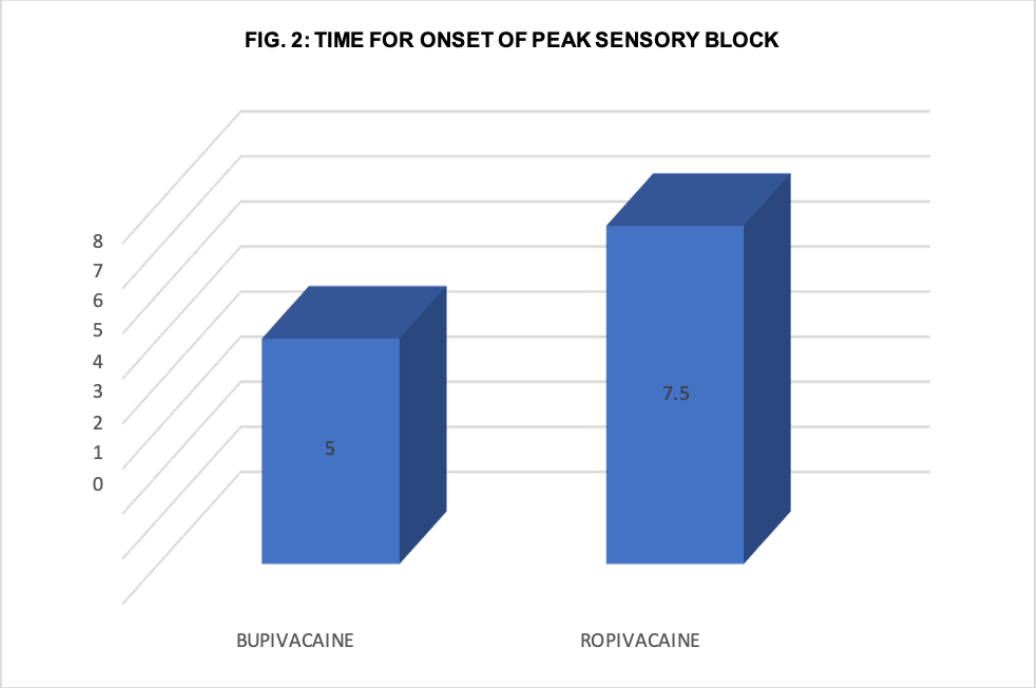


Table no. 2 shows that the patients who received Group B reached this point faster averaging 5 ± 0.5 minutes. In contrast Group R took significantly longer averaging 7.5 ± 0.5 minutes. It was statistically significant ($p<0.05$).

Table 3: Total duration of sensory block (in min).

Time of Duration of Sensory Block (In Min.)	Group B	Group R	P- Value
Number of Cases	75	75	0.001
Mean ± SD	180 ± 18	157 ± 25	

