

A Comparative Study of Intrathecal 0.5% Isobaric Ropivacaine Vs 0.5% Isobaric Bupivacaine in Lower Abdominal Surgeries

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ABSTRACT

Introduction: Pka of bupivacaine and ropivacaine are identical, but ropivacaine is less fat soluble predicting that ropivacaine will block A-alpha fibers more slowly than bupivacaine. Intrathecal spread of local anaesthetic is not affected by patient position during and after injection is an added advantage of isobaric solution.

Study aimed to see the anaesthetic efficacy of intrathecal isobaric ropivacaine 0.5%, with isobaric bupivacaine 0.5% in lower abdominal surgeries with respect to: 1. Onset and duration of sensory block, 2. Onset, quality and duration of motor block, 3. Hemodynamic changes.

Material and Methods: Anaesthetic efficacy of intrathecal isobaric 0.5% ropivacaine with isobaric 0.5% bupivacaine in lower abdominal surgeries in 100 ASA grade I and II patients of both sexes in age group of 19 to 60 years undergoing elective lower abdominal surgery under spinal anaesthesia were compared. Two groups of 50 patients each received 3 ml of intrathecal respective local anaesthetic agents. The pulse rate, mean arterial pressure, the onset of sensory and motor block, duration of sensory and motor block was recorded in both groups.

Results: It is found that the intrathecal isobaric 0.5% ropivacaine produces delayed onset, but similar duration of sensory block and a statistically significant shorter duration of motor block. The haemodynamics and the height of block (peak sensory level) are similar in both groups.

Conclusion: In view of shorter duration of motor blockade, with similar duration of sensory blockade, haemodynamics and height of blockade 0.5% isobaric ropivacaine is a better choice for ambulatory anaesthesia.

Keywords: Isobaric Ropivacaine, Isobaric Bupivacaine, Intrathecal, Sensory block, Motor block

INTRODUCTION

Lignocaine was extensively used local anaesthetic for spinal anaesthesia, but now the use has fallen dramatically due to concerns regarding transient neurological symptoms.¹

Bupivacaine is the first long acting amide linked local anaesthetic with advantage over lignocaine in its longer duration of action. The increase in day care surgery has generated a need for a local anaesthetic with a quick onset and shorter duration of action allowing early ambulation. The major concern about the cardiotoxicity of bupivacaine has led to the development of ropivacaine, a new long acting amide.² It is a pure enantiomer. Ropivacaine's lipid solubility is less than bupivacaine.³⁻⁵ Pka of bupivacaine and ropivacaine are identical, but ropivacaine is less fat soluble predicting that ropivacaine will block A-alpha fibers more slowly than bupivacaine. The L form of ropivacaine is less cardiotoxic and has shorter duration of action than bupivacaine. It is available in isobaric, hyperbaric forms. Intrathecal spread of local anaesthetic is not affected by patient position during and after injection is an added advantage of isobaric solution.

It is useful when lower thoracic dermatomal sensory block is desired and when degree of sympathetic blockade needs to be minimized. It has little motor block.⁶ The regression of motor block was significantly more rapid after ropivacaine than bupivacaine.⁷

The present study was undertaken with the objective of comparing the anaesthetic efficacy of intrathecal isobaric ropivacaine 0.5%, with isobaric bupivacaine 0.5% in lower abdominal surgeries with respect to: 1. Onset and duration of sensory block, 2. Onset, quality and duration of motor block, 3. Hemodynamic changes.

MATERIAL AND METHODS

With the approval of Institutional Ethical Committee, and written informed consent from the patients, the study was conducted in 100 elective lower abdominal surgeries under spinal anaesthesia in ASA physical status I-II patients. The age of the patients ranged from 19-60 years weighing 35-65 and height ranging from 150-168 cms. All patients were thoroughly examined pre-operatively. After explaining the procedure, informed written consent was obtained. Patients weight and height were noted.

Preoperative vital data such as pulse rate, blood pressure and baseline investigations like Haemoglobin, urine analysis for albumin, sugar, blood urea, creatinine and ECG were checked. Thorough examination of all the systems and airway assessment were done.

Exclusion criteria included, local infection, bleeding disorder, patient refusal gross spinal deformity, neurological diseases. The patients were randomly allocated into two groups of 50 each.

