

Comparative Study of Epidural 0.75% Ropivacaine and 0.5% Levobupivacaine in Lower Limb Surgeries with Respect to Block Characteristics

Geeta Karki¹, Priyank Srivastava², Juhi Saran³

¹Assistant Professor, Department of Anaesthesiology, Critical Care and Pain Management, Shri Ram Murti Smarak Institute of Medical Sciences, Bhojipura, Bareilly, Uttar Pradesh, India, ²Post Graduate Student, Department of Anaesthesiology, Critical Care and Pain Management, Shri Ram Murti Smarak Institute of Medical Sciences, Bhojipura, Bareilly, Uttar Pradesh, India, ³Professor and Head, Department of Anaesthesiology, Critical Care and Pain Management, Shri Ram Murti Smarak Institute of Medical Sciences, Bhojipura, Bareilly, Uttar Pradesh, India

Abstract

Introduction: Epidural block during orthopedic surgery pain relief enables early post-operative mobilization, accelerates rehabilitation, and return to normal function.

Methods: After obtaining Ethical Committee approval and informed written consent from patients, the study was conducted on 70 patients of either sex, between 18 and 65 years of age and belonging to the American Society of Anesthesiologists Grade I and II physical status. Patient was divided into two groups Group R (ropivacaine) Group L and 20 ml of study drug given in each group.

Results: There was no significant difference in the sensory and motor block onset time between group R and L. The variations in the time duration of motor block between R ($P = 0.028$) and L ($P = 0.043$) was significant. The difference in the time of regression among the groups R and L was highly significant in both motor and sensory block parameters ($P < 0.001$). There was no marked difference in the duration of analgesia between the patients of group L and R.

Conclusion: Onset of sensory and motor block for levobupivacaine is delayed as compared with ropivacaine, whereas ropivacaine has shorter duration of motor block when compared with levobupivacaine

Key words: Block characteristics, Epidural, Levobupivacaine, Lower limb surgery, Ropivacaine

INTRODUCTION

Providing comfort to the patient by prevention and relief of pain and monitoring and maintenance of normal physiology during the perioperative period is the primary goal of an anesthesiologist.¹

Epidural blockade is becoming one of the most useful and versatile procedures in modern anesthesiology. It is unique in that it can be placed at virtually any level of the

spine, allowing more flexibility in its application to clinical practice. It is more versatile than spinal anesthesia, giving the clinician the opportunity to provide anesthesia and analgesia, as well as enabling chronic pain management. It provides better postoperative pain control and more rapid recovery from surgery.

For orthopedic surgery, the provision of pain relief enables early post-operative mobilization, accelerates rehabilitation, and return to normal function.²

Levobupivacaine and ropivacaine, the two new long-acting local anesthetics, have been developed as an alternative to bupivacaine, after the evidence of its severe toxicity. Both of these agents are pure left-isomers and, due to their three-dimensional structure, seem to have less toxic effects on the central nervous system (CNS) and on the cardiovascular system.

Access this article online



www.ijss-sn.com

Month of Submission : 11-2016
Month of Peer Review : 12-2016
Month of Acceptance : 12-2016
Month of Publishing : 01-2017

Corresponding Author: Dr. Geeta Singh, Department of Anaesthesiology, Critical Care and Pain Management, Shri Ram Murti Smarak Institute of medical sciences, Bhojipura, Bareilly, Uttar Pradesh, India. E-mail: krgits@gmail.com

Ropivacaine is developed as a pure S(-) enantiomer of ropivacaine. It is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibers resulting in a relatively reduced motor blockade. The reduced lipophilicity is also associated with decreased potential for CNS and cardiotoxicity. Thus, ropivacaine appears to be an important option for regional anesthesia and for the management of post-operative and labor pain.³

Levobupivacaine, the isolated S(-) enantiomer of bupivacaine, has been shown to be less cardiotoxic than bupivacaine in preclinical studies. Owing to the lower affinity of the S(-) isomer to the cardiac sodium channels compared to the R(+) isomer, it is associated with less cardiac side effects.⁴

Hence, in this study, we compared levobupivacaine 0.5% and ropivacaine 0.75% in epidural anesthesia in elective lower limb surgeries.

