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Comparative Study of Intrathecal Isobaric 0.5% Bupivacaine and Isobaric 0.75% Ropivacaine for Lower Abdominal and Lower Limb Surgeries.

Dr. Dinesh Lalwani, Assistant Professor, Department of Anesthesia, Dr Ulhas Patil Medical College, Jalgaon.

Dr. S.S. lawahale, Professor and HOD, Department of Anesthesia, PDMC,Amrawati.

Dr Lalit Jadhav, Resident ,Department of Anesthesia, JNMC,Sawangi(Wardha).

Dr. Sneha Nikam, Assistant Professor , Department of Anesthesia, KEM Hospital, Mumbai

Corresponding Author: Dr Lalit Jadhav, Resident ,Department of Anesthesia, JNMC,Sawangi(Wardha),India.

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Abstract

Background and Aim The study is to compare the effects of 2.0 ml (15mg) of intrathecal isobaric Ropivacaine 0.75% with 2.0 ml (10mg) of isobaric Bupivacaine 0.5%. with respect to sensory and motor block, Recovery parameters, Hemodynamic changes.

Settings and Design: A randomized double-blind study was conducted among 200 healthy parturients, scheduled for lower abdominal and lower limb surgeries, at PDMMC Amravati India.

Materials and Methods This clinical study was conducted on 200 adult patients of ASA physical status I & II in the age group of 18 years to 60 years, of either sex, posted for elective lower limb, lower abdominal, gynaecological and urological surgeries under spinal anaesthesia after taking informed consent at Panjabrao Deshmukh memorial medical college and Hospital Amravati over a period of 18 months. After approval from the hospital ethical committee, a comparative study was carried out on 200 adult patients.

Results: This study reveals that 15 mg of isobaric Ropivacaine (2 ml of 0.75%) when administered intrathecally provides adequate anaesthesia for lower abdomen and lower limb surgeries and is an alternative to Bupivacaine. Ropivacaine is similar to Bupivacaine in onset of sensory and motor block, quality of analgesia, degree of motor block and duration of sensory block, But there is shorter duration of motor block with Ropivacaine compared to Bupivacaine.

Keywords: Lower abdominal surgery, isobaric Ropivacaine, isobaric bupivacaine, Spinal anesthesia.

Introduction

The greatest gift that God has given to mankind is not happiness, but relief of pain. In pursuit of relief of pain, particularly pain during and after surgery, many attempts have been made since time immemorial.

Spinal anaesthesia was introduced into clinical practice by Karl August Bier in 1898[1]. More than a century has passed and even today, it is one of the most popular techniques for both elective and emergency surgical procedures particularly Caesarean sections, lower abdominal surgeries, orthopaedic lower limb surgeries and urological surgeries just to name a few[2].

Spinal anaesthesia, defined, as the regional anaesthesia

obtained by blocking nerves in the subarachnoid space is a popular and common technique used worldwide. The advantages of an awake patient, simple to perform, rapid onset of action, minimal drug cost, minimal stress response, relatively less side effects and rapid patient turnover has made this the choice for many a surgical procedures.[3]

Lignocaine had been the most widely used local anaesthetic for spinal anaesthesia because of its faster onset and shorter duration of action but it is associated with very high incidence of transient neurological symptoms[4]. Presently the most widely used drug bupivacaine 0.5% is cardiotoxic and also produces motor blockade of prolonged duration.

Ropivacaine is a relatively new amide long acting enantiomerically pure (S enantiomer) local anaesthetic with high pka and low lipid solubility, and it is considered to block sensory nerves to greater degree than motor nerves and having similar local anaesthetic properties and chemical structure to that of bupivacaine.[5]

The newer drug Ropivacaine being comparatively less cardio toxic, also produces minimal motor blockade of shorter duration[6] which relives the psychological distress of being immobile for a longer period of time after surgery compared to intrathecal Bupivacaine during lower abdomen and lower limb surgeries.[7]

Hence the purpose of this study is to assess the quality and duration of sensory and motor blockadeof Ropivacaine and toxic side effects if any compared to intrathecal Bupivacaine during lower abdomen and lower limb surgeries.

