Original Article

Sensory and motor blockade during spinal anaesthesia with 0.75% and 0.5% ropivacaine – A double-blind study

Harish K[1*], Sunil K S[2], Sudhaprasad[3]

[1]Assistant Surgeon, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, INDIA.
[2]Junior Consultant, BGS Global Hospital, Bangalore, Karnataka, INDIA.
[3]EX - HOD, Vydehi Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, INDIA.
Email: drharish.mks@gmail.com

Abstract

Background: Spinal anaesthesiaproduces intense sensory and motor blockade as well as sympathetic blockade. Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. It is developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles. This study was undertaken to determine sensory and motor blockade profiles for 0.5% and 0.75% ropivacaine given intrathecally for perineal and lower limb surgeries. **Material and Methods:**A total of 100 patients were randomly divided into two equal groups. Group I received 0.5% and Group II received 0.75% isobaric Ropivacaine. After spinal anesthesia, sensory and motor blocks were assessed by pin prick test and Bromage scale respectively. **Results:** The results of our study indicate dose dependency. In both sensory and motor blockade cases, onset was quicker, intensity greater, regression slower, and duration longer with increasing concentrations. **Conclusion:** Intrathecal administration of 0.75% isobaric ropivacaine produced better quality of analgesia and motor block with negligible hemodynamic disturbances as compared to 0.5% ropivacainein perineal and lower limb surgeries.

Keywords: Spinal anaesthesia, Ropivacaine, sensory blockade, motor blockade, dose dependency.

[*]**Address for Correspondence:**
Dr. Harish K, Assistant Surgeon, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, INDIA.
Email: drharish.mks@gmail.com
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INTRODUCTION

Spinal anesthesia is a safe and effective alternative to general anesthesia when the surgical site is located on the lower extremities, perineum. It has the advantage that profound nerve block can be produced in a large part of the body by the relatively simple injection of a small amount of local anaesthetic. It produces intense sensory and motor blockade as well as sympathetic blockade.[1] As a block extends cephalad, there is progressive impairment of motor as well as sensory function. Many methods may be used to assess afferent (sensory), or efferent (motor or autonomic) functions. Sensory block can be assessed by pin prick test and motor block with Bromage scale.[2]

Ropivacaine is a new long-acting, enantiomerically pure (S-enantiomer), amide local anaesthetic with a high pharmacokinetics and low lipid solubility.[3] It is considered to block sensory nerves to a greater degree than motor nerves. Because of sensorimotor dissociation ropivacaine should be a favorable local anesthetic for day-case surgery and could be associated with earlier postoperative mobilization than bupivacaine.[4] This study was undertaken to determine sensory and motor blockade profiles for 0.5% and 0.75% ropivacaine given intrathecally for perineal and lower limb surgeries.

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MATERIAL AND METHODS

A prospective, randomized, double-blind study was conducted on 100 patients undergoing perineal and lower limb surgeries. Patients of American Society of Anaesthesiologists physical Status I or II of either sex, aged between 20 and 60 years, presenting for perineal or lower limb surgeries were included. Whereas, patients with severe systemic disease, coagulopathies, sepsis at the site of spinal injection, or allergic to local anaesthetic agent were excluded.

After approval of Institutional Ethical Committee and written informed consent from all patients, patients were allocated into two groups viz; Group-I: 50 patients receiving 3ml of isobaric Ropivacaine 0.5% and Group-II: 50 patients receiving 3ml of isobaric Ropivacaine 0.75%. A total of 100 envelopes were divided into two groups of 50 each. The drug to be given was mentioned inside the envelope. An envelope was randomly picked up just before the surgery. The envelope was opened by an anesthesiologist and the drug was loaded by that person. Another person conducted the procedure of spinal anaesthesia and theobservations were done by a third person who did not know what drug was given.

Before commencement of anesthesia, patients were instructed on the methods of sensory and motor assessments, and baseline measurements were made.