MATERIALS AND METHODS

After obtaining Ethical Committee approval and informed written consent from patients, the study was conducted on 70 patients of either sex, between 18 and 65 years of age and belonging to the American Society of Anesthesiologists (ASA) Grade I and II physical status.

Patients with the history of uncontrolled labile hypertension, heart block, dysrhythmia, on cardiac medication (adrenergic receptor antagonist, calcium channel blocker, or angiotensin-converting enzyme inhibitor), addiction to narcotic, patient posted for lower segment cesarean section and with any contraindication to epidural anesthesia were not included in the study.

1. Group R -20 ml of 0.75% ropivacaine
2. Group L - 20 ml of 0.5% levobupivacaine.

In each group, equal volume was injected. All patients were preloaded with 15 ml/kg of Ringer Lactate. In the operation theater pulse oximetry (Spo₂), noninvasive blood/pressure and electrocardiogram were monitored and in sitting posture epidural catheter was placed into L2-L3 or L3-L4 epidural space under strict aseptic conditions, using Tuohy's needle with loss of resistance technique.

Onset, duration and quality of anesthesia were assessed. Sensory block was assessed bilaterally by short hypodermic needle in mid clavicular line motor block was assessed by modified bromage scale. The changes in above parameters were clinically and statistically compared.

Statistical Analysis

Results were expressed by standard methods, i.e., as mean \pm standard deviation. Unpaired *t*-test was used for

analysis in numerical data while for frequency Fisher exact test was applied. Statistical analysis was performed by SPSS (version 20.0). *P*-value was considered significant if <0.05 and highly significant if <0.001 .

Study Design

Cross-sectional.

Study Period

November 2014 - May 2016.

Study Area

Patients posted for lower limb orthopedic surgeries.

Sample Size

70 patients, 35 in each group.

RESULTS

The objective of this study was to compare levobupivacaine 0.5% and ropivacaine 0.75% in epidural anesthesia in lower limb surgeries, with respect to onset and duration of motor blockade and sensory blockade, maximum dermatomal level of analgesia and time taken to achieve that.

As shown in Table 1 and Figure 1 group wise distribution of demographic data, like age, height, weight, body mass index (BMI), and sex were tabulated. On perusal of the same, we observe no significant deviation in any of these data among different groups of the cases. *P* value range was 0.067-0.982.

As shown in Table 2 and Figure 2, the mean sensory block onset time for the groups R and L was 9.9 ± 1.78 and 11.31 ± 1.5 min, respectively. The corresponding time figures for the motor block were 30.14 ± 5.6 and 29.8 ± 5.3 min, respectively. There was no significant difference in the sensory block time between group R and L. The variation in the motor block time between two groups R and L were not significant.

Table 1: Group wise distribution of demographic data

Demographic data	Groups		Significance (R*L)
	Mean \pm SD		
	Group R	Group L	
Age* (year)	36.86 \pm 11.73	42.77 \pm 14.70	<i>P</i> =0.067
Height* (cm)	163.69 \pm 5.06	163.66 \pm 5.64	<i>P</i> =0.982
Weight* (kg)	64.31 \pm 6.23	64.46 \pm 5.36	<i>P</i> =0.918
BMI	23.82 \pm 1.49	24.04 \pm 1.27	<i>P</i> =0.505
Sex			
Male (%)	27 (77.14)	24 (68.57)	$\chi^2=0.897$, <i>P</i> =0.638
Female (%)	8 (22.86)	11 (31.43)	

SD: Standard deviation, **P*<0.05

As shown in Table 3 and Figure 3, the duration of motor block for the patients of group R and L was 242 ± 71.6

