

Comparative Study of Equal Doses of Intrathecal Isobaric Bupivacaine and Isobaric Ropivacaine for Lower Limb Surgeries and Perineal Surgeries

V Manorema¹, R Selvarajan², Heber Anandan³

¹Assistant Professor, Department of Anaesthesiology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India, ²Associate Professor, Department of Anaesthesiology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India, ³Senior Clinical Scientist, Department of Clinical Research, Dr. Agarwal's Healthcare Limited, Tirunelveli, Tamil Nadu, India

Abstract

Introduction: Subarachnoid (spinal) block is a safe and effective alternative to general anesthesia when the surgical site is located on the lower extremities, perineum, or lower body wall.

Aim: The aim of this study is to evaluate the effect of equal doses of intrathecal isobaric bupivacaine and isobaric ropivacaine in terms of duration of analgesia and hemodynamic parameters.

Materials and Methods: 50 patients were randomly allocated into two groups; Group B received isobaric bupivacaine 0.5% 3 ml (15 mg) and Group R received isobaric ropivacaine 0.5% 3 ml (15 mg); American Society of Anesthesiologists I and II patients, aged 20-60 years, height: 150-170 cm, patients undergoing elective lower limb and perineal surgeries with duration <2 h were included in the study.

Results: In Group B, the mean duration of sensory block is 219.9 min. In Group R, the mean duration of sensory block is 162.9 min. In Group B, the mean duration of motor block is 203.8 min. In Group R, the mean duration of motor block is 142.9 min.

Conclusion: Ropivacaine is an ideal drug for ambulatory anesthesia and a good alternative to bupivacaine for surgeries of short duration.

Key words: Anesthesia, Bupivacaine, Isobaric, Motor block, Ropivacaine, Spinal

INTRODUCTION

Subarachnoid block is a commonly employed anesthetic technique for performing lower abdominal and lower limb surgeries.¹ It is a safe, inexpensive, and easy to administer technique which also offers a high level of post-anesthesia satisfaction for patients. Spinal anesthesia has a fast onset and provides effective sensory and motor blockade.² Administration of the appropriate choice and dose of local anesthetic into the subarachnoid space results in rapid onset of dense surgical anesthesia with a

high degree of success. The risks of general anesthesia including mishaps due to airway management are avoided such as failed intubation, aspiration, venous thrombosis, and pulmonary embolism.³

Bupivacaine, levobupivacaine, and ropivacaine have all been used as intrathecal drugs.⁴ Bupivacaine is the most commonly used long-acting local anesthetic agent for spinal anesthesia.⁵ Apart from its common undesirable side effects as hypotension, bradycardia, and urinary retention,⁶ its more serious cardiotoxicity and central nervous system toxicity led to identification of ropivacaine.⁷

Aim

The aim of this study is to evaluate the effect of equal doses of intrathecal isobaric bupivacaine and isobaric ropivacaine in terms of duration of analgesia and hemodynamic parameters.

Access this article online



www.ijss-sn.com

Month of Submission : 03-2017
Month of Peer Review : 04-2017
Month of Acceptance : 05-2017
Month of Publishing : 05-2017

Corresponding Author: R Selvarajan, Associate Professor, Department of Anaesthesiology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India. Phone: 9443133669. E-mail: jaymichella@gmail.com

MATERIALS AND METHODS

This study was done in 100 patients who are divided into two groups after getting approval from the Ethical Committee. Written informed consent was taken from all patients. It is a prospective, randomized double-blinded study. 50 patients were randomly allocated into two groups; Group B received isobaric bupivacaine 0.5% 3 ml (15 mg) and Group R received isobaric ropivacaine 0.5% 3 ml (15 mg).

Inclusion Criteria

American Society of Anesthesiologists (ASA) I and II patients, aged 20-60 years, height: 150-170 cm, patients undergoing elective lower limb and perineal surgeries with duration <2 h.

Exclusion Criteria

ASA III and IV, morbidly obese patients, patients with neurological disease, spinal deformity, drug allergy to local anesthetics, any other contraindication for regional technique.

Parameters recorded

Pulse rate, non-invasive blood pressure (BP), oxygen saturation, sensory blockade, motor blockade, time of micturition, quality of block, two-segment regression time, the highest dermatomal level of sensory block, time taken to achieve the highest dermatomal level, duration of surgery.

RESULTS

50 patients were randomly allocated in each group. Mean age of Group B was 40.8 and Group R was 39.7 (Table 1). Each group had almost equal numbers of both gender (Table 2). ASA physical status was not comparable (Table 3).