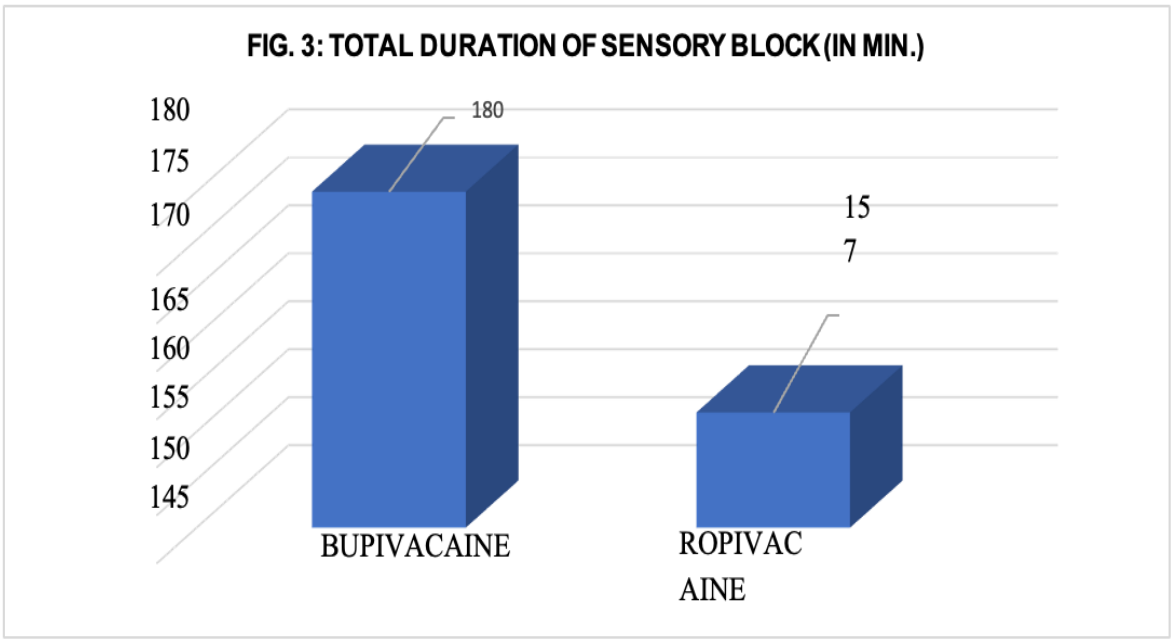


Table no.3 shows that the Patients who received Group B had a longer block duration on average lasting 180 ± 18 minutes. In comparison Group R experienced a shorter duration at 157± 25 minutes. It was statistically significant ($p<0.05$).

Table 4: Total duration of motor block (in min).

Time of Duration of Motor Block (Min.)	Group B	Group R	P- Value
Number of Cases	75	75	0.035
Mean ± SD	150 ± 35.09	120 ± 30.09	

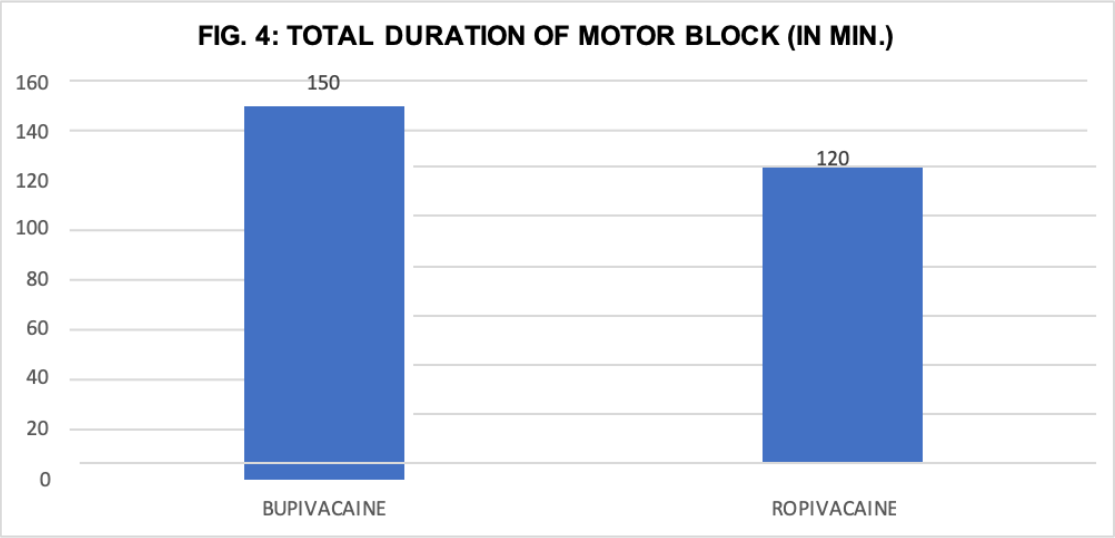


Table no. 4 shows that the Group B experienced a longer block duration on average lasting 150 ± 35.09 minutes. The Group R had a shorter duration at 120 ± 30.09 minutes. It was statistically significant ($p<0.05$).

Table 5: Incidence of side effect in post operative period.

Post Op Side effects		Group B (n-75)	Group R (n-75)	X^2	P Value
Hypotension	Yes	43	17		
	No	32	58	7.994	0.012
Bradycardia	Yes	20	20	0.0000	0.123
	No	55	55		
Vomiting	Yes	15	2	9.45	0.0045
	No	60	73		
Shivering	Yes	10	4	10.45	P<0.05
	No	65	71		

Table no.5 shows that the Group B 43 patients experienced hypotension while 32 did not. In Group R 17 patients experienced hypotension while 58 did not. It was statistically significant ($p<0.05$). Also, the Group B 20 patients experienced bradycardia while 55 did not. In Group R 20 patients experienced bradycardia while 55 did not. It was statistically not significant ($p>0.05$). While, in the Group B 15 patients experienced vomiting while 60 did not. In Group R only 2 patients experienced vomiting while 73 did not. It was statistically significant ($p<0.05$). In the Group B 10 patients experienced shivering while 65 did not. In Group R 4 patients experienced shivering while 71 did not. It was statistically significant ($p<0.05$).

Discussion

In our study, the mean time for onset of sensory blockade at T10 dermatome in group B was 5 ± 0.5 min. While in group R it was 7.5 ± 0.5 min. There was faster onset in group B compared to group R, which was found to be statistically significant.