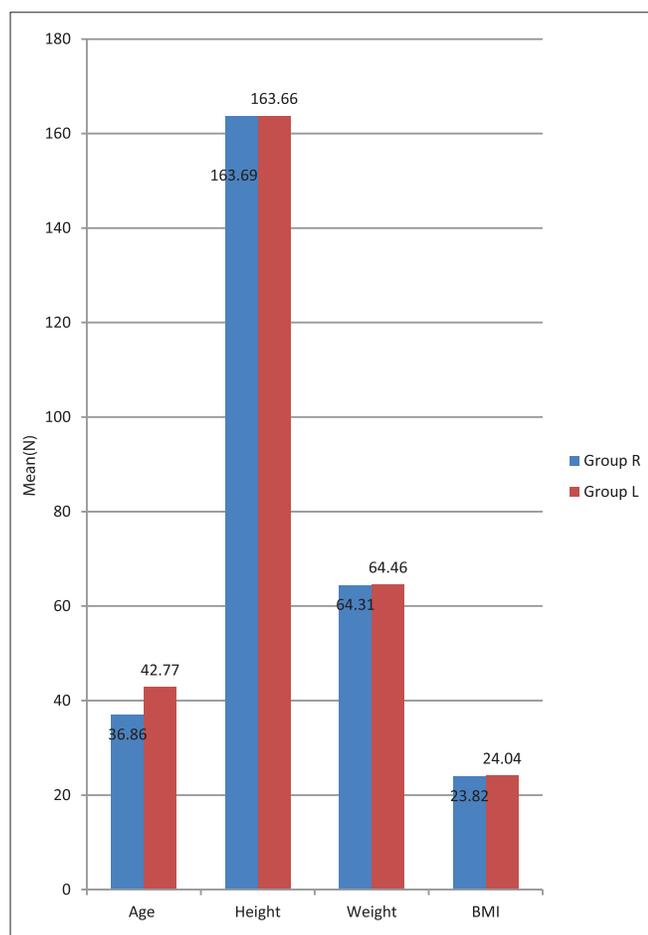


Figure 1: Demographic data groupwise

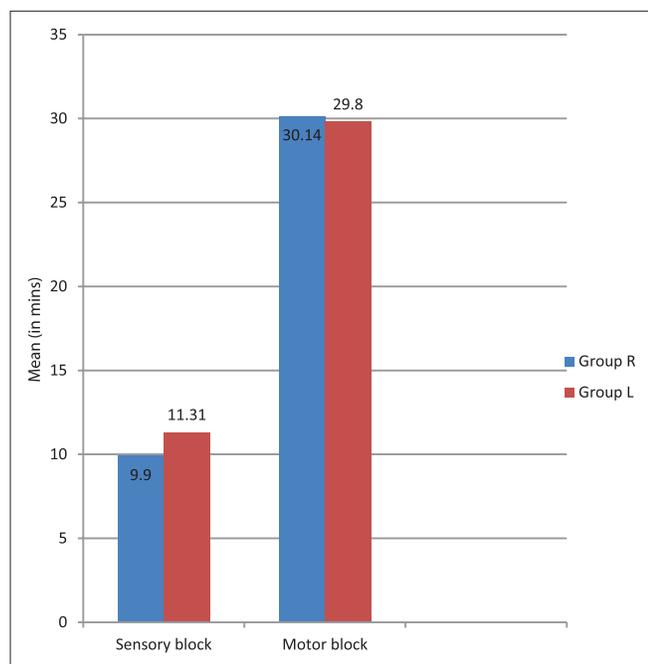


Figure 2: Time of onset of block

and 278 ± 74 min, the time duration for sensory block was 388 ± 70.2 and 385 ± 72 min, respectively. The variations in the time duration of motor block between R and L was significant $P = 0.028$ and 0.043 .

As shown in Table 4 and Figure 4, the time required for regression of sensory block in patients of the groups R and L was 84.6 ± 4.47 and 192.2 ± 17.01 min, respectively, the corresponding regression time required for motor blocks was 81.37 ± 5.52 and 124.57 ± 11.88 min. The difference in the time of regression among the groups R and L was highly significant in both the parameters $P < 0.001$.