Methods and Materials

Source of data

This clinical study was conducted on 200 adult patients of ASA physical status I & II in the age group of 18 years to 60 years, of either sex, posted for elective lower limb, lower abdominal, gynaecological and urological surgeries under spinal anaesthesia after taking informed consent at Panjabrao deshmukh memorial medical collage and Hospital ,Amravati over a period of 18 months. After approval from the hospital ethical committee, a comparative study was carried out on 200 adult patients.

Patients were randomly divided on an alternative basis into two groups of 100 each.

Group "B" Bupivacaine group- Receive Intrathecal isobaric 0.5% Bupivacaine 2ml (10 mg)

Group „R" Ropivacaine group- Received Intrathecal isobaric 0.75% Ropivacaine 2ml (15mg)

Inclusion criteria

- Adult patients aged between 18-60 years of both sex
- Patients belonging to ASA Grade I & II
- Patients giving valid informed consent.
- Patients scheduled to undergo elective lower abdominal, lower extremity, gynecological or urological surgeries under subarachnoid block.

Exclusion criteria

- Patient refusal.
- Age >60 years or <18years
- Patients belonging to ASA grade III and IV.
- known cases of hypersensitive reactions to local anaesthetics
- Patients with medical complications like anaemia, heart disease, severe hypovolemia, shock, septicaemia.
- Patients with coagulation disorders or on anticoagulant therapy.
- Local infection at the site of proposed puncture for spinal anaesthesia

Method of study

Pre anaesthetic check up was carried out with a detailed history, general physical examination and systemic examination. Airway assessment and spinal column examination were done.

The following laboratory examinations were done in

selected cases -

- Hemoglobin
- Urine analysis
- Blood sugar
- Blood urea
- Serum creatinine
- Coagulation profile
- Blood grouping and Rh typing
- Electrocardiogram(ECG)-for patients over 40 years of age
- Chest X- ray

Preoperatively

- Patient‘s informed written consent was taken.
- Nil per oral status was confirmed.
- The procedure of subarachnoid block was explained and the patient was informed to communicate to the anesthesiologists about perception of pain or discomfort during the surgery.
- Patients were given tab diazepam 10 mg and tab ranitidine 150 mg orally 10:00 pm at night before surgery and at 7:00 am on the morning of surgery.

Procedure

- Patient was shifted on the OT table, IV access was obtained on the forearm with 20 Gauge IV cannula and Lactated Ringer's solution 10 mL/kg was infused intravenously before the block. The monitors that were connected to the patient included non invasive B.P, oxygen saturation using pulse oximeter. Baseline Pulse rate, BP and RR, SpO2 was recorded.
- Under strict aseptic precautions, lumbar puncture was performed in left lateral or sitting position by midline approach by using disposable Quincke Babcock spinal needle (25 G) at L2-L3 or L3-L4 intervertebral space. The study solution (2ml) was administered over 30sec.
- After the spinal block, pulse rate, Respiratory rate and NIBP were measured at 0,5,10,15,20,25,30,45,60,90,120,180 min,. Hypotension was defined as 20% decrease in blood pressure from baseline values, and was treated with incremental i.v. boluses of mephentermine 3 mg. Bradycardia was defined pulse rate less than 60bpm and treated with iv atropine 0.6mg Patients were monitored continuously using non invasive blood pressure, pulse oximeter and electrocardiogram. After giving spinal anaesthesia, Oxygen (4L/min) by facemask was given. Fluid therapy was maintained with lactated Ringer's solution (10mL/kg/hr)

Assessment of Sensory Blockade

- The onset of sensory block was tested by pin-prick method using a hypodermic needle. The time of onset was taken from the time of injection of drug into subarachnoid space to loss of pin prick sensation.
- The highest level of sensory block and time required to achieve it was noted. The time for two dermatomal segments regression of sensory level was noted. The duration of sensory blockade was taken as time from onset to time of return of pinprick sensation to S1 (heel) dermatomal area . Requirement of any supplemental analgesics intra operatively was noted

Assessment of Motor Blockade

This was assessed by Bromage scale*.

