COMPARISON OF INTRATHECAL ISOBARIC ROPIVACAINE WITH HYPERBARIC BUPAVICAINE FOR SPINAL ANAESTHESIA IN LOWER LIMB SURGERIES

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ABSTRACT

Background: Spinal anesthesia, is one of the commonly applied surgical anesthesia. **Objective:** This study was conducted to compare the efficiency and safety of intrathecal ropivacaine with intrathecal bupivacaine for spinal anesthesia in lower limb surgeries. **Material and methods:** Study Design: Quasi - experimental study. Place and Duration of Study: The study was carried out at. operation theatres of Combined Military Hospital Panoaqil Cantt from 1st December 2013 to 30th June 2014. Sixty patients of age between 20 to 60 years, males and females and American Society of Anaesthesiologist physical status or, planned for lower limb surgeries were included in the study. Selected patients were divided into two groups (Group A and Group B). Group A (n = 30) received 3 ml of isobaric ropivacaine 5mg/ ml (15 mg) and Group B (n = 30) received 3 ml of hyperbaric bupivacaine 5mg/ ml (15 mg). Sensory block was tested with pinprick and motor block was evaluated with Bromage scale until full recovery. The primary end point was to compare the duration of sensory and motor block. **Results**: Both the groups were demographically similar. Onset of sensory block at T1 ($p<0.05$) and the median time of onset of sensory block at T10 ($p<0.05$) was statistically significantly different . The time taken to achieve maximum motor blockade (group A 9.073 ± 1.075 min, group B 5.540 ± 0.760 min) was delayed with group A compared to group B ($p<0.05$). The mean duration of analgesia ($p<0.05$) and the mean duration of motor blockade ($p<0.05$) was less in Group A as compare to Group B. Return of Bromage to zero ($P<0.05$) was faster in Group A as compared to group B and was statistically significant. **Conclusion:** Isobaric ropivacaine 0.5% (study group A) provided lesser grade of motor blockade and shorter duration of both sensory and motor blockade, for short duration lower limb surgeries where prolonged motor blockade is quite undesirable and early mobilization can be planned.

Keywords: Spinal anesthesia, Ropivacaine, Bupivacaine, Lower limb surgeries.

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INTRODUCTION

Spinal Anaesthesia is a safe, reliable and inexpensive technique with the advantage of providing surgical anaesthesia and prolonged post operative pain relief. It is also an effective treatment for operative pain and blunts autonomic, somatic and endocrine responses.[1] Spinal anesthesia is widely used for lower limb and lower abdominal surgeries. It has been the mainstay for regional anesthesia in developing countries, especially in Pakistan.

Bupivacaine is being extensively used and produces an adequate sensory and motor blockade.[2] However it has its own disadvantages and side-effects such as cardiac and central nervous system toxicity.[3] They are usually because of accidental intravascular injections or a pronounced overdose. These adverse effects have prompted a search for drugs with lesser toxicity.

Ropivacaine is a long-acting amide local anesthetic with a structure closely related to bupivacaine and mepivacaine.[4] Ropivacaine is a local anesthetic with a high pKa and low lipid solubility that blocks the nerve fibers involved in pain transmission (Aδ and C fibers) to a greater degree than those controlling motor function (A_ fibers).[5] Few studies have shown that 15mg 25mg of the drug can be used for producing satisfactory anaesthesia.[6] The drug is less cardiotoxic than equal concentrations of racemic bupivacaine and has a significantly higher threshold for CNS toxicity than racemic bupivacaine in healthy volunteers.[7] Ropivacaine administered by the epidural route, is reported to be 20% less potent than bupivacaine at equal dosage.[8] It may produce less motor blockade and is of shorter duration.[8,9] This study was conducted to compare the efficiency and safety of intrathecal bupavaine with ropavicaine for spinal anesthesia.

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MATERIAL AND METHODS

The study was carried out at operation theatres of Combined Military Hospital Pano Aqil Cantt. The study was carried out in 07 months from 1st December 2013 to 30th June 2014. Sixty patients were included who were planned for lower Limb Surgery. Divided into two groups, 30 patients in Group "A" and 30 patients in Group "B", after obtaining informed consent of the patient and approval by the hospital ethics committee. Patients in group A received isobaric ropivacaine 15 mg (3 ml isobaric 0.5%) and in group B received hyperbaric bupivacaine 15 mg (3 ml hyperbaric 0.5%). Non-probability convenience sampling techniq was used:

Inclusion Criteria

Age: 20-60 years
Both males and females
A.S.A Physical status

Exclusion Criteria

Patients on anticoagulants.
Patients with hypertension or cardiac diseases.
Emergency surgery.
Patient's refusal for regional anaesthesia.