As shown in Table 5 and Figure 5, sensory levels of T6 to T10 segments were recorded in the table. The highest sensory level of T7 segment was found in 18 (51.43%) and 10 (28.57%), respectively, members of each of the groups. The variation in the sensory level among the members of different groups, in respect of each of these segments, was however not significant $P = 0.53$.

As shown in Table 6, duration of analgesia was respectively 218 ± 19.3 and 213 ± 20 min for members of group R and L. There was no marked difference in the duration of analgesia between the patients of group L and R.

DISCUSSION

Levobupivacaine and ropivacaine, the two new long-acting local anesthetics, have been developed as an alternative to bupivacaine, after the evidence of its severe toxicity. Both of these agents are pure left-isomers and, due to their three-dimensional structure, seem to have less toxic effects on the CNS and on the cardiovascular system.

Table 2: Onset of sensory block and motor block among the groups

Onset time of block	Mean±SD (min)		Significance (R*L)
	Group R	Group L	
Sensory block	9.9±1.78	11.31±1.5	$P=0.001$ $T=-3.4$
Motor block	30.14±5.6	29.8±5.3	$P=0.713$ $T=0.369$

SD: Standard deviation

Table 3: Duration of motor block and duration of sensory block among the groups

Duration (in min)	Mean±SD (min)		Significance (R*L)
	Group R	Group L	
Duration of motor block	242±71.6	278±74	$P=0.043$
Duration of sensory block	388±70.2	385±72	$P=0.853$

SD: Standard deviation

Table 4: The time regression of blocks among the groups

Time of regression of block (min)	Groups		Significance (R*L)
	Mean±SD (min)		
	Group R	Group L	
Sensory block	84.6±4.47	192.2±17.01	P=0.001
Motor block	81.37±5.52	124.57±11.88	P≤0.001

SD: Standard deviation

Table 5: Highest sensory level among the groups

Highest sensory level (N)	Groups		Significance
	Mean±SD (%)		
	Group R	Group L	
T6	5 (14.29)	5 (14.29)	X ² =7 P=0.53
T7	18 (51.43)	10 (28.57)	
T8	8 (22.86)	8 (22.86)	
T9	2 (5.71)	5 (14.29)	
T10	2 (5.71)	7 (20.00)	

SD: Standard deviation

Table 6: Duration of analgesia among the groups

Duration of analgesia	Groups (R*L)		Significance
	Mean±SD		
	Group R	Group L	
Duration of analgesia (in min)	218±19.3	213±20	P=0.273

SD: Standard deviation

Demographic Details

Group R receiving 20 ml of 0.75% ropivacaine, group L receiving 20 ml of 0.5% levobupivacaine. Distribution of demographic data - such as age, height, weight, BMI, and sex - were observed, on perusal of the same we observe no significant deviation in any of these data among different groups of the cases. An Indian study by Kameshwara Rao *et al.*⁵ reported that patients studied in the three groups did not vary much with respect to age, sex or weight.

Block Characteristics

In our study, the mean time for onset of sensory block in ropivacaine group was 9.9 ± 1.78 min and 11.31 ± 1.5 min in levobupivacaine group. The mean time for onset of motor block in ropivacaine group was 30.14 ± 5.6 min and 29.8 ± 5.3 min in levobupivacaine group. There was no significant difference in the sensory block onset time between the groups (P > 0.05). The variation in the motor block onset time between the two groups was not significant (P > 0.05). Casati *et al.*⁶ conducted study on 45 ASA I-III patients undergoing elective hip replacement surgery comparing epidural block with 10 ml of 0.5% levobupivacaine, 0.5% bupivacaine, or 0.5% ropivacaine found no difference in the time of onset of sensory and

