



A COMPARISON OF INTRATHECAL 0.75% HYPERBARIC ROPIVACAINE WITH 0.5% HYPERBARIC BUPIVACAINE FOR ELECTIVE SURGERY.

Dr. Mendem.divya Pravalika

Post Graduate

Dr. Shahedha Parveen*

Associate professor. *Corresponding Author

Dr. Athaluri Vishnuvardhan

MD.professor &HOD

ABSTRACT

INTRODUCTION : To compare the onset of action, intensity and duration of motor block of 0.75% hyperbaric Ropivacaine with 0.5% hyperbaric Bupivacaine for elective lower abdominal, perineal and lower-limb surgeries.

METHODS: 70 patients undergoing elective lower abdominal, perineal and lower limb surgery receiving spinal anesthesia were divided randomly into two groups, Group B, (Bupivacaine 5 mg/ml with glucose 80 mg/ml;4 ml, and Group R, (Ropivacaine 7.5 mg/ml with glucose 80mg/ml; 4 ml). **RESULTS:** The results were analyzed and compared using Chi-square test, student's t-test and Fisher's exact tests. The onset of sensory block was more rapid with Bupivacaine ($p < 0.05$). The maximum cephalad spread was similar in both groups. However, the time required to maximum extent of cephalic spread was less in Group B ($p < 0.05$). Motor block 3 according to the Modified Bromage scale was obtained in both groups and the time to achieve the same was not significant. The duration of motor blockade i.e., time to complete regression of motor block was significantly greater with Group B than with Group R (0.0001). We found that there was no significant difference in the time taken to achieve grade 3 motor block but Ropivacaine gave a lesser degree of motor lock which regressed faster than Bupivacaine (118 min versus 156 min; $p < 0.0001$). There was no significant difference in hemodynamic parameters except that diastolic and mean pressures remained on lower side in group B ($p < 0.05$). **CONCLUSIONS:** We conclude that 0.75% hyperbaric Ropivacaine provides a sensory block of similar onset and extent, shorter duration of action and less frequency of hypotension and better hemodynamic Stability as compared to 0.5% hyperbaric Bupivacaine

KEYWORDS : Hyperbaric, Intrathecal Bupivacaine, Intrathecal Ropivacaine.

INTRODUCTION

Spinal anaesthesia is the most commonly performed neuraxial blockade for surgeries involving lower abdomen, lower limbs, pelvis, caesarean section. Subarachnoid block has higher safety and cost-effectiveness than general anaesthesia. Additionally, it prevents the use of several pharmaceuticals, airway manipulation, an increased risk of aspiration, hemodynamic changes linked to stress responses from laryngoscopy and intubation, and a lengthier recovery time. 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.

Its longer duration of action and urinary retention make it unsuitable for ambulatory anaesthesia.

This led to a quest for a newer local anesthetic agent which could be used for spinal anaesthesia for day care cases and could sidetrack the cardiotoxic potential of bupivacaine.

It is well established that addition of dextrose to local anesthetic increases the specific gravity thereby providing more reliable block as compared to isobaric solutions. This improves their anesthetic 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 of surgery.

Bupivacaine :

Bupivacaine was discovered in 1957. Bupivacaine is an amino-amide anaesthetic; the aromatic head and the hydrocarbon chain are linked by an amide bond rather than an ester as in earlier local anaesthetics. As a result, the amino-amide anaesthetics are more stable and less likely to cause allergic reactions. Unlike lidocaine, the terminal amino portion of Bupivacaine (as well as Mepivacaine, Ropivacaine, and Levobupivacaine) is contained within a piperidine ring; these agents are known as pipercolyl xylidines. Bupivacaine binds to the intracellular portion of voltage-gated sodium channels and blocks sodium influx into nerve cells, which prevents depolarization. Without depolarization, no initiation or conduction of a pain signal can occur. Half life: neonates, 8.1 hr, adults: 2.7 hr Time to peak plasma concentration (for peripheral, epidural, or caudal block): 30–45 min

Protein binding: about 95%

Metabolism: hepatic

Excretion: renal (6% unchanged)

Ropivacaine:

Ropivacaine was introduced in 1996 and is another highly protein-bound amide local anaesthetic. It is structurally related to bupivacaine, with the same pKa (8.1) and so it is also characterized by slow onset and a long duration of action. Compared to bupivacaine, the proposed advantages of spinal Ropivacaine were less cardiotoxicity and greater motor-sensory block differentiation, resulting in less motor block. Subsequently, the potency of Ropivacaine was found to be 0.6 that of Bupivacaine. When Ropivacaine is given in an equivalent dose to bupivacaine, There is slightly less motor block and earlier recovery with Ropivacaine.

MATERIAL AND METHODS:

A randomized double blinded study was conducted in government general hospital, Kakinada over a period from March 2022 to April 2022. After attaining ethical committee approval, 70 subjects were taken for the study with ASA grade I and II aged between 25-55 years belonging to both the genders.