Study Design: Quasi- experimental study. Sixty patients scheduled for lower limb surgery, were included in the study. After preoperative assessment by history, physical examination and laboratory investigations, all the patients were explained about the procedure and written consent was taken. Selected patients were divided into two groups. Resuscitation trolley containing all the necessary drugs for resuscitation including ephedrine, atropine and adrenaline, laryngoscope endotracheal tubes and defibrillator was made available before giving spinal anaesthesia. Intravenous cannula of appropriate size was passed, monitoring was done with dynamap make for noninvasive blood pressure, cardiac monitor to record cardiac activity and pulse oximetery for oxygen saturation and pulse rate. After identification of selected patients, base line heart rate and blood pressure were taken. Both the group were preloaded with Inj. Ringer solution 500ml. Patients were premedicated with 2 mg of midazolam intravenously and placed in the left lateral position and whole of the back draped under aseptic measures.

After skin's infiltration with 2% lidocaine, a 25G Quinke Babcock needle was inserted at the L3/4 interspace in the midline. Correct needle placement was identified by free flow of cerebrospinal fluid and 3 ml (15 mg) of the study drug was injected. Patients in group A received isobaric ropivacaine 15 mg (3 ml isobaric 0.5%) and in group B received hyperbaric bupivacaine 15 mg (3 ml hyperbaric 0.5%). Both 3-ml solutions were prepared in an adjacent room by a person not involved in the subsequent evaluation of the study patient. After the injection of the drug the spinal needle was removed and the patient placed supine.

Standard monitoring was used throughout the operation. ECG and pulse oximetry were monitored continuously while arterial pressure was measured every 5 minutes intervals by NIBP. Heart rate and arterial pressure were recorded before intrathecal injection, 5 minutes after the intrathecal drug administration, and thereafter every 10 minutes till the end of the operation. Any hypertension (mean arterial pressure lower than 60 mmHg) or bradycardia (heart rate < 45/min) incidents were treated with ephedrine 5 mg or atropine 0.5 mg increments. A decrease in SpO2 to < 92% was defined as hypoxia and treated with supplemental oxygen. The level of sensory block was evaluated by loss of pinprick sensation (20-gauge hypodermic needle).

Onset of sensory block assessed in the both limb by assessing the changes in pin prick sensation every 1minute till no sensation (grade 2) is achieved (graded according to Gromley and Hill 1996, {Normal sensation - 0, Blunted sensation -1, No sensation -2}) Grade 2 was taken as onset of sensory block. We checked bilaterally S1, L3,L1, T12 and T10 dermatomes by needle protrusion 2 mm through a guard and we used T4 as baseline point for normal sensation.

Onset of Motor block assessed every 1 minute till complete motor block was achieved (grade 3) in the normal limb. (Graded according Modified Bromage scale {0 = no paralysis, able to flex hips/knees/ankles; 1 = able to move knees, unable to raise extended legs; 2 = able to flex ankles, unable to flex knees; 3 = unable to move any part of the lower limb}). Grade 3 was taken as complete motor block.

Duration of sensory block was taken as the time from

the onset of sensory block to the time when the patient requires first dose of analgesia for post operative pain. Duration of motor block (recovery of motor blockade to grade 1) was taken as the time from complete motor block to when the patient recovers the ability to flex knees i.e. grade 1 on Bromage scale. The data was analyzed by using the SPSS version 16.0 for windows. P value <0.05 was taken as significant. Student t test was applied to find out the statistical significant differences on primary variable. The primary variable measured was Time taken in Minutes.

Onset of sensory blockade at T1 (min), to achieve peak sensory level at T10 (min), to achieve maximum motor blockade Bromage 3 (min), duration of surgery (min), return of Bromage Scale to Zero (min) and total duration of analgesia Side effect measured included, hypotension and bradycardia

RESULTS

Total 60 patient were included in the study that were planned for lower Limb surgery and were divided into two group designated as Group A (patient given Inj. Ropivacaine 0.5%) and Group B (patient given Inj. Bupivacaine 0.5%).
The percentage of different age range of both the group was presented in Table I.

Table I: Distribution of age in patients of group A and group B (n = 60)

Age (years)	Group A		Group B	
	Frequency	%	Frequency	%
20-40	22	73.3	21	70
41 - 50	04	13.3	05	16.6
41 - 50	04	13.3	05	16.6

Key:
Group A = Inj. Ropivacaine
Group B = Inj. Bupivacaine

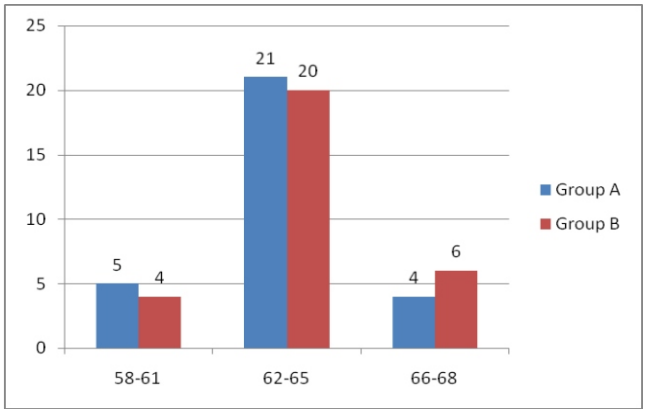
Demographic data showed no difference between two groups in term of weight, sex and American Society of Anaesthesiologist physical status (Figure I, II and III).
Onset of sensory block at T1 (p<.05) and the median time of onset of sensory block at T10 (p<0.05) was statistically significant. The study group achieved lower levels of peak sensory block compared to control group (p<0.05). The time taken to achieve maximum motor blockade (group A, 9.073 ± 1.075 min group B , 5.540 ± 0.760 min) was statistically significant. The mean duration of analgesia (p<0.05), the mean duration of motor blockade (p<0.05) and Return of Bromage to zero (P<0.05) was achieved in less time in group A when compared to group B and was statistically significant (Table II)