Group A patients received 3 ml of 0.5% isobaric ropivacaine (15 mg). 5 mg/ml.

Group B patients received 3 ml of 0.5% isobaric bupivacaine (15 mg) 5 mg/ml.

In the operating room appropriate equipment for airway management and emergency drugs were kept ready. The horizontal position of the operating table was checked. Baseline pulse rate, mean arterial pressure, and O₂ saturation were

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Parameters	Group A (Mean±SD)	Group B (Mean±SD)	'p' value
Age (in years)	40±13	45±12.5	0.543*
Sex (Male:Female)	35:15	36:14	0.8264*
Duration of Surgery (in Min)	94±22.2	97.4±12.9	0.4924*
* Not Significant			

Table-1: Demographic Characteristics

Grading of Motor Block (Bromage Scale)	Group A		Group B	
	No.	%	No.	%
0	-	-	-	-
1	-	-	-	-
2	22	44	-	-
3	28	56	50	100
Total	50	100	50	100
'p'	0.0001, Significant			

Table-2: Grading of Motor Block

recorded preoperatively. Patients were preloaded with 10 ml/kg of Ringer's lactate using 18G intravenous cannula. Lumbar puncture was performed with a 23G spinal needle under aseptic precautions at L2-L3 or L3-L4 interspace via midline approach in right lateral position. After confirming free flow of CSF, the drug was injected and immediately patients were turned supine position.

The following Parameters were observed

Sensory Block

The onset block was defined as the time between the injection of anaesthetic and the loss of pinprick sensation at the T10 dermatomal level. Patients were tested with pin prick bilaterally along the midclavicular line for loss of sensation to pin prick to assess the sensory block. This assessment started immediately after turning the patient supine and continued every minute till the peak block height was reached and the time was noted. Sensory block was checked every 15 mins till it reached two segment regression.

Motor block

Modified Bromage scale was used to assess motor block bilaterally.⁸

Modified Bromage Scale

- Grade 0-No block, able to raise extended legs against gravity
- Grade 1-Unable to raise extended legs, but just able to flex knees
- Grade 2-Unable to flex knees, but able to flex ankle
- Grade 3- Total block, inability to flex ankle

We started Motor block assessment with the patient in supine position. Complete motor block was deemed to be achieved when Bromage score of 3 was reached. Duration for complete motor block recovery was taken as the time from subarachnoid injection to return of Bromage score to zero.

Vital Signs and Side Effects

Mean arterial pressure, pulse rate was recorded every two minutes for the first 10 minutes and thereafter every 5 minutes until the immediate post-operative period. Oxygen saturation monitored continuously. Decrease of systolic blood pressure less than 90 mm of Hg or more than 30 mm of Hg decrease from the base line was considered as Hypotension. This was managed by incremental doses of 6 mg intravenous ephedrine.

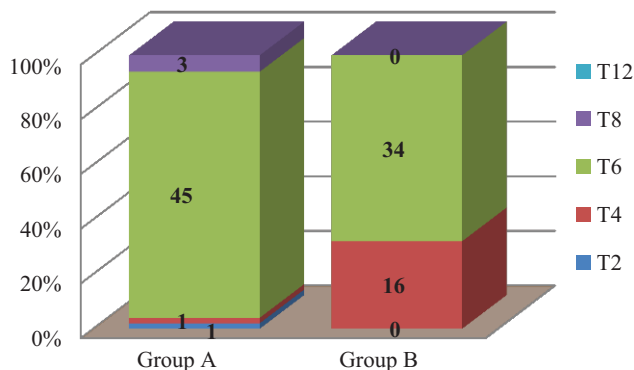


Figure-1: Peak Sensory Level

Heart rate was less than 60/min considered as Bradycardia and managed by incremental doses of 0.3 mg intravenous atropine. Respiratory rate less than 8/min and/or SPO₂ less than 85% were considered as Respiratory depression. Vomiting was managed with ondansetron 4 mg intravenously. Urinary retention was monitored postoperatively and catheterization was planned in patients with prolonged retention more than 6 hours. Patients were shifted to recovery room postoperatively

Statistical Tools

The information collected regarding all the selected cases were recorded in a Master Chart. Epidemiological Information Package was used for Data analysis. Using this software ranges, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskal Wallis chi-square test was used to test the significance of difference between quantitative variables. The 'p' value less than 0.05 is taken to denote significant relationship.