INCLUSION CRITERIA:

- ASA I & ASA II patients between age 25-55years, belonging to both sexes.
- No known history of allergy, sensitivity or other form of reaction to local anaesthetics.
- Patient willing to sign informed consent.
- BMI < 35kg/m².

EXCLUSION CRITERIA:

- Patients not willing to participate in the study
- ASA III & ASA IV patients
- Those with known sensitivity to local anaesthetics
- Patients with local infection at the site of injection
- Patient with spine deformity; Coagulation disorders,
- Emergency surgeries.

GROUP B: Inj 0.5% hyperbaric Bupivacaine intrathecally.

GROUP R: Inj 0.75% hyperbaric Ropivacaine intrathecally.

All patients were evaluated thoroughly during a pre anaesthetic checkup and relevant investigations were done before surgery.

After taking informed consent. The patient was shifted to operation theatre. Standard monitoring like Ecg, Pulse oximetry, NIBP, temperature, were recorded and baseline vitals were taken. Patient was pre-medicated with Inj. Ondansetron 4mg and Inj. Glycopyrrolate 0.2 mg was given intravenously and preloaded with Ringer lactate solution at 10ml/kg.

GROUP B(35) received Inj. 0.5% hyperbaric Bupivacaine intrathecally.

GROUP R(35) received Inj 0.75% Hyperbaric Ropivacaine intrathecally.

HR, SBP, DBP, SpO2 were noted at 0, 2, 5, 10, 15, 20, 30, 60, 90mins. Mean onset time of sensory blockade was noted as point of drug administration to absence of appreciation of pin prick at T10 after which surgery was started. Total sensory blockade duration was considered from point of onset of sensory blockade to regression of level by two segments.

Mean onset time of motor blockade was assessed via Modified Bromage scale was noted from point of drug administration to complete grade 3 motor blockade. Total motor blockade time noted as the duration till effect reduced to grade 0 blockade pain score was assessed by visual analogue scale (VAS). Duration of analgesia was considered from the time of intrathecal injection to when VAS ≥4. Inj Diclofenac sodium 75mg intramuscularly was given for rescue analgesia.

STATISTICAL ANALYSIS

A sample size of 35 patients per group was selected randomly. The Independent sample T – test was used to compare means for both groups. Results are expressed as means and Standard deviations. The comparison of normally distributed continuous variables between the groups was performed using one-way analysis of variance (ANOVA). P < 0.05 was considered to be significant. Statistical software used was SPSS 20, excel data analysis tool pack, MS word and excel has been used to generate graphs and tables.

RESULTS AND OBSERVATION:

Parameters	Group -B (n=35)	Group -R (n=35)	P VALUE
1. Time sensory onset (min)	5.0+ 0.0	5.5+- 1.6	0.03
2. Max cephalad spread	T6 (T4-T8)	T6 (T4-T8)	0.009
3. Time max level T6(min)	10.0+- 0.0	12+-4.4	0.07
4. Time to motor block grade -3	10.0+- 0.0	10.4+- 1.4	0.0001
5. Motor block duration	156.7+-34	118 +-31.1	0.41

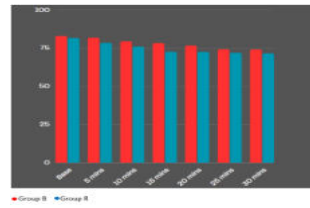
1. Onset of sensory blockade was more rapid with Bupivacaine (p<0.05).
2. The max cephalad spread was similar in both groups.
3. The time required to max extent of cephalic spread was less in Group – B (p<0.05).
4. Motor block according to the modified Bromage scale was obtained in both groups and the time to achieve this was not significant.
5. The duration of motor blockade (the time to regress the motor block) was significantly greater with Group – B than Group- R (0.0001).

Hemodynamic parameters:

HEART RATE:

Heart rate	Group -B (n=35)	Group -R (n=35)	P VALUE
Baseline	83.06+ 14.6	81.7+ 15.6	0.71
After 5 min	81.8+ 16.0	78.5+ 15.4	0.37
After 10 min	79.5+ 15.5	76.0+ 15.3	0.34
After 15 min	78.3+ 15.8	72.7+ 15.4	0.13
After 20 min	76.7+ 15.7	72.6+ 16.3	0.28
After 25 min	74.3+ 14.0	72.0+ 15.5	0.50
After 30 min	74.3+ 13.6	71.6+ 15.6	0.44

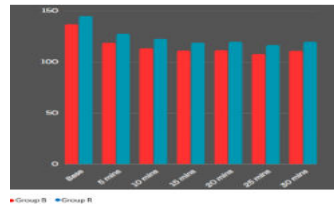
Heart rate was comparable in both groups



SBP:

