Original Article

A Comparative Evaluation of 0.5% Hyperbaric Ropivacaine with 0.5% Hyperbaric Bupivacaine for Sub-Arachnoid Block for Elective below Umbilical Surgeries

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ABSTRACT

Aim : To compare the onset and duration of sensory and motor blockade of intrathecal 0.5% hyperbaric ropivacaine and 0.5% hyperbaric bupivacaine for elective below umbilical surgeries.

Materials and Methods: A prospective randomized study was conducted with forty ASA (American society of Anaesthesiologist) grade I and II patients undergoing lower-abdominal or lower-limb surgery under subarachnoid who were selected to receive 3ml of 0.5% hyperbaric ropivacaine (Group R) or 3 ml of 0.5% hyperbaric bupivacaine (Group B) randomly. The onset, duration of sensory and motor block and side-effects were observed.

Results: The sub-arachnoid block with the study drugs in both the groups was adequate for the surgery, but there were significant differences in mean time of onset of sensory block.The level of sensory blockade was tested by pinprick and time taken for onset of analgesia at T10 was more rapid in Group R (2.9 + 1.04 minutes) than for Group B (5.3 + 1.34 minutes). In group R, the maximum level of block attained was T7 in 50 % of the cases, whereas it was T6 in 60 % of cases in group B. The total duration of sensory block was shorter in Group R (P=0.0001). The degree and duration of motor block were greater in group B when compared to group R. Mean time taken for complete regression of sensory block was (160 + 9.65 minutes) with group R compared with (201 + 8.65minutes) with group B.

Conclusion: 0.5% hyperbaric ropivacaine provides a reliable and a good quality sub-arachnoid block with better haemodynamic stability but with shorter duration when compared to 0.5% hyperbaric bupivacaine.

Keywords: Local anesthetics 0.5% hyperbaric bupivacaine, 0.5% hyperbaric ropivacaine

INTRODUCTION

All the surgeries below the level of umbilicus can usually be done under sub-arachnoid block. It gives good relaxation, better analgesia that will be extending to immediate post-operative period. Lignocaine, Bupivacaine are popular preferred local anesthetics for sub-arachnoid block, available as hyperbaric solutions. Ropivacaine another amide local anesthetic is having the chemical structure similar to bupivacaine and is available commercially as isobaric preparations. Dextrose has to be added to make it hyperbaric to compare its clinical efficacy to hyperbaric bupivacaine, a widely used drug for below umbilical surgeries, [1,2] for subarachnoid block [3, 4].

MATERIALS AND METHODS

This prospective, randomized clinical study was conducted at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar for a period of 6 months in first half of 2013. Institutional Ethical committee approval was obtained for the study. Forty patients were randomly selected for surgeries below the level of umbilicus, they

were divided in two groups of twenty each i.e Group R and group B. The Inclusion criteria for patient selection were age group between 18-65 years, ASA grade I and II.

Exclusion criteria were patients with spinal deformities, local skin sepsis, bleeding disorders, psychiatric illness, intracranial lesion, or increased intracranial pressure.

Patients were screened for routine laboratory investigations like complete blood picture, complete urine examination, blood sugars, serum electrolytes, blood urea and serum creatinine. The procedure was explained to patients and informed consent was taken from all the patients on the day of surgery.

On arrival in the operation theatre, a suitable peripheral vein was cannulated with 18G catheter and 500 ml Ringer lactate was infused as preload for all the patients over a period of 15 minutes. Continuous monitoring of ECG, non-invasive arterial pressure and pulse-oximetry were started.

Pre-medication with ondansetron 0.08mg/kg intravenously and glycopyrrolate 0.02mg/kg intravenously was given. Lumbar puncture was done in left lateral position using 23G Quincke Beck needle with the bevel facing laterally, and the appropriate local anaesthetic solution was injected slowly. Group B patients received 3ml of 0.5% hyperbaric bupivacaine (15mg). Group R patients received 3ml of 0.5% hyperbaric ropivacaine. Hyperbaric ropivacaine solutions were prepared aseptically, immediately before injection by anaesthesiologist, by mixing 2 ml of 0.75% isobaric ropivacaine with 0.6ml of 25 % dextrose and adding 0.4 ml of normal saline to make a final solution of 3 ml. The specific gravity of thus aseptically prepared 0.5 % hyperbaric ropivacaine solution was tested in the hospital labaratory by 'multiagent Dipstick strip test' and found to be 1.025 whereas it is 1.023 for 0.5% hyperbaric bupivacaine.

These patients were maintained in supine position for 12 minutes without any tilt. The level of sensory block was tested by loss of response to pinprick. The time taken for the level of blockade to attain T10 was taken as onset of sensory block, the same was continued till the sensory block stopped ascending and taken as maximum level. The quality of motor block was assessed by modified bromage scale (0 = full movement, 1 = inability to raise extended leg but can bend knee, 2 = inability to bend knee can flex ankle, 3 = no movement).

