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ORIGINAL RESEARCH

Comparison of clinical efficacy of isobaric ropivacaine versus hyperbaric ropivacaine in patients posted for lower limb surgeries

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ABSTRACT

Background: Ropivacaine is structurally related to bupivacaine but less toxic, is preferred for its favourable sensory and motor block profiles. The present study was conducted to compare clinical efficacy of isobaric ropivacaine versus hyperbaric ropivacaine in patients posted for lower limb surgeries. **Materials & Methods:** 60 patients of ASA I & II between the age of 18 to 65 years of either gender undergoing lower limb surgeries were randomly divided into 2 groups by close envelope method. Group Hr (n=30) – to receive 3ml 0.75% Hyperbaric Ropivacaine + 0.5ml Fentanyl (25mcg). Group Ir (n=30) – to receive 3ml 0.75% Isobaric Ropivacaine + 0.5ml Fentanyl (25mcg). **Results:** In group I, males were 16 and females were 14. In group II, males were 17 and females were 13. There was non- significant difference in anthropometric parameters and pre-operative vitals between both groups. The mean onset of sensory block was significantly (p=0.001) lower amongpatients of Hr (3.57 ± 0.67 minutes) compared to Ir (4.90 ± 0.71 minutes). The mean onset of motor blockade was significantly (p=0.001) lower among patients of Hr (7.17±1.17 minutes) compared to Ir (9.57±0.81 minutes). T8 was achieved in 53.3% patients of Hr group and in 10% patients of Ir group. However, T10 was achieved among 46.7% patients of Hr group and in 33.3% patients of Ir group. There was significant (p=0.001) difference in maximum level of block achieved between the groups. The mean duration of surgery was insignificantly (p>0.05) lower among patients of Hr (85.17±20.61 minutes) than Ir (90.17±19.27 minutes). The mean total duration of sensory block was significantly (p=0.001) lower among patients of Hr (163.50±9.57 minutes) compared to Ir (187.67±8.88 minutes). The mean total duration of post operative analgesia was significantly (p=0.001) lower among patients of Hr (212.17±10.80 minutes) compared to Ir (230.67±12.22 minutes). The difference was significant (P< 0.05). Complications such as bradycardia and hypotension was present in 4 (13.3%) in Hr and 1 (3.335) in Ir group. The difference was significant (P< 0.05). **Conclusion:** Hyperbaric ropivacaine has early and faster onset, spreads more to higher levels and is early to regress while Isobaric ropivacaine has longer duration of action, longer duration of post-operative analgesia and better VAS score.

Keywords: Hyperbaric ropivacaine, Spinal anesthesia, sensory block

INTRODUCTION

Spinal anesthesia is a type of regional anesthesia achieved by blocking nerves in the subarachnoid space, has been widely used globally for over a century. It is favoured for many surgeries due to advantages such as patient alertness, ease of administration, rapid onset, cost- effectiveness, minimal stress response, fewer side effects, and quick patient recovery.[1]

Observational studies suggest that compared to general anesthesia, spinal anesthesia may lower risks of death, delirium, and major complications, and shorten hospital stays. General anesthesia, however, offers the benefit of patients not remembering the procedure, potentially enhancing satisfaction amidst the unfamiliar surgical environment.[2,3] Despite this, spinal anesthesia offers unique benefits such as less intraoperative hypotension, avoidance of neurologically active drugs, and possibly reducing early delirium. Decisions

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on anesthesia type are typically made case by case, with guidelines suggesting patients should choose between general and spinal anesthesia after discussing their respective pros and cons.[4]

Ropivacaine is structurally related to bupivacaine but less toxic, is preferred for its favourablesensory and motor block profiles. Its lowersolubility enhances sensory-motor differentiation, promoting earlier recovery of motor function and potentially reducing complications like venous thromboembolism.[5] Hyperbaric solutions will flow in the direction of gravity and settle in the most dependent areas of the intrathecal space. Conversely, hypobaric mixtures will rise in relation to gravitational pull. These properties allow the anesthesiaprovider to preferentially control the spread of the block by choice of mixture and patient positioning.[6,7] The present study was conducted to compare clinical efficacy of isobaric ropivacaine versus hyperbaric ropivacaine in patients posted for lower limb surgeries.

MATERIALS & METHODS

This study was conducted in Department of Anaesthesiology, Hind Institute Of Medical Sciences, Mau, Sitapur. This study was done after ethical committee approval and written consent obtained from all patients included in study. 60 patients of ASA I & II between the age of 18 to 65 years of either gender undergoing lower limb surgeries were enrolled.