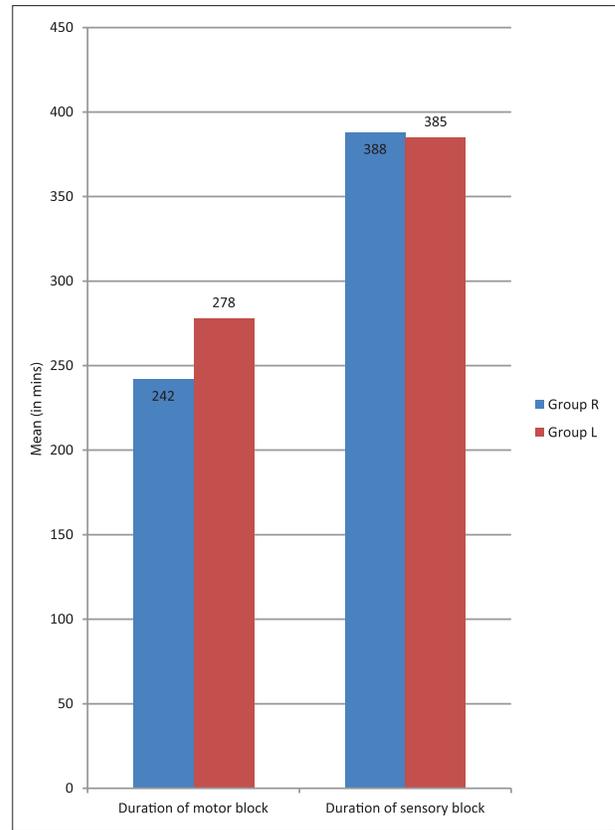


Figure 3: Time of duration of motor and sensory block

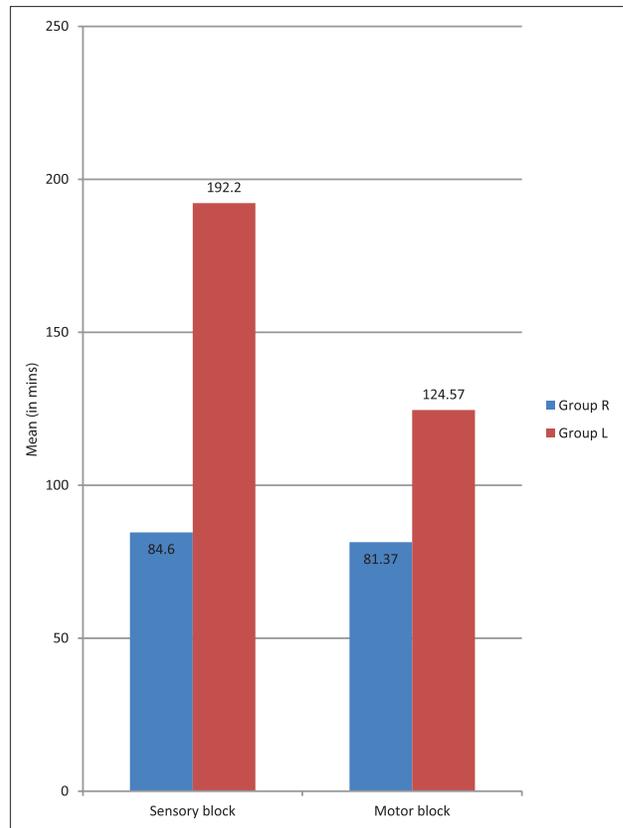


Figure 4: Time of regression of block

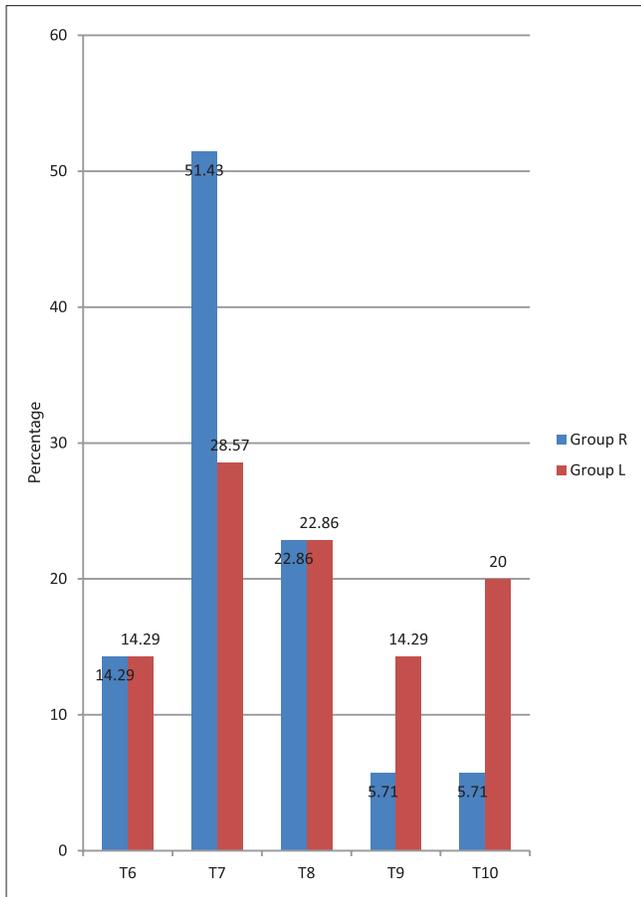


Figure 5: Highest sensory level

motor block. Peduto *et al.*⁷ conducted study on 65 adult patients of ASA I-III undergoing elective lower limb procedures with 15 ml of 0.5% epidural Levobupivacaine or 15 ml of 0.75% epidural ropivacaine. They observed that the onset of sensory block was similar in both groups.

Duration of motor blockade was assessed from the time of administration of drug to complete motor recovery. In our study, the mean duration of motor block in ropivacaine group was 242 ± 71.6 min and in levobupivacaine group was 278 ± 74 min. The variations in the time duration of motor block between ropivacaine and levobupivacaine group were significant ($P < 0.05$). Brockway *et al.*⁸ showed that motor block produced by ropivacaine was slower in onset. The mean duration of motor blockade of ropivacaine is lower than that of levobupivacaine.

It was concluded that levobupivacaine 0.5% produces a motor block deeper than that produced by 0.5% ropivacaine.⁹ Our results are similar to a study done by David L Brown,⁹ where the duration of motor block with 20 ml of 0.5% ropivacaine was 220 ± 52 min and 0.5% bupivacaine was 276 ± 52 min and thus of longer

duration. Zaric *et al.*¹⁰ found that motor blockade with 0.75% ropivacaine was comparable to 0.5% bupivacaine. Brown *et al.* and Cekmen *et al.*¹¹ showed that duration of motor block was significantly longer in the 0.5% bupivacaine group as compared to 0.5% ropivacaine. Zaric *et al.*¹⁰ found that motor blockade with 0.75% ropivacaine was comparable to 0.5% bupivacaine. De Negri¹² *et al.* conducted prospective, randomized, observer-blinded clinical trial, and compared the incidence of unwanted lower extremity motor blockade and the analgesic. He concluded no difference in post-operative analgesia with the drugs.