The time interval between injection of drug into subarachnoid space, to the patient‘s inability to lift the straight extended leg was taken as onset time (grade 3). The duration of motor block was taken from time of injection to complete regression of motor block. (Ability to lift the extended leg) (grade 0).

***Bromage Scale for Assessing Motor Block And Degree of Paralysis**

- Grade 0 - Full flexion of knees and feet
- Grade 1 - Just able to flex knees, full flexion of feet

- Grade 2 - Unable to flex knees, but some flexion of feet possible
- Grade 3 - Unable to move legs or feet

Quality of intraoperative analgesia

Was assessed on a four point modified Belzarena scale [68]

- Unable to tolerate pain
- Able to tolerate discomfort with additional analgesia
- Some discomfort but no additional analgesics required
- Completely satisfied

Post operatively, monitoring of vital signs was continued every 30 minutes until the time of regression of sensory block to L1 dermatome. Hypotension (arterial blood pressure < 20 % of baseline), was treated with Inj. mephentermine 3 mg intravenous increments and bradycardia (as pulse rate < 60/ min) was treated by atropine 0.6 mg intravenous stat. Side effects like sedation , nausea, vomiting urinary retention were monitored in the recovery room and then shifted to the ward. Neurological examination was done to rule out any neurological deficits at discharge.

Statistical Methods

The demographic data were analyzed using either Student's t -test or Chi-square test. Quantitative data was analyzed by student's t-test and qualitative data was analyzed by Chi-square test. Mann Whitney U test has been used to find the significance between two groups for parameters on non-interval scale. All values were expressed as mean ± standard deviation. P < 0.05 was considered statistically significant.

Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 and Systat 12.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.**

Observation and Results

A total of 200 patients belonging to ASA grade I and II posted for lower abdominal and lower limb surgeries were randomly selected. The patients were divided into 2groups of 100 each.

Group R (Ropivacaine group) received 0.75 %(2ml) 15 mg

Group B (Bupivacaine group) received 0.5 %(2ml) 10 mg

Demographic Profile

	Group R		**Group B**	
Age (Years)	**No.**	**%**	**No.**	**%**
18-29	20	20	20	20
30-39	38	38	34	34
40-49	28	28	24	24
50-60	14	14	22	22
Total	100	100	100	100
Mean+/-SD	36.8± 9.7		38.5±10.8	
P* Value, significance	0.42 Not Signif icant			
* Student's unpaired t test				

Table 8: Age distribution of patients studied

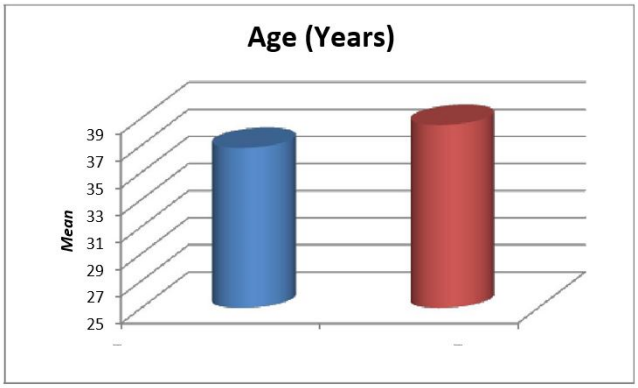
38% of patients in group R and 34% of patients in group B belonged to the age group between 30 and 39 years and mean age in Group R was 36.8±9.7yrs and mean age in group B was 38.5±10.8 yrs and were comparable among two groups.