Swetha Purohit et al.[5], in their study observed onset time of sensory blockade at T10 dermatome to be 4.5 ± 1.2 min in group B and 3.2 ± 0.75 min in group. They found that onset of sensory block was earlier in group R than group B which was not comparable with our study.

J.B. Whiteside et al6., in their study observed onset time of sensory blockade at T10 dermatome to be 2 min (2-10 mins) in group B and 5 min (2-25 mins) in group R, which was found to be statistically

significant. The study findings were not similar to our study results.

Feroz Ahmad Dar et al.[7], also observed Time for onset of sensory block in bupivacaine group 3 (2-10) min and in Ropivacaine group 6 (2-25) min, that was statistically significant which correlates with our study.

In our study, the time for onset of peak sensory level in group B was 6.05 ± 1.05 min and in group R was 10.05 ± 2.06 min. The difference was found to be statistically significant. Ramesh Ghimire et al8., in their study found that onset of peak sensory level in group B was 9.10 ± 3.90 min and in group R was 10.87 ± 5.37 min. The difference was found to be statistically significant. This study findings were similar to our study.

In the present study, the time for onset of motor blockade in group B was 10.00 ± 0.15 min and in group R was 10.75 ± 1.30 min. The difference was found to be statistically significant.

Swetha Purohit et al.[5], also found that in group B time for onset of motor block was 7.9 ± 2.4 min and in group R 8.4 ± 2.1 min. The difference was found to be statistically not significant. The onset of motor lock was earlier in group B which was comparable to our study.

Pallavi Amol Kharat et al.[9]], in their study found that time of onset of motor block in group B was 10.00 ± 0.00 min and in group R was 10.43 ± 1.42 min. The difference was found to be statistically not significant.

In the present study, the time of duration of sensory block in group B was 180 ± 18 min and in group R was 157 ± 25 min. The difference was found to be statistically significant.

The duration of action of a local anaesthetic is a function of the degree of protein binding of the drug. The higher the degree of protein binding, the greater the affinity of the drug for the protein receptor in the transport channel and the longer the drug remains bound to the receptor.[10]

Swetha Purohit et al5., also found that in group B the time of duration of sensory block was 180.60 ± 23.06 min and in group R 157.44 ± 17.78 min. The difference was found to be statistically significant. The study findings were similar when compared to our study.

J.B. Whiteside et al.[6], in their study found that the time of duration of sensory block in group B was 255 min (150-420 mins) and in group R was 180 min (120 – 270 mins). The difference was found to be statistically significant. They also found duration of sensory block in Group B to be more than group R which correlates with our study but duration of block was more as compare to our study.

In the present study, the time of duration of motor block in group B was 150 ± 35.09 min and in group R was 120 ± 30.09 min. The difference was found to be statistically significant.

Swetha Purohit et al.[5], also found that in group B the time of duration of motor block was 148.7 ± 35.4 min and in group R 126.3 ± 38.3 min. The study findings were similar.

Pallavi Amol Kharat et al.[9], in their study found that time of duration of motor block in group B was 156.71 ± 34.17 min and in group R was 118.86 ± 31.18 min. The difference was found to be statistically significant. The study findings corelates with our study.

In our study there was no significant difference in heart rate between the groups at baseline (0 minutes) and during the first 10 minutes after medication. From 15 minutes to 100 minutes, the Bupivacaine group exhibits a consistently higher average heart rate compared to the Ropivacaine group, with statistically significant differences observed at certain points ($p<0.05$). However, after 100 minutes, the differences in heart rate between the groups become less pronounced and were statistically significant. Pallavi Amol Kharat et al.[9], found in their study that heart rate was comparable in both groups in baseline readings. Ramesh Ghimire et al.[8], found in their study that heart rate was not statistically significant throughout the study.

In the present study there was no statistically significant difference in blood pressure in group B and group R. Swetha Purohit et al5 and Pallavi Amol Kharat et al.[9], found in their study that there was no statistically significant difference in blood pressure in group B and group R.

In the present study, hypotension in group B and group R observed was 57.3% and 22.6% respectively. Hypotension was found to be significant in Group B. Bradycardia was statistically not significant. Vomiting in group B and group R observed was 20% and 2.66% respectively. Vomiting was found to be significant in Group B as

compared to Group R. Swetha Purohit et al5 and Pallavi Amol Kharat et al.[9] found significant hypotension in group B as compared to group R which corelates to our study.

Conclusion

Finally, we conclude that freshly prepared hyperbaric 0.5% Ropivacaine is a better alternative to hyperbaric 0.5% Bupivacaine for undergoing infraumbilical surgeries with faster onset of motor block, better haemodynamic stability, lower incidence of adverse effects and early recovery of sensory and motor block.

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