RESULTS

All 100 patients in two groups completed the study without any exclusion. We did an inter group analysis and the results were as followed. Of the 100 patients 50 belonged to Group A (ropivacaine) and other 50 categorized as Group B (bupivacaine). Data were presented as range, mean, standard deviation. The probability value 'P' of less than 0.05 considered statistically significant.

Patient's demographic data between the two groups were comparable. In table 1 illustrated the age, sex and duration of surgery, which are similar in both the groups and statistically not significant.

In this Figure 1, the distribution of upper extent of sensory block in both groups was given. T8 sensory level is attained in 90% in A group (Ropivacaine), and in B Group (Bupivacaine) T8 is achieved in 68% and T6 in 32, T8 sensory level is attained in both the groups.

As shown in the Table 2, in Group A 44% attained grade 2 motor block and 56% attained grade 3 motor block. In group B 100% attained grade 3 motor block. The p value is 0.0001 which is

statistically significant.

Table 3 shows the average time taken for onset of sensory block is 10.2 minutes in group A (Ropivacaine) and 4.2 minutes was shown in group B (Bupivacaine). The p value was 0.0001 which was significant. In this table duration of sensory block in Group A was 145.9 minutes and in Group B is 152.8 minutes. The 'p' value was 0.145 which was not significant. The onset of motor block distribution in both groups was depicted. The p value was 0.0001, which was significant. The onset of motor block time to achieve a Bromage score of 3 was significantly faster in bupivacaine group of 9.3 minutes when compared with ropivacaine of 14.3 minutes with shorter duration of motor block in Group A (Ropivacaine) of 137.2 ± 35.5 than Group B (Bupivacaine) with significant 'p' value of 0.0001.

The study showed stable hemodynamic status with decreased incidence of hypotension and insignificant 'p' value.

The Figure 2 shows shorter duration of motor block in Group A (Ropivacaine) of 137.2 ± 35.5 than Group B (Bupivacaine) with significant 'p' value of 0.0001.

In Figure 3 hemodynamic Parameters of this study showed stable hemodynamic status with decreased incidence of hypotension and insignificant 'p' value.

DISCUSSION

Mantouvalou. M S Rali et al in the study compared the anaesthetic efficacy and safety of three local anaesthetic agents namely 15 mg racemic Bupivacaine, Ropivacaine and Levobupivacaine in patients undergoing lower abdominal surgeries showed no significant difference in duration of sensory block between the groups.⁹ It stated delayed onset of motor block of 12 ± 5 minutes and faster recovery of motor block of 100 ± 34 minutes in ropivacaine group as seen in our study.

Kim S. Khaw et al, in their study compared 25 mg of intrathecal hyperbaric and isobaric solution of ropivacaine in caesarean section. The onset of sensory block in isobaric group was 11.4 minutes which was comparable to our study of 10 minutes. Similarly the onset of motor block in isobaric ropivacaine group was 13.8 minutes which was comparable to our study of 14.3 minutes. The duration of sensory block and motor block was 216 minutes and 184 minutes, where as in our study it

was 145.2 minutes and 137.2 minutes respectively, and the difference in this results was due to usage of higher dose of 25 mg of isobaric ropivacaine in their study.¹⁰

Jean Marc, Malinovsky et al in their study compared 15 mg of intrathecal isobaric ropivacaine with 10 mg of isobaric bupivacaine in patients scheduled for transurethral resection of bladder or prostate. The study showed no difference in hemodynamic effects between their groups as correlated with our study. The study reported similar intensity and the duration of motor block with isobaric ropivacaine was 165 minutes and that of bupivacaine was 184 minutes. The difference in the duration of motor block in the above study is comparable to our results.¹¹

Helena Kallio, Snail E. V. T. et. al., conducted the randomized prospective double blinded study with 90 ambulatory lower extremity surgical patients, who were given 2 ml of isobaric ropivacaine 1%, 0.75% and isobaric 0.5% bupivacaine. In this study, they observed that adequate block level with hemodynamic stability has occurred. And also found that faster motor recovery of 137.2 minutes along with ropivacaine, while comparing to bupivacaine (204.4 minutes).¹²