Parameter	Group R	Group B	P Value
Age (Years)	36.8±9.7	38.5±10.8	0.42 NS
Sex (Male/Female)	50:50	52:48	0.8 NS
Height (Ft)	5.6±0.2	5.5±0.3	0.1 NS
Weight (Kgs)	53.9±6.2	55.3±5.9	0.22 NS

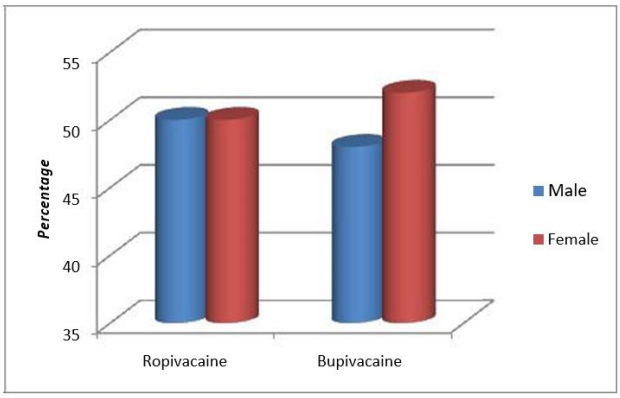
Table 9: Demographic Profile

*Values are expressed as Mean +SD.

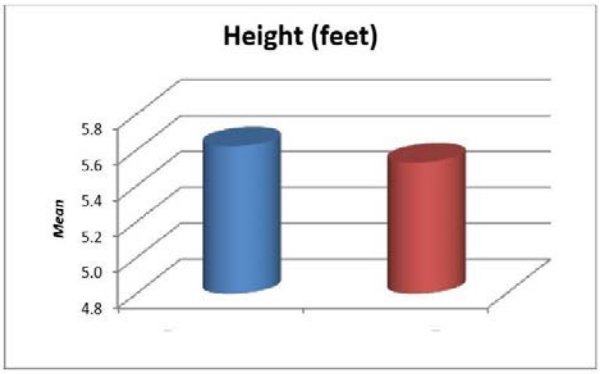
The mean age of the patient in group R was 36.8±9.7 years and in group B was 38.5±10.8 years. In group R, there were 50 males and 50 females, and in group B there were 52 males and 48 females. The mean height of the patient in group R was 5.6±0.2 feet and in group B was 5.5±0.3 feet .The mean weight of the patient in group R was 53.9±6.2 kgs and in group B 55.3± 5.9 kgs (Table 9). There was no statistically significant difference between the two groups with regards to age, sex, height and weight (p>0.05) and the samples were age, sex, height and weight matched.