Haemodynamics like pulse rate, mean arterial pressure was recorded with Non-invasive blood pressure monitoring every 5 minutes for first half an hour then every 10 minutes thereafter. Complications if any were noted.

Post operative analgesia was monitored with visual analogue scale, no pain being scored – 0, worst pain-10.

The time required for rescue analgesia was noted, injection tramadol 50mg intravenously given when numerical scale was 4 and above.

STATISTICAL ANALYSIS

Data is presented as median (range), mean (Standard deviation) as appropriate. The data obtained were subjected to statistical computation with analysis variance t-test using statistical package subjected to statistical computation with analysis variance t-test using statistical package Epi v2.3 open source and values for $P<0.01$ was considered as significant and $P<0.0001$ as highly significant.

RESULTS

Demographic Data

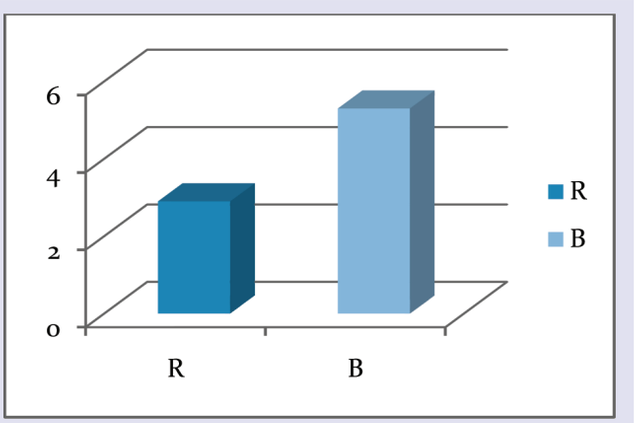
All the 40 patients who were included in the study were comparable in age, sex, weight and height.

Onset of T10 sensory block

The mean time taken by the Group R to attain T10 level was (2.9 + 1.04 minutes) and in Group B was (5.3 + 1.34 minutes). The difference in both the groups were statistically highly significant with $P<0.000001$.

Table 1: Time taken for onset of T10 sensory block

Time for T10 Blockade	N	Mean	Standard Deviation	P Value
R	20	2.9	1.04	<0.0000
B	20	5.3	1.34	01



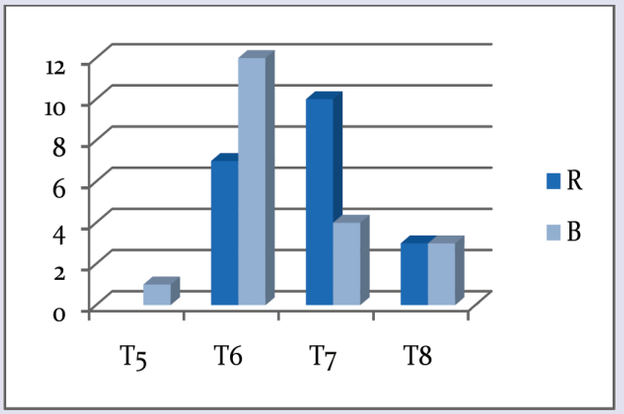
x-axis showing group R and group B
y-axis showing time in minutes

Maximum level of analgesia

Maximum Level of analgesia with 50 % of patients in group R was T7 and in group B 60 % patients of patients attained T6 as maximum level.

Table 1: Time taken for onset of T10 sensory block

Max. cephalad spread	R	B
T5		01 (05%)
T6	07 (35%)	12 (60%)
T7	10 (50%)	04 (20%)
T8	03 (15%)	03 (15%)



x-axis showing segments blocked in group R and group B.

y-axis showing number of patients achieved block in each group.

Comparison of time taken for two segment regression

Mean time taken by Ropivacaine group for two segment regression was (54.5 + 5.13minutes) as compared with bupivacaine group which was (68.6 + 4.64 minutes).

Two Segment Regression Time	N	Mean	Standard Deviation	P Value
R	20	54.45	5.13	<0.000001
B	20	68.6	4.64	

Rescue analgesia time

Mean time for rescue analgesia for patients in Ropivacaine group was (116 + 6.44 minutes) when compared with bupivacaine group who required analgesia at (140 + 8.55

Time For Rescue Analgesia	N	Mean	Standard Deviation	P Value
R	20	116	6.44	<0.000001
B	20	140.75	8.55	

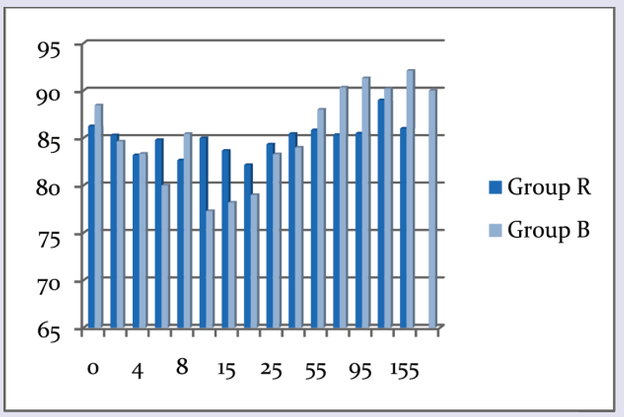
Total duration of sensory block

The total duration of sensory block in ropivacaine group was (160.75 + 9.65 minutes), in bupivacaine group it was (201.75 + 8.98 minutes).