In Group B, the mean onset of sensory block is 3.32 min. In Group R, the mean onset of sensory block is 6.40 min. The mean onset of sensory block is delayed in ropivacaine when compared to bupivacaine and is statistically significant (Table 4).

In Group B, the maximum sensory level ranges from T4-T8, and in 46% of cases, the maximum level reached is T6. In Group R, the maximum sensory level ranges from T8-T12, and in 52% of cases, the maximum level reached is T10. Ropivacaine reaches a low sensory level as compared to bupivacaine (Table 5).

In Group B, the time taken to reach the highest sensory level is 14.26 min. In Group R, the time taken to reach the highest sensory level is 14.76 min. Both groups are comparable and are not statistically significant (Table 6).

Table 1: Age distribution

Age group (years)	n (%)	
	Group B	Group R
20-30	9 (18)	14 (28)
31-40	17 (34)	11 (22)
41-50	13 (26)	15 (30)
>50	11 (22)	10 (20)
Total	50 (100)	50 (100)
Range (years)	20-60	20-60
Mean±SD	40.84±10.42	39.76±12.41

P=0.638 not significant

Table 2: Sex distribution

Sex distribution	n (%)	
	Group B	Group R
Male	41 (82)	40 (80)
Female	9 (18)	10 (20)
Total	50 (100)	50 (100)

P=0.542 not significant

Table 3: ASA physical status

ASA risk	n (%)	
	Group B	Group R
I	46 (92)	46 (92)
II	4 (8)	4 (8)

P=1.000 not significant. ASA: American Society of Anesthesiologists

Table 4: Onset of sensory block (min)

Onset of sensory block (min)	Group B	Group R
Range	2-5	4-8
Mean±SD	3.32±0.741	6.40±0.948

P<0.001 significant. SD: Standard deviation

Table 5: Maximum sensory level

Maximum sensory level	n (%)	
	Group B	Group R
T4	4 (8)	0 (0)
T5	8 (16)	0 (0)
T6	23 (46)	0 (0)
T7	12 (24)	0 (0)
T8	3 (6)	7 (14)
T9	0 (0)	6 (12)
T10	0 (0)	26 (52)
T12	0 (0)	11 (22)

Table 6: Time taken to reach the maximum sensory height (min)

Time to reach maximum sensory level (min)	Group B	Group R
Range	12-16	12-18
Mean±SD	14.26±0.944	14.76±1.302

P=0.060 not significant. SD: Standard deviation

In Group B, the mean value of time taken for two-segment regression is 97.9 min. In Group R, the mean value of time taken for two-segment regression is 63.7 min. The two-segment regression time is shorter for ropivacaine than bupivacaine and is statistically significant (Table 7).

In Group B, the mean onset of motor block is 4.70 min. In Group R, the mean onset of motor block is 9.40 min. The onset of motor block of ropivacaine is delayed as compared to bupivacaine and is statistically significant (Table 8).

In Group B, the mean duration of sensory block is 219.9 min. In Group R, the mean duration of sensory block is 162.9 min. The duration of sensory block is shorter for ropivacaine compared with bupivacaine and is statistically significant (Table 9).

In Group B, the mean duration of motor block is 203.8 min. In Group R, the mean duration of motor block is 142.9 min. The duration of motor block is shorter for ropivacaine when compared to bupivacaine and is statistically significant (Table 10).

The quality of block was adequate in both groups (Table 11).

In Group B, the time taken to micturate is 319 min. In Group R, the time taken to micturate is 240.8 min. The time taken to micturate is shorter for ropivacaine compared with bupivacaine and is statistically significant (Table 12).

In Group B, 28% of cases had bradycardia, and in Group R, 6% of cases had bradycardia (<60/min), which is statistically significant (Table 13).

In Group B, 28% of cases had fall in systolic BP, and in Group R, 6% of cases had fall in systolic BP, which is statistically significant (Table 14).

In Group B, 28% of cases had fall in diastolic BP, and in Group R, 6% of cases had fall in diastolic BP, which is statistically significant (Table 15).

The oxygen saturation is comparable in both groups. It is not statistically significant (Table 16).

Atropine is used in 28% of cases in Group B and 6% of cases in Group R. Atropine is used less in ropivacaine group as compared to bupivacaine group and is statistically significant (Table 17).

Vasopressor is used in 28% of cases in Group B and 6% of cases in Group R. Vasopressor is used less in ropivacaine group compared to bupivacaine group and is statistically significant (Table 18).