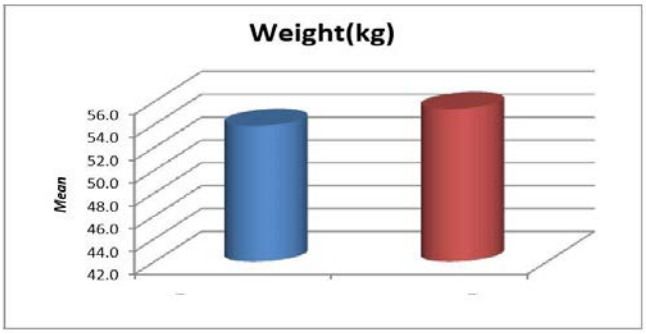
Graph 1: Comparison of age



Graph 2: Comparison of sex



Graph 3: Comparison of height



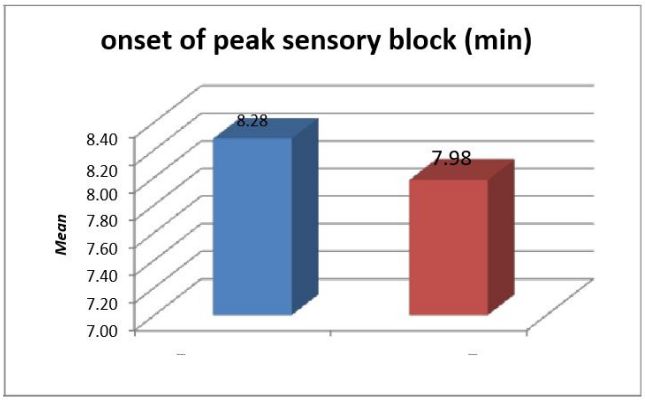
Graph 4: Comparison of weight

	Group R	Group B	P Value
Time to onset of peak sensory block (in min)	8.28 ± 2.2	7.98 ± 2.2	0.49 NS

Table – 10: Time to Onset of Peak Sensory Block

- Values are expressed as Mean + SD.
- Students unpaired‗t' test.

- The mean time for onset of peak sensory block in Group R was 8.28
- ± 2.2 minutes and in Group B was 7.98±2.2 minutes, with p value 0.49, which was statistically not significant. (Table.10, graph 5).



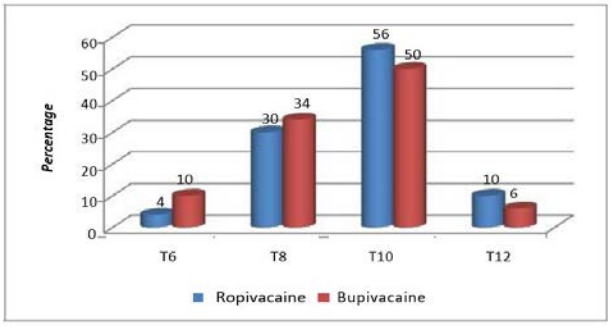
Graph 5: time to onset of peak sensory block

Highest Level of Sensory Block	Group R	Group B
T4	0	0
T6	4 (4%)	10(10%)
T8	30(30%)	34(34%)
T10	56(56%)	50(50%)
T12	10(10%)	6(6%)

TABLE 11- Maximum level of sensory block

X^2 =2.08 P=0.55 NS.

Highest level of block achieved in group R was T6 with 4(4%) % of patients achieving it. Highest level of block achieved in group B was also T6 with 10 (10%) patients achieving it. 56 % of patients of group R achieved a sensory block upto T10 where as 50% of patients of group B achieved a maximum sensory block upto level of T10. These findings were clinically and statistically not significant.

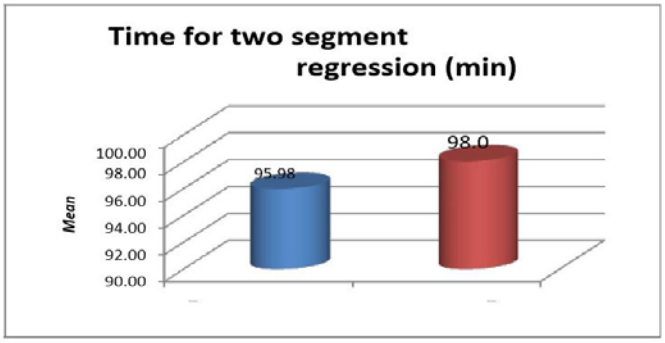


GRAPH 6: Maximum level of sensory block

	Group R	Group B	P Value
Time for two segment regression (min)	95.98 ±8.2	98.04±8.5	0.22 NS

Values are expressed as Mean + SD. Students unpaired‗t' test

The time taken for two segment regression of sensory block was 95.98 ±8.2 min in the group R and 98.04±8.5 min in the group B. P value was 0.22 and statistically not significant.