The mean duration of sensory analgesia in ropivacaine group was 388 ± 70.2 min and in levobupivacaine group was 385 ± 72 min. Casati *et al.*⁶ conducted study on 45 ASA I-III patients undergoing elective hip replacement surgery comparing epidural block with 10 ml of 0.5% levobupivacaine, 0.5% bupivacaine or 0.5% ropivacaine. It was found that there was no significant difference in the duration of sensory analgesia among all the groups. Peduto *et al.*⁷ conducted study on 65 adult patients of ASA 1-3 undergoing elective lower limb procedures and were given epidural levobupivacaine 0.5% 15 ml or epidural ropivacaine 0.75% 15 ml. The duration of sensory blockade in both the groups was similar as reported by Peduto *et al.* Higher concentration of levobupivacaine (i.e., 0.75%) provides a longer duration of sensory and motor block without any increase in the incidence of adverse side effects.⁶

The highest sensory level of T7-T8 segment was found to be 74.3% and 51.4%, respectively, among the members of each of the groups (as named R, L) respectively. The variation in the sensory level among the members of different groups, in respect of each of these segments was however not significant. Chandran *et al.* also reported that the mean maximum sensory level reached was T8 in ropivacaine and bupivacaine groups with the volume administered.¹³ An Indian study reported that there was no difference in highest level of sensory blockade in the three groups.⁵ Few studies reported, equal doses of levobupivacaine and bupivacaine (15 ml of 0.5%) provide maximum cephalic spread (T7-T8) and duration of analgesia (4-6 h).¹⁴

CONCLUSION

It can be concluded that onset of sensory and motor block for levobupivacaine is delayed as compared with ropivacaine. Ropivacaine has shorter duration of motor block when compared with levobupivacaine. Thus, ropivacaine and levobupivacaine both can be used as an alternative to bupivacaine.