Table 7: Two-segment regression time (min)

Two-segment regression time (min)	Group B	Group R
Range	75-155	45-165
Mean±SD	97.9±11.48	63.7±21.02

P<0.001 significant. SD: Standard deviation

Table 8: Onset of motor block (min)

Onset of motor block (min)	Group B	Group R
Range	3-7	8-12
Mean±SD	4.70±0.886	9.40±1.069

P<0.001 significant. SD: Standard deviation

Table 9: Duration of sensory block (min)

Duration of sensory block	Group B	Group R
Range	180-245	120-190
Mean±SD	219.9±17.04	162.9±15.55

P<0.001 significant. SD: Standard deviation

Table 10: Duration of motor block (min)

Duration of motor block (min)	Group B	Group R
Range	165-235	100-175
Mean±SD	203.8±17.16	142.9±14.61

P<0.001 significant. SD: Standard deviation

Table 11: Quality of block

Adequate	n (%)	
	Group B	Group R
Yes	0 (0)	0 (0)
No	50 (100)	50 (100)

Table 12: Time of micturition (in min)

Time of micturition	Group B	Group R
Range	260-340	200-270
Mean±SD	319.0±16.93	240.8±14.55

P<0.001 significant. SD: Standard deviation

Table 13: Fall in pulse rate (%)

Fall in pulse rate	n (%)	
	Group B	Group R
Yes	14 (28)	3 (6)
No	36 (72)	47 (94)

P=0.003 significant

Table 14: Fall in systolic BP

Fall in systolic BP	n (%)	
	Group B	Group R
Yes	14 (28)	3 (6)
No	36 (72)	47 (94)

P=0.003 significant. BP: Blood pressure

Table 15: Fall in diastolic BP

Fall in diastolic BP	n (%)	
	Group B	Group R
Yes	14 (28)	3 (6)
No	36 (72)	47 (94)

P=0.003 significant. BP: Blood pressure

Table 16: Oxygen saturation in %

Oxygen saturation in %	Group B	Group R
Range	98-100	98-100
Mean±SD	99.26±0.694	99.26±0.664

P=1.000 not significant. SD: Standard deviation

Table 17: Use of atropine

Use of atropine	n (%)	
	Group B	Group R
Yes	14 (28)	3 (6)
No	36 (72)	47 (94)

P=0.003 significant

Table 18: Use of vasopressor

Use of vasopressor	n (%)	
	Group B	Group R
Yes	14 (28)	3 (6)
No	36 (72)	47 (94)

P=0.003 significant

DISCUSSION

Hyperbaric bupivacaine is commonly used intrathecally for lower limb and perineal surgeries. The newly introduced ropivacaine have evolved a history in spinal anesthesia because of its short duration of action and quality of anesthesia for surgeries of short duration. Ropivacaine, because of its differential blockade, is used in epidural labor analgesia and in epidural postoperative analgesia. In isobaric drug, gravity has no effect on the distribution. The upper level of sensory block was two segments higher in hyperbaric and hypobaric than isobaric solutions. Hence, possibly fewer segments are blocked, limiting the extent of sympathetic block and hence more of hemodynamic stability. In this study, isobaric bupivacaine and isobaric ropivacaine at equal doses (15 mg) are given intrathecally for lower limb surgeries and perineal surgeries of short duration.

Onset of Sensory Block

In this study, onset of sensory block at L1 is 6.4 min for ropivacaine group and 3.32 min for bupivacaine group. This delay is due to the lower lipid solubility of ropivacaine when compared to bupivacaine. A Mehta *et al.* studied in

75 patients and concluded that the onset of sensory level is delayed in ropivacaine than bupivacaine, which is similar to this study.⁸

Maximum Sensory Level (Dermatome)

In this study, the maximum sensory level ranges from T8-T2 in ropivacaine group and T4-T8 in bupivacaine group. Since more segments are blocked in bupivacaine group, the extent sympathetic block is more and there is more of hypotension and bradycardia in bupivacaine group compared to ropivacaine group. Hence, vasopressor and atropine are used more in bupivacaine group than ropivacaine group. Hence, ropivacaine is more of hemodynamically stable than bupivacaine. Mantouvalou *et al.* concluded that maximum sensory level reached is higher for bupivacaine than ropivacaine, which is similar to this study.²

Time Taken to Reach the Highest Dermatome

In this study, ropivacaine took 14.76 min, when compared to 14.26 min for bupivacaine. There is no marked difference in both. In studies of Malinovsky *et al.*, they concluded that the time taken to reach the highest dermatome is same in both ropivacaine and bupivacaine, which is similar to this study.⁹

Two-Segment Regression Time

In this study, two-segment regression time in ropivacaine group was 63.7 min and bupivacaine group was 97.9 min. The two-segment regression time is shorter for ropivacaine when compared to bupivacaine.