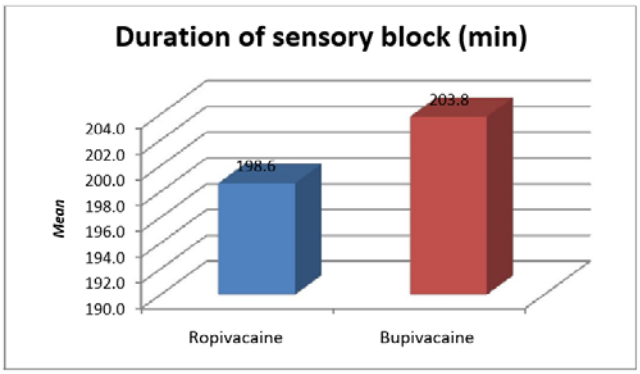
GRAPH-7: Time for two segment regression

Table-13: Duration of Sensory Block (Regression to S1)

	Group R	Group B	P Value
Duration of sensory block (min)	198.6±18.4	203.8±19.5	0.17 NS

The mean value for duration of sensory block (regression of sensory block to S1 was 198.6±18.4 minutes for group

R and 203.8±19.5 minutes for group B. By 4 hours all patients of both groups had complete sensory regression. This was not significant clinically or statistically with a p value
(0.17).



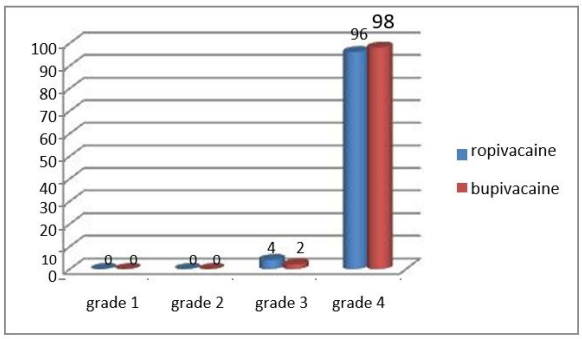
GRAPH 8: Duration of sensory block (regression to S1)

- Was assessed on a four point modified Belzarena scale [68]
- Unable to tolerate pain
- Able to tolerate discomfort with additional analgesia
- Some discomfort but no additional analgesics required
- Completely satisfied

Table 14: Quality of intra operative analgesia

Quality of analgesia	Group R	Group B
□ Grade 1	0	0
□ Grade 2	0	0
□ Grade 3	4(4%)	2(2%)
□ Grade 4	96(96%)	98(98%)

Four patients out of the 100 patients in the group R felt some discomfort during surgery. two patients were undergoing appendicectomy and the other two for hernia repair, They were sedated and no analgesics were supplemented. In group B Two patient out of the 100 felt some discomfort while undergoing appendicectomy. Surgery went on without any requirement of any additional analgesics. 96% of group R and 98% of group B patients were completely satisfied.



GRAPH 9: Quality of intra operative analgesia

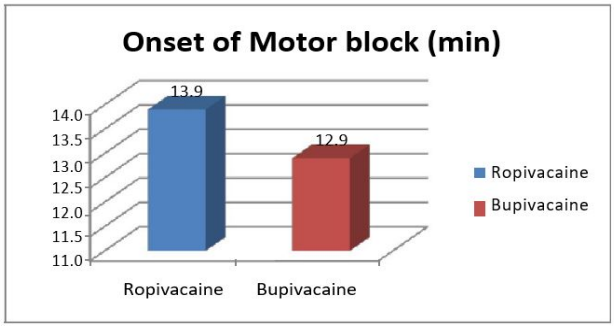
Table-15: Onset of motor blockade

	Group R	Group B	P Value
Onset of Motor block (min)	13.9±2.9	12.9±3.9	0.16 NS

Values are expressed as Mean + SD.