Fettes P. D. W., Hocking G et al conducted a study in 40 patients undergoing elective perineal surgery under spinal anaesthesia receiving either 15 mg of isobaric ropivacaine or 15 mg of hyperbaric ropivacaine. The onset of sensory block in isobaric ropivacaine group was 10 minutes which was comparable to our study of 10 minutes. Duration of sensory and motor block in isobaric ropivacaine group was 270 minutes and 180 minutes respectively. This shows that duration of motor block is shorter than sensory minutes and its recovery of 120 minutes. The difference in the rapid onset and recovery of motor block in hyperbaric versus isobaric ropivacaine group is attributed to the baricity of the solution.¹³

McNamee et al compared 17.5 mg of plain ropivacaine with 17.5 mg plain bupivacaine was given in patients who under gone total hip arthroplasty operation under spinal anaesthesia. The onset of

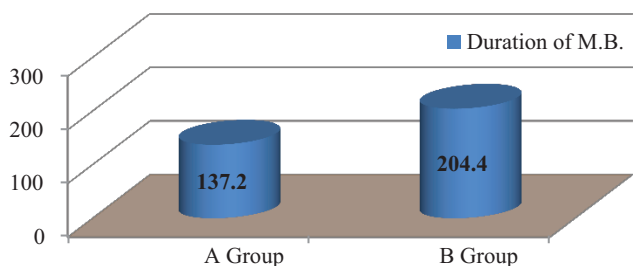


Figure-2: Total Duration of Motor Block (in Minut)

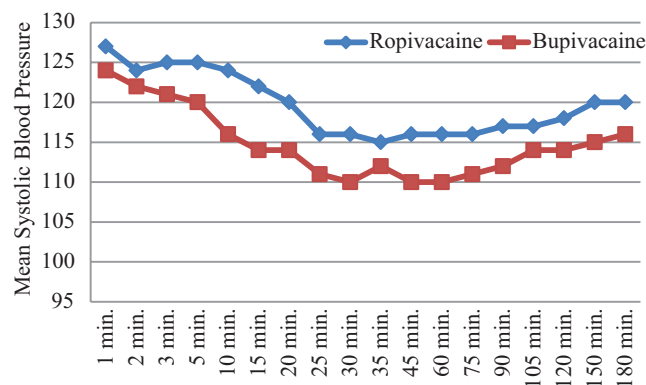


Figure-3: Hemodynamic Parameters

Parameter	Group A		Group B		'p'
	Mean ± S.D.	Range	Mean ± S. D.	Range	
Onset of Sensory block (in minutes)	10.2 ± 2.8	5-15 minutes	4.2 ± 1.0	3-7 minutes	0.0001 NS
Total Duration of Sensory block (in minutes)	145.9 ± 34.8	100-230 minutes	152.8 ± 9.1	135-180 minutes	0.145 NS
Onset of Motor block (in minutes)	14.3 ± 3.1	10-20 minutes	9.3 ± 1.0	6-10 minutes	0.0001 NS
Total Duration of Motor block (in minutes)	137.2 ± 35.5	80-240 minutes	204.4 ± 37.2	100-300 minutes	0.0001 NS

NS - Not significant

Table-3: Onset and Duration of Sensory and Motor Blockade

sensory block in both groups was 2 minutes. But in our study, it was 10 minutes in ropivacaine and 4 minutes bupivacaine. The difference is due to method of testing of sensory loss to ice in the above study. The duration of motor block is 130 minutes in ropivacaine group which was comparable to our study of 137.2 minutes.⁶ The duration of motor block in bupivacaine group was 230 minutes whereas 204 minutes in our study. Thus the above study is showing shorter duration of motor block in ropivacaine group as seen in our study. The duration of sensory block in the study was 180 minutes in ropivacaine group and 310 minutes in bupivacaine group where as 145.9 minutes and 152 minutes respectively in our study. The difference in the duration of motor and sensory block of bupivacaine group between their and our study may be attributed to different dosage used in their study. A randomized, double blinded study of 60 patients scheduled for lower limb surgeries received 2,4,7,10, or 14 mg of ropivacaine diluted to 2.8 ml with normal saline. Anaesthesia was successful in 0, 0, 42, 83, and 100% of the 2, 4, 7, 10, 14 mg given groups respectively. In the lower limb surgeries, for spinal ropivacaine, the derived value for ED₉₅ was 11.4 mg. and derived value for ED₅₀ was 7.6 mg.¹⁴ In our study we used 15 mg of ropivacaine which provided effective anaesthesia.