Onset of Motor Block

In this study, onset of motor block is 9.40 min in ropivacaine group and 4.70 min in bupivacaine group. The onset of motor block is delayed in ropivacaine when compared to bupivacaine. Mehta *et al.* concluded that onset of motor block is delayed in ropivacaine when compared to bupivacaine, which is similar to this study.⁸

Duration of Sensory Block

In this study, the duration of sensory block is 162.9 min in ropivacaine and 219 min for bupivacaine group. The duration of sensory block is shorter in ropivacaine than bupivacaine. Hence, ropivacaine is an ideal drug for ambulatory surgeries. Mehta *et al.* concluded that duration of sensory block is shorter for ropivacaine than bupivacaine, which is comparable with this study.⁸

In this study, bradycardia occurred in 28% of cases in bupivacaine group and 6% of cases in ropivacaine group and treated with atropine 0.6 mg. Bradycardia occurred between 25 and 35 min. Hence, ropivacaine is hemodynamically stable than bupivacaine. Use of

atropine was less in ropivacaine group than bupivacaine group.

In this study, fall in BP occurred in 28% of cases in bupivacaine group and 6% of cases in ropivacaine group and treated with ephedrine 6.0 mg. Fall in BP occurred between 25 and 35 min. Use of ephedrine was less with ropivacaine group than bupivacaine group. Hence, ropivacaine is hemodynamically stable than bupivacaine.²

In this study, oxygen saturation maintained the same as preoperative level, throughout the surgery in both bupivacaine and ropivacaine groups.

CONCLUSION

Intrathecal ropivacaine delayed the onset of sensory and motor block; lowered the level of sensory block; shortened the duration of motor and sensory block, two-segment regression time, and time of micturition; with stable hemodynamics, than bupivacaine. Ropivacaine is an ideal drug for ambulatory anesthesia and a good alternative to bupivacaine for surgeries of short duration.

REFERENCES

1. Valovski IT, Valovska A. Spinal anesthesia. In: Vacanti CA, Sikka PK, Urman RD, editors. *Essential Clinical Anesthesia*. Vol. 57. United States of America: Cambridge University Press; 2011. p. 340-6.
2. Mantouvalou M, Ralli S, Arnaoutoglou H, Tziris G, Papadopoulos G. Spinal anesthesia: Comparison of plain ropivacaine, bupivacaine and levobupivacaine for lower abdominal surgery. *Acta Anaesthesiol Belg* 2008;59:65-71.
3. Butterworth JF, Mackey DC, Wasnick JD, editors. *Local anesthetics. Morgan & Mikhail's Clinical Anesthesiology*. 5th ed., Vol. 16. USA: McGraw-Hill Companies; 2013. p. 263-76.
4. Lee YY, Ngan Kee WD, Fong SY, Liu JT, Gin T. The median effective dose of bupivacaine, levobupivacaine, and ropivacaine after intrathecal injection in lower limb surgery. *Anesth Analg* 2009;109:1331-4.
5. Tariq M, Bhutta IA. Single dose caudal tramadol versus bupivacaine for postoperative analgesia in perineal surgery. *J Pak Army Med Corps* 2009;4:210-5.
6. Shaikh JM, Mughal SA, Shaikh SM, Siddiqui FG, Memon A. Caudal epidural for postoperative analgesia in male children. *J Liaquat Uni Med Health Sci* 2006;5:110-3.
7. Leone S, Di Cianni S, Casati A, Fanelli G. Pharmacology, toxicology, and clinical use of new long acting local anesthetics, ropivacaine and levobupivacaine. *Acta Biomed* 2008;79:92-105.
8. Mehta A, Gupta V, Wakhloo R, Gupta A, Bakshi R, Kapoor B, *et al.* Comparison of efficacy of intrathecal ropivacaine and levobupivacaine for lower limb surgeries. *Internet J Anaesthesiol* 2000;17:17.
9. Malinovsky JM, Charles F, Kick O, Lepage JY, Malinge M, Cozian A, *et al.* Intrathecal anesthesia: ropivacaine versus bupivacaine. *Anesth Analg* 2000;91:1457-60.

How to cite this article: Manorema V, Selvarajan R, Anandan H. Comparative Study of Equal Doses of Intrathecal Isobaric Bupivacaine and Isobaric Ropivacaine for Lower Limb Surgeries and Perineal Surgeries. *Int J Sci Stud* 2017;5(2):115-119.

Source of Support: Nil, **Conflict of Interest:** None declared.