Students unpaired‗t' test

The mean time for onset of motor blockade (Bromage 3) was 13.9±2.9 minutes for group R and 12.9±3.9 minutes for group B with P value of 0.16 which was statistically and clinically not significant(table 15 ,graph 10)



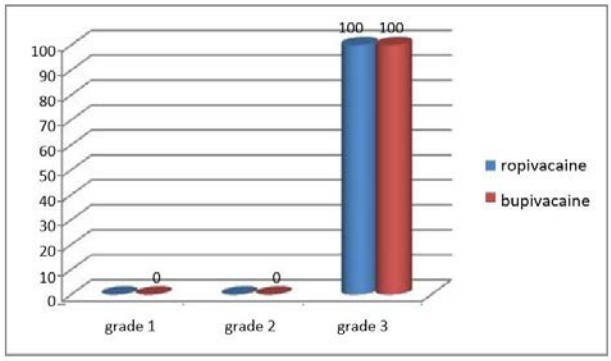
Graph 10: Onset of motor block

Degree of motor block[72]:

Grade	Criteria	Degree of block
0	Free movement of legs and feet	Nil (0%)
1	Just able to flex knees with free movement of feet	Partial (33%)
2	Unable to flex knees, but with free movement of Feet	Almost complete (66%)
3	Unable to move legs or feet	Complete (100%)

Degree of motor blockade	Group R	Group B
Grade 1	0	0
Grade 2	0	0
Grade 3	100(100.0%)	100(100.0%)

Table 16: Degree of motor block



Graph 11: Degree of motor block

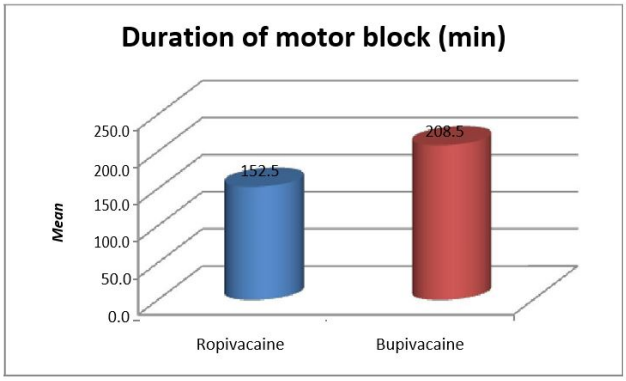
Table 17: Duration of motor block:

	Group R	Group B	P Value
Duration of Motor Block(Min)	152.5±13.1	208.5±12.5	<0.001 HS

Values are expressed as Mean ± SD.

Students unpaired "t" test

Duration of motor blockade (time to recovery of complete motor block-grade 0) ranged from 135 min to 165 min in group R whereas it ranged from 195 min to 215 min in group B. At 160th min none of the patients were recovered from motor block in group B while 80% of patients in group R recovered from motor blockade. Maximum duration of motor blockade noted in group B was 230 min in one patient, where as in group R it was 188 min in one patient. The mean duration of motor blockade was 152.5±13.1 min in group R compared to min in 208.5±12.5 group B. This was clinically and statistically highly significant.



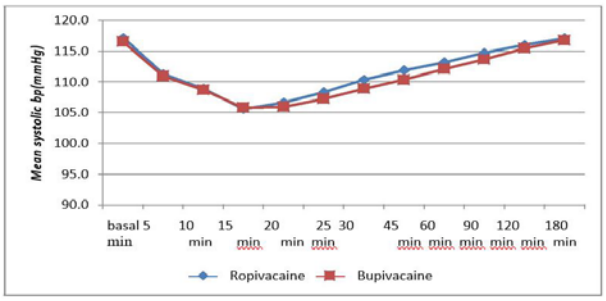
GRAPH 12: Duration of motor block

Comparison of hemodynamics between the two groups

systolic BP	group R		Group B		
(mm Hg)	Mean	SD	mean	SD	P* value
Basal	117.2	7.5	116.6	9.2	0.61 NS
5 min	111.3	7.2	111.0	9.4	0.47 NS
10 min	108.9	7.2	108.7	9.3	0.57 NS
15 min	105.6	7.0	105.8	9.3	0.62 NS
20 min	106.7	7.6	106.0	9.6	0.68 NS
25 min	108.4	7.9	107.3	9.0	0.76 NS
30 min	110.4	7.6	108.9	9.3	0.85 NS
45 min	111.9	7.2	110.4	9.3	1.00 NS
60 min	113.2	6.9	112.1	8.0	0.90 NS
90 min	114.7	6.8	113.7	8.0	0.69 NS
120 min	116.0	6.2	115.5	8.0	0.50 NS
180 min	117.1	6.4	116.8	8.4	0.25 NS