Whiteside JB done a comparative study for spinal anaesthesia in elective surgeries by using ropivacaine 0.5% (in glucose 5% solution) along with bupivacaine 0.5% (in glucose 8% solution) and observed that ropivacaine 15 mg in glucose 50 ml⁻¹ provides reliable spinal anaesthesia of shorter duration and with less hypotension than bupivacaine. The recovery profile for ropivacaine may be of interest given that more surgery is being performed in the day care setting¹⁵ as seen in our study.

CONCLUSION

In view of shorter duration of motor blockade, with similar duration of sensory blockade, haemodynamics and height of blockade 0.5% isobaric ropivacaine is a better choice for ambulatory anaesthesia.

REFERENCES

1. Shmuel Evron, Victoria Gurstiena. Tiberiu Ezri, Vladimir gladkov, Sergey Shopin, Transient Neurological symptoms after sobaric subarachnoid anaesthesia with 2% lidocaine. The impact of needle type *Anaesth Analg.* 2007;105;1494-99.
2. Hansen TG. Ropivacaine: A Pharmacological review, *Expert Rev Neurother.* 2004;4:781-91.
3. Leisure G.Di Fazio C. Ropivacaine the new local anaesthetic. *Semin. Anesth.* 1996;15;1-9.
4. Marltham A. Faulds D; Ropivacaine. A review of its pharmacology and therapeutic use in regional anaesthesia. *Drugs.* 1996;52:29-49.
5. Mc Clellan KS, Faulds D. Ropivacaine; An update of its use in regional anaesthesia. *Drugs.* 2000;60;1065-93.
6. Camorcia M, Capogna G, Lyons G et al. The relative motor blocking potencies of intrathecal ropivacaine: effects of concentration. *Anesth Analg.* 2004;98;1779-82.
7. Casati A, Moizo E, Marchetti C, et al. 2004a. A prospective, randomized double blind comparison of unilateral spinal anaesthesia with hyperbaric bupivacaine, ropivacaine, or levobupivacaine for inguinal herniorrhaphy. *Anesth Analg.* 99:1387-92.
8. Bromage PR. Epidural anesthesia, Philadelphia: WB

Saunders. 1978:144.

9. Mantouvalou M, Ralli S, Arnautoglou H, Tziris G and PapadopoulosG. Spinal anesthesia. Comparison of plain Ropivacaine, bupivacaine and levobupivacaine for lower abdominal surgery. *Acta Anaesth. Belg.* 2008;59:65-71.
10. Kim S. Khaw et al – Spinal ropivacaine for caesarean delivery: A comparison of hyperbaric and plain solution, *Anesth Analg.* 2002;94:680-85.
11. Jean-Marc Malnovsky, Florence Charles et al – Intrathecal Anaesthesia ropivacaine versus bupivacaine – *Anesth Analg.* 2000;91:1457-60.
12. Helena Kallio, Snail EVT et al – A comparison of intrathecal plain ropivacaine 20 or 15 mg versus bupivacaine 10 mg *Anaesth. Anal* 2004;1999:713-717.
13. Fettes PDW Hockings O. Peterson M.K. et al comparison of Plain and Hyperbaric solution of ropivacaine for spinal anaesthesia – *Br J Anaesth.* 2005;94;107-111.
14. Ying Y Lee, Ngan Kee, Chang K “Spinal ropivacaine for lower limb Surgery: A dose response study International Anaesthesia research Society. 2007;105:No. 2.
15. Whiteside JB, Burke D, Wildsmith JAW, Comparison of ropivacaine 0.5% (in glucose 5%) with bupivacaine 0.5% (in glucose 8%) for spinal anaesthesia for elective surgery. *Br J Anaesth.* 2003;90:304-8.

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