Total Duration of Sensory Block	N	Mean	Standard Deviation	P Value
R	20	160.75	9.65	<0.0001
B	20	201.75	8.98	

Comparison of Mean arterial pressure between Group R and Group B

The group R patients were more haemodynamically stable when compared to the group B patients.



x-axis showing time in minutes.
y-axis mean arterial pressures in mmHg.

DISCUSSION

Ropivacaine is a local anesthetic which like all other amide anesthetics is structurally related to bupivacaine. Bupivacaine is associated with cardiotoxicity when used in high concentrations or when accidentally injected intravascularly. For the purpose of reducing potential toxicity and improving relative sensory and motor block profiles, bupivacaine is supplied as racemate. Ropivacaine is a pure S-enantiomer and is less lipophillic than bupivacaine and is less less likely to penetrate large myelinated motor fibres, therefore, it has selective action on pain transmitting A and C fibres rather than A, which are involved in motor function. Ropivacaine, both as isobaric or hyperbaric solutions have been tried for various surgical procedures and generally resulted in faster onset and recovery from the blocks with varied levels of blockade.

The present study was undertaken to compare the onset, duration and extent of sensory and motor block with

ropivacaine in comparison to bupivacaine. The demographic profile of both groups was comparable with respect to mean age, sex, weight, height, ASA grade and duration of surgery. The results of present study has confirmed that 15mg of 0.5% hyperbaric ropivacaine produced good subarachnoid block with shorter duration of sensory and motor blockade compared to 0.5 % hyperbaric bupivaciane[5,7]. Present study revealed that the onset of analgesia at T[10] was rapid with ropivacaine, demonstrated by loss of response to pinprick. Time taken to establish the block effectively was earlier and maximum level of block achieved was slightly lower with 0.5 % hyperbaric ropivacaine. The degree and duration of motor block was significantly greater in patients who received 0.5 % hyperbaric bupivacaine. This may be due to less lipophillic action of ropivacaine, thus causing less penetration of thick myelinated A fibres that are involved in motor function. This may explain the difference in sensory and motor blockade with ropivacaine, when compared to bupivacaine[13,14]. It has been demonstrated in the previous studies that addition of dextrose to solutions both for tetracaine and bupivacaine [9-12] limited the level of block. This was also held good in the present study for ropivacaine to produce a reliable, less extensive block and agrees with that of previous work of Van Kleef and colleagues[5].

The potency of drug relates to the effect produced and not the duration of that effect, and both the groups studied produced blocks that were effective for the surgery undertaken. This is in contrast to the results of the two early clinical studies of intrathecal ropivacaine, varied widely in extent and were frequently inadequate for surgery[1,2], however those studies were done with isobaric preparations of ropivacaine.

There is a general view that ropivacaine has less potent effect on motor nerves. It is confirmed in present study, considering both the degree and duration of motor block, is adequate for the surgery. There is a considerable evidence suggesting a greater degree of difference between sensory and motor blockade when using ropivacaine than bupivacaine. In the present study, equal doses of ropivacaine and bupivacaine were compared, the onset was earlier but the extent of sensory block were similar. The duration and degree of both sensory and motor blockade were less with ropivacaine.

Mean time taken for complete regression of sensory block (160 + 9.65 minutes) was shorter with ropivacaine than with bupivacaine (201 + 8.65 minutes). Thus, intrathecal ropivacaine has shorter duration of sensory and motor blockade than bupivacaine, but it cannot form a basis for conclusion that it is less potent and certainly unsuitable for clinical use with this route. In the present study ropivacaine provided a relatively stable haemodynamics compared to bupivacaine.

CONCLUSION

In conclusion, a solution of hyperbaric ropivacaine can be used for reliable subarachnoid block that is comparable to hyperbaric bupivacaine in terms of quality, but with a shorter duration. The present study has confirmed that a hyperbaric ropivacaine can be a choice of subarachnoid block for a wide range of surgical procedures with better haemodynamic stability, compared to hyperbaric bupivacaine of equal dosage. Thus, hyperbaric ropivacaine, with its good sensory efficacy, lesser propensity for motor blockade and reduced cardiovascular and central nervous system toxicity, appears to be a drug alternative to bupivaciane for subarachnoid block. Ropivacaine is an agent worthy of further study for subarachnoid block.

CONFLICT OF INTEREST
The authors declared no conflict of interest.

FUNDING: None

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