Assessment of Sensory blockade

This was tested by pin-prick method. The time of onset was taken from time of injection of the drug into the subarachnoid space to loss of pin-prick sensation. The time to achieve maximum sensory block was noted from time of injection of drug to loss of pin-prick sensation at highest dermatomal level. The time for regression of sensory level was noted. Duration of sensory blockade was recorded from time of onset to time of complete return of sensations. Analgesics were avoided until the patient complained of pain. This was done to note the total duration of analgesia.

Assessment of Motor Blockade

This was assessed by Bromage scale (0-3):0=Full flexion of knees and feet, 1=Just able to flex knees, full flexion of feet, 2=Unable to flex knees, but some flexion of feet possible, 3=Unable to move legs or feet. After spinal anesthesia, the patient's pulse rate, systolic, diastolic and mean BP along with sensory and motor block were recorded every three minutes.

RESULTS

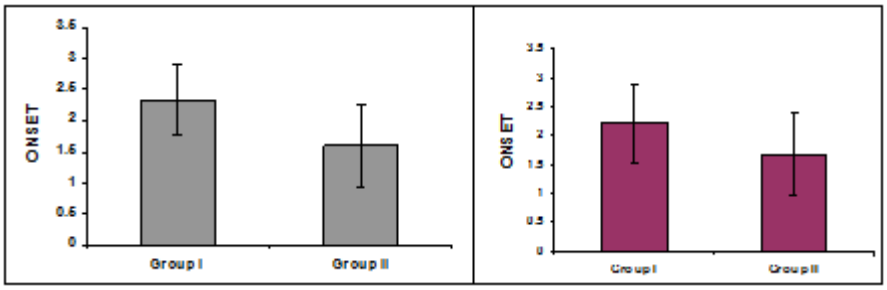
Sensory blockade

In the present study, the onset of sensory blockade in Group-I was 140.50±14.01 seconds compared to 96.40±11.61 seconds in Group-II which was statistically highly significant (P< 0.001).The median time to reach the highest level of analgesia was less than 20 min in both groups (ropivacaine 0.5% group, 16.22±4.59 min; ropivacaine 0.75% group, 19.24±6.10 min).However, the analgesic spread was extremely variable with both solutions, sometimes being restricted to the lumbosacral segments, sometimes extending to the upper thoracic segments. glucose-free ropivacaine 0.5% and 0.75% solutions will behave as slightly hypobaric solutions.

The two segment regression of sensory level to T10 dermatome in Group-I was 47.16±15.03 minutes compared to 92.38±37.60 minutes in Group-II which was statistically highly significant (P<0.001). This shows that ropivacine 0.75% has a more reliable duration of analgesia.The time of first request of analgesics in Group-I was 155.00±26.95 minutes compared to 187.10±19.67 minutes in Group-II which was statistically highly significant (P<0.001). This shows that there was significantly longer period of analgesia with 0.75% ropivacaine.