Data such as name, age, gender etc. was recorded. Patients were randomly divided into 2 groups by close envelope method. Group Hr (n=30) – to receive 3ml 0.75% Hyperbaric Ropivacaine + 0.5ml Fentanyl (25mcg). Group Ir (n=30) – to receive 3ml 0.75% Isobaric Ropivacaine + 0.5ml Fentanyl (25mcg). Sensory blockade was assessed by pin prick test (loss of sensation to pinprick) by using 22G hypodermic needle. Motor blockade was assessed by Modified Bromage scale. Post operative monitoring of systolic blood pressure (SBP), diastolic blood pressure(DBP), heart rate (HR), and oxygen saturation (SpO2) was done. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Gender	Hr	Ir
Male	16	17
Female	14	13

Table I shows that in group I, males were 16 and females were 14. In group II, males were 17and females were 13.

Table II Assessment of parameters

Parameters	Variables	Hr	Ir	P value
Anthropometric parameters	Weight in kgs	60.47±8.71	59.57±9.09	0.69
	Height in cms	158.93±6.75	160.23±3.67	0.35
	BMI	23.91±2.93	23.13±2.93	0.30
Pre-operative	SBP	132.03±12.12	135.73±12.82	0.25
	DBP	75.93±7.26	74.80±8.93	0.59
	HR	95.50±11.11	97.33±14.32	0.58
vitals	RR	17.33±1.32	17.47±1.38	0.70
	SPO2	99.70±0.65	99.40±0.85	0.13
Onset of sensory blockin minutes		3.57 ± 0.67	4.90 ± 0.71	0.001
Onset of motor block in minutes		7.17±1.17	9.57±0.81	0.001
ximum level of blockachieved	T8	16	3	0.001
	T10	14	10	
	T12	0	17	
Duration of surgery in minutes		85.17±20.61	90.17±19.27	0.33
Total duration of sensory block in minutes		163.50±9.57	187.67±8.88	0.001
Total duration of motor block in minutes		178.00±9.34	199.67±8.80	0.001
total duration of post operative analgesia		212.17±10.80	230.67±12.22	0.001

Table II shows that there was non- significant difference in anthropometric parameters and pre-operative vitals between both groups. The mean onset of sensory block was significantly (p=0.001) lower amongpatients of Hr (3.57 ± 0.67 minutes) compared to Ir (4.90 ± 0.71 minutes). The mean onset of motor blockade was significantly (p=0.001) lower among patients of Hr (7.17±1.17 minutes) compared to Ir (9.57±0.81 minutes). T8 was achieved in 53.3% patients of Hr group and in 10% patients of Ir group. However, T10 was achieved among 46.7% patients of Hr group and in 33.3% patients of Ir group. There was significant (p=0.001) difference in maximum level of block achieved between the groups. The mean duration of surgery was insignificantly (p>0.05) lower among

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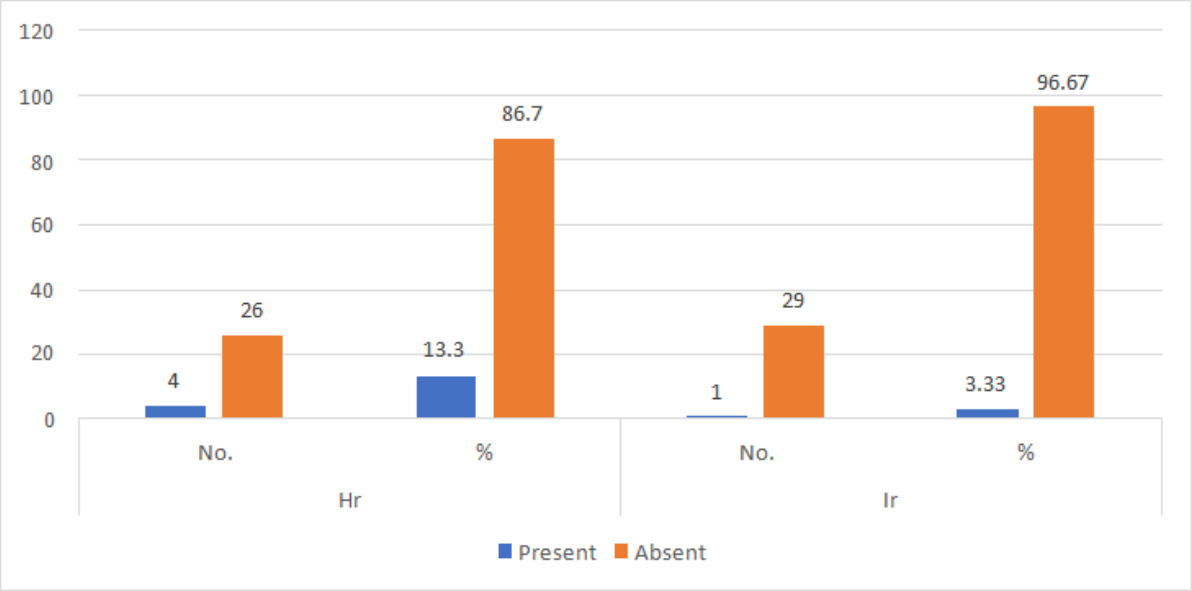
patients of Hr (85.17±20.61 minutes) than Ir (90.17±19.27 minutes). The mean total duration of sensory block was significantly (p=0.001) lower among patients of Hr (163.50±9.57 minutes) compared to Ir (187.67±8.88 minutes). The mean total duration of post operative analgesia was significantly (p=0.001) lower among patients of Hr (212.17±10.80 minutes) compared to Ir (230.67±12.22 minutes). The difference was significant (P< 0.05).