Table II: Comparison of sensory and motor block and duration of surgery

	Group A	Group B	P-value
Onset of sensory blockade at T1(min)	6.47 ± 1.050	3.17 ± 0.941	P <0.05
To achieve peak sensory level at T10 (min)	14.090 ± 1.645	9.146 ± 1.322	P < 0.05
To achieve maximum motor blockade Bromage 3 (min)	9.073 ± 1.075	5.540± 0.760	P <0.05
Duration of surgery (min)	107.51 ±13.03	109.5 ±13.77	P >0.05
Return of Bromage Scale to Zero (min)	132.46 ± 6.90	204.54 ± 12.21	P <0.05
Total Duration of Analgesia	200.7 ± 5.32	259.7 ± 10.31	P < 0.05

Key: Group A = Inj. Ropivacaine
Group B = Inj. Bupivacaine

Fig. I : Distribution of patients according to weight in both groups n=60



Group A = Inj. Ropivacaine
Group B = Inj. Bupivacaine

Table III: Comparison of Hypotension and Bradycardia between two groups

	Group A	Group B	P value
Hypotension	01	05	P <0.05
Bradycardia	0	03	P < 0.05

DISCUSSION

It was demonstrated that the significantly faster onset and motor block was seen with intrathecal bupivacaine, however, significantly shorter motor block duration with intrathecal plain ropivacaine might be advantageous because it allowed a faster discharge, and early recognition of any neurologic complications. In 2008, Mantouvalou et al[10] performed a study to compare the anaesthetic efficacy and safety of three local anesthetic agents: racemic bupivacaine and its two isomers: ropivacaine and levobupivacaine, in patients undergoing lower abdominal surgery. 150 patients, ASAI-III, were randomized to receive an intrathecal injection of one of three local anesthetic solutions. Group A (n = 40) received 3 ml of isobaric bupivacaine 5 mg/ml (15 mg). Group B (n=40) received 3 ml of isobaric ropivacaine 5 mg/ ml (15 mg). Group C (n=40) received 3 ml of isobaric levobupivacaine 5 mg/ml (15 mg). The onset of motor block was significantly faster in the bupivacaine group compared with that in the ropivacaine group and almost the same of that in the levobupivacaine group ($P < 0.05$). Ropivacaine presented a shorter duration of both motor and sensory block than bupivacaine and levobupivacaine ($P < 0.05$). Bupivacaine required more often the use of a vasoactive drug (ephedrine) compared to both ropivacaine and levobupivacaine and of a sympathomimetic drug (atropine) compared to the ropivacaine group. McDonald and colleagues,[11] found that Ropivacaine 0.5% produce sensory block of similar onset and extent as Bupivacaine 0.5% but it was associated with lesser degree of motor block and faster regression of both sensory and motor block.

Whiteside et al,[12] reported that Ropivacaine provided reliable spinal anesthesia of shorter duration and with less hypotension than Bupivacaine. Sanchez et al in 2009, [13] compared the effects of intrathecal isobaric ropivacaine versus isobaric bupivacaine in a dose ratio of 3:2 in non-ambulatory urologic and orthopedic surgery. They concluded that the motor blockade was longer in the Bupivacaine Group (266.5+/- 29.5) compared to the Ropivacaine Groups (226.4 ± 22.3 min), ($p < 0.001$).

The results of our study showed that 15 mg Ropivacaine and 15 mg Bupivacaine provide adequate block for lower limb surgeries but onset was faster in bupivacaine group as compare to ropivacaine group but duration of motor blockade was prolonged with bupivacaine group as compared with ropivacaine group. Our study supported the above studies that ropivacaine provide slow onset of sensory and motor block as compare to bupivacaine but there was early recovery of motor and sensory block with ropivacaine as compare to bupivacaine. Regarding complication there was significant difference in hypotension and bradycardia between two groups.

CONCLUSION

In conclusion, intrathecal administration of either 15 mg bupivacaine, 15 mg ropivacaine was well-tolerated and provided similar, effective anesthesia for lower limb surgeries. In an equal milligram dose, ropivacaine produced a shorter duration of motor and sensory block than bupivacaine. So intrathecal ropivacaine may prove useful when surgical anesthesia of a similar quality but of a shorter duration than that of bupivacaine is desired.

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