SBP	Group -B (n=35)	Group -R (n=35)	P VALUE
Baseline	136.8+ 15.2	144.9+ 23.6	0.09
After 5 min	118.6+ 19.1	127.6+ 21.4	0.06
After 10 min	113.2+ 16.9	122.5+ 22.8	0.05
After 15 min	111.0+ 17.2	118.8+ 25.1	0.13
After 20 min	111.4+ 15.3	119.6+ 20.9	0.06
After 25 min	107.6+ 15.2	116.5+ 22.6	0.06
After 30 min	110.8+ 18.1	119.6+ 22.7	0.07

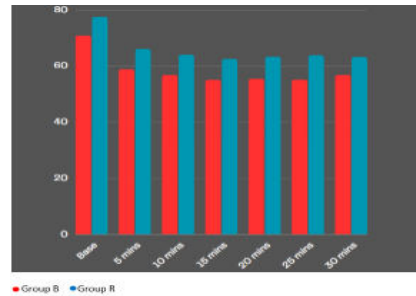
No significant difference in SBP in both groups with respect to change from Baseline (p>0.05).



DBP:

DBP	Group -B (n=35)	Group -R (n=35)	P VALUE
Baseline	70.8+ 15.0	77.5+ 14.0	0.09
After 5 min	58.8+ 14.0	66.0+ 12.0	0.06
After 10 min	56.8+ 11.9	64.0+ 10.7	0.05
After 15 min	55.0+ 11.1	62.5+ 9.5	0.13
After 20 min	55.4+ 12.3	63.3+ 10.5	0.06
After 25 min	55.1+ 12.3	63.8+ 10.7	0.06
After 30 min	56.8+ 13.5	63.2+ 10.2	0.03

- All the study intervals DBP was significantly low in Group- B (P<0.05) as compared to Group-R.



ADVERSE EFFECTS:

- There were 2 patients in Group- B who developed Postoperative Shivering and were treated with Inj. TRAMADOL (0.5 mg / kg) slow Iv.

DISCUSSION

In the present study we compared the onset of action: intensity & duration of motor block of 0.75% hyperbaric Ropivacaine with 0.5% hyperbaric Bupivacaine for elective lower abdominal perineal, lower limb surgeries.

Ropivacaine is a relatively new amino- amide LA which came into market in 1996. it is first S-enantiomer of Bupivacaine.

Ropivacaine also has less cardiovascular & central nervous system toxicity than Bupivacaine.

Most of the cases are of short duration (<3 hrs) for which intense motor block & urinary retention caused by commonly used intrathecal

Bupivacaine is not necessary; thus Bupivacaine does not suffice the need of growing number of day care surgeries.

SENSORY BLOCK:

- in the present study onset of sensory block & the time to reach maximum level of T6 was earlier in Group –B than Group –R.
- Fettes et al (2003) confirmed hyperbaric Ropivacaine produces consistent block than the plain Ropivacaine leading to more rapid onset of spread.
- Whiteside et al(2003) found that Ropivacaine produced a slower onset at T10 (5min VS 2 min) than Bupivacaine.

MAXIMUM CEPHALAD SPREAD :

- in the present study maximum cephalad spread ($p > 0.05$) the results are in accordance with studies done by Guatier et al who compared Ropivacaine (4ml of 2%) with Bupivacaine (4 ml of 2%) extent of sensory block is similar in both groups.

MOTOR BLOCK :

- in the present study there was no significant difference in time taken to achieve Grade 3 motor block but Ropivacaine gave a lesser degree of motor block which regressed faster than Bupivacaine (118 min vs 156 min); $p < 0.0001$.
- These results are in accordance with studies done by Guatier et al compared Bupivacaine with Ropivacaine in knee arthroscopy surgeries and found that Ropivacaine has a shorter duration of action than Bupivacaine (107 min vs 169 min).
- Whiteside et al 2003 confirmed than Ropivacaine had less potent effect on motor nerves with both degree & duration in comparison to Bupivacaine (90 min vs 180 min); $p < 0.0001$.

HAEMODYNAMIC PARAMETERS :

1. HEART RATE :

- In the present study no significant difference was seen in the heart rate at various intervals in both the groups.

2. BLOOD PRESSURE :

- There is no significant difference in fall of SBP from baseline in both groups ($p > 0.05$); but DBP & MAP were on lower side in Group –B than Group –R ($p < 0.05$).
- Whiteside et al 2003 noticed marked difference in cardio vascular changes in both groups. 70% patients in Bupivacaine had fall in SBP as compared to 15% in Ropivacaine group.

ADVERSE EFFECTS:

Shivering occurred in 2 patients in Group-B.

CONCLUSION :

From overall observation and the results, after comparing with other studies, we can conclude that 0.75 % hyperbaric Ropivacaine provides a sensory block of similar onset & extent ; shorter duration of action & less frequency of Hypotension as compared to 0.5% Hyperbaric Bupivacaine.

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