REFERENCES

1. Morgan GM, Mikhail MS, Murray MJ. The practice of anesthesiology. Clinical Anesthesiology. 4th ed. New York: McGraw-Hill; 2008. p. 1-16.
2. Höhener D, Blumenthal S, Borgeat A. Sedation and regional anaesthesia in the adult patient. Br J Anaesth 2008;100:8-16.
3. Hadzic A. Regional Anaesthesia and Acute Pain Management. 1st ed. New York: McGraw-Hill Professional; 2006.
4. de Beer DA, Thomas ML. Caudal additives in children – Solutions or problems? Br J Anaesth 2003;90(4):487-98.
5. Kameshwara Rao SJ, Chander DS, Nagesh V, Harinath G. Study comparing bupivacaine with ropivacaine and levo-bupivacaine in sub umbilical surgeries under epidural anaesthesia. J Evid Based Med Healthc 2015;2:4939-48.
6. Casati A, Santorsola R, Aldegheri G, Ravasi F, Fanelli G, Berti M, *et al.* Intraoperative epidural anesthesia and postoperative analgesia with levobupivacaine for major orthopedic surgery: A double-blind, randomized comparison of racemic bupivacaine and ropivacaine. J Clin Anesth 2003;15:126-31.
7. Peduto VA, Baroncini S, Montanini S, Proietti R, Rosignoli L, Tufano R, *et al.* A prospective, randomized, double-blind comparison of epidural levobupivacaine 0.5% with epidural ropivacaine 0.75% for lower limb procedures. Eur J Anaesthesiol 2003;20:979-83.
8. Brockway MS, Bannister J, McClure JH, McKeown D, Wildsmith JA. Comparison of extradural ropivacaine and bupivacaine. Br J Anaesth 1991;66:31-7.
9. Brown DL, Carpenter RL, Thompson GE. Comparison of 0.5% ropivacaine and 0.5% bupivacaine for epidural anesthesia in patients undergoing lower-extremity surgery. Anesthesiology 1990;72:633-6.
10. Zaric D, Axelsson K, Nydahl PA, Philipsson L, Larsson P, Jansson JR. Sensory and motor blockade during epidural analgesia with 1%, 0.75%, and 0.5% ropivacaine – A double-blind study. Anesth Analg 1991;72:509-15.
11. Cekmen N, Arslan M, Musdal Y, Babacan A. Comparison of the effects of a single dose of epidural ropivacaine and bupivacaine in arthroscopic operations. Medwell Res J Med Sci 2008;2:109-15.
12. De Negri P, Ivani G, Tirri T, Modano P, Reato C, Eksborg S, *et al.* A comparison of epidural bupivacaine, levobupivacaine, and ropivacaine on postoperative analgesia and motor blockade. Anesth Analg 2004;99:45-8.
13. Chandran S, Hemalatha S, Viswanathan P. Comparison of 0.75% ropivacaine and 0.5% bupivacaine for epidural anaesthesia in lower extremity orthopaedic surgeries. Indian J Anaesth 2014;58:336-8.
14. Cox CR, Faccenda KA, Gilhooly C, Bannister J, Scott NB, Morrison LM. Extradural S(-)-bupivacaine: Comparison with racemic RS-bupivacaine. Br J Anaesth 1998;80:289-93.

How to cite this article: Karki G, Srivastava P, Saran J. Comparative Study of Epidural 0.75% Ropivacaine and 0.5% Levobupivacaine in Lower Limb Surgeries with Respect to Block Characteristics. Int J Sci Stud 2017;4(10):109-114.

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