Graph I Complications between groups



Graph I shows that complications such as bradycardia and hypotension was present in 4(13.3%) in Hr and 1 (3.335) in Ir group. The difference was significant (P< 0.05).

DISCUSSION

Ropivacaine produces similar sensory block and reduced motor block to that of an equivalentdose of bupivacaine due to its less lipophilicity. However, in comparison with bupivacaine, plain ropivacaine produces rapid postoperative recovery of sensory and motor blockade.[8,9]

Glucose free solutions are marginally hypobaric and quality of block is unpredictable because gravity does not affect their spread in the supine position. Addition of glucose will lead to more rapid spread to higher median level and less variation in maximum sensory and motor block.[10] The increase in density produced by adding glucose results in more even distribution of the local anaesthetics, gravity presumably encouraging spread of the bolus of drug down the slopes of the lumbar curve.[11] Various studies have been conducted with other local anaesthetics which improved the quality of block by adding glucose along with them.[12,12] The present study was conducted in the Department of Anaesthesiology, Hind Institute of Medical Sciences, Mau, Sitapur with the objective to compare the clinical efficacy of intrathecal isobaric ropivacaine versus hyperbaric ropivacaine in patients posted for lower limb surgeries. A total of 30 patients were included in each group.

We found that in group I, males were 16 and females were 14. In group II, males were 17 and females were 13. Deepak and Jammar[14] also found that the heart rate, SBP and DBP were statistically insignificant between the two groups (p>0.05).

We found that there was non- significant difference in anthropometric parameters and pre- operative vitals between both groups. The mean onset of sensory block was significantly (p=0.001) lower amongpatients of Hr (3.57 ± 0.67 minutes) compared to Ir (4.90 ± 0.71 minutes). Vallabha et al[15] observed that ropivacaine's had slower time to motor blockade onset and shorter motor blockade duration compared to Bupivacaine were both highly significant with P value of 0.0001.

It was seen that the mean onset of motor blockade was significantly (p=0.001) lower among patients of Hr (7.17±1.17 minutes) compared to Ir (9.57±0.81 minutes). T8 was achieved in 53.3% patients of Hr group and in 10% patients of Ir group. However, T10 was achieved among 46.7% patients of Hr group and in 33.3% patients of Ir group. There was significant (p=0.001) difference in maximum level of block achieved between the groups. The mean duration of surgery was insignificantly (p>0.05) lower among patients of Hr (85.17±20.61 minutes) than Ir (90.17±19.27 minutes). Van Kleef et al[16] found that the duration of analgesia at the level of T12 was significantly longer in the 0.75% group as compared to 0.5% group. This showed that ropivacaine 0.75% had a longer duration of analgesia compared to 0.5% ropivacaine.

The mean total duration of sensory block was significantly (p=0.001) lower among patients of Hr (163.50±9.57 minutes) compared to Ir

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(187.67±8.88 minutes). The mean total duration of post operative analgesia was significantly (p=0.001) lower among patients of Hr (212.17±10.80minutes) compared to Ir (230.67±12.22 minutes). We observed that complications such as bradycardia and hypotension was present in 4 (13.3%) in Hr and 1 (3.335) in Ir group. Khaw et al[17] found that the incidence of hypotension were similar in a comparison of different doses of plain ropivacaine. They observed the same, that there were no major cardiovascular changes in the two groups receiving two different doses (2.5ml and 3ml) of 0.75% ropivacaine in caesarean section. They opined that the onset of sensory and motor block were similar in twogroups of ropivacaine 0.75%.

The limitations of our study focus on a specific patient population and its sample size may restrict the generalizability of our findings to broader populations.

CONCLUSION

Authors found that Hyperbaric ropivacaine has early and faster onset, spreads more to higherlevels and is early to regress while Isobaric ropivacaine has longer duration of action, longer duration of post-operative analgesia and better VAS score.

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