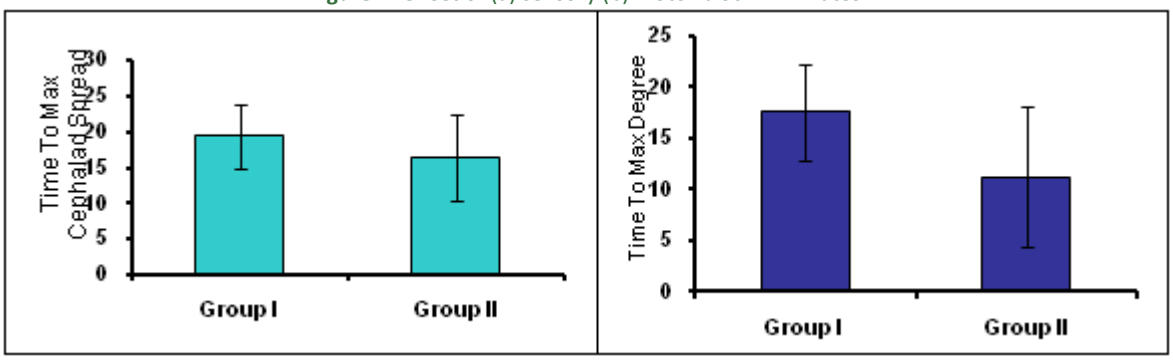
Motor blockade

In the present study, the onset of motor blockade in Group-I was 133.14±42.71 seconds compared to 100.80±11.53 seconds in Group-II which was also statistically highly significant (P< 0.001). The duration of motor blockade in Group-I was 118.50±12.71 minutes compared to 153.60±20.01 minutes in Group-II which was statistically highly significant (P<0.001).The 0.75% ropivacaine solution resulted in a higher frequency of complete motor block and a longer duration of motor block in the lower limbs.On the other hand, the 0.5% ropivacaine solution with its shorter duration of analgesia and often relatively moderate motor block of the lower limbs could be useful for transurethral procedures or minor orthopedic surgery, where the degree of motor block is not of critical importance.



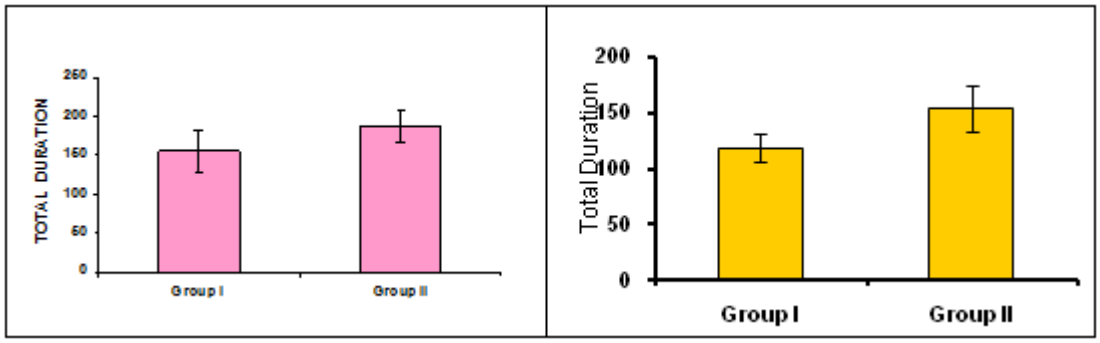
(a) (b)

Figure 1: Onset of (a) sensory (b) motor block in minutes



(a) (b)

Figure 2: Time to (a) max cephalad (b) maximum degree of motor block in minutes



(a) (b)

Figure 3: Total duration of (a) sensory and (b) motor block in minutes

DISCUSSION

Ropivacaineis considered to block sensory nerves to a greater degree than motor nerves. Because of sensorimotor dissociation ropivacaine should be a favorable local anesthetic for day-case surgery and could be associated with earlier postoperative mobilization than bupivacaine.

The patients studied across the group did not vary much with respect to age, sex or height. They were hemodynamically stable throughout the procedure, and only one experienced a short hypotension.Recent studies with intrathecal ropivacaine have demonstrated low cardiovascular and neurotoxic effects, good tolerability and efficacy.[5] In this study, 0.5% and 0.75% ropivacaine blocked pain perception without missing segments. Sensory blockade was well established in the lower lumbar and sacral segments. However, the analgesic spread was extremely variable with both solutions, sometimes being restricted to the lumbosacral segments, sometimes extending to the upper thoracic segments. The results of our study indicate dose dependency. In both sensory and motor blockade cases, onset was quicker, intensity greater, regression slower, and duration longer with increasing concentrations. However, the median time to reach the highest level of analgesia did not increase with increase in ropivacaine dose. An increase in dose prolonged the duration of analgesia, which is also in agreement with other studies.[6,7] Motor blockade was also dose dependent when measured by the Bromage scale, which is in agreement with the findings of other investigators.[7,8]

In conclusion, intrathecal administration of 22.5mg of 0.75% isobaric Ropivacaine produced better quality of analgesia and motor block with negligible hemodynamic disturbances as compared to 15mg of isobaric 0.5% ropivacainein perineal and lower limb surgeries.

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