Table 18: Comparison of systolic blood pressure (mm Hg) between the 2 groups

Both groups recorded fall in systolic blood pressure after the institution of spinal anaesthesia. Maximum fall in systolic blood pressure among both groups was seen between 10 th and 25th minutes. The magnitude of fall in systolic blood pressures was similar in both groups and it was not clinically or statistically significant.



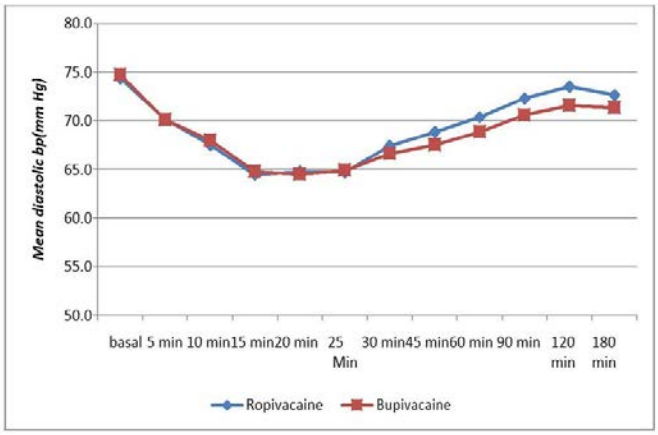
Graph 13: Comparison of systolic blood pressure (mm Hg) between the 2 groups

	Ropivacaine		Bupivacaine		
DBP(mm Hg)	Mean	SD	Mean	SD	P* Value
Basal	74.4	6.6	74.8	7.0	0.79 NS
5 min	70.2	5.6	70.1	5.9	0.99 NS
10 min	67.5	6.4	68.0	6.5	0.69 NS
15 min	64.5	7.2	64.8	7.0	0.80 NS
20 min	64.8	5.7	64.5	6.4	0.83 NS
25 min	64.7	6.1	65.0	6.3	0.85 NS
30 min	67.4	6.6	66.6	6.4	0.54 NS
45 min	68.9	6.6	67.6	6.5	0.32 NS
60 min	70.4	6.4	68.9	6.0	0.22 NS
90 min	72.4	6.9	70.6	6.1	0.18 NS
120 min	73.5	6.1	71.6	5.6	0.10 NS
180 min	72.7	6.2	71.4	5.8	0.29 NS

*Student's unpaired t test

TABLE 19: Comparison of diastolic blood pressures between the 2 groups

There was fall in diastolic blood pressure following spinal anaesthesia in both groups. The magnitude of fall was similar in both groups and it was not clinically or statistically significant.



Graph 14: Comparison of Diastolic blood pressures (mm Hg) between the 2 groups

	Ropivacaine		Bupivacaine		
Pulse Rate (Per min)	Mean	SD	Mean	SD	P* Value
basal	81.8	6.6	82.5	6.7	0.61 NS
5 min	77.9	7.1	78.9	6.9	0.47 NS
10 min	75.3	7.4	76.1	7.2	0.57 NS
15 min	73.3	6.8	74.0	6.8	0.62 NS
20 min	72.6	6.4	73.1	6.3	0.68 NS
25 min	73.1	5.6	73.5	5.3	0.76 NS
30 min	75.0	5.3	74.8	5.4	0.85 NS
45 min	76.6	5.3	76.6	5.4	1.00 NS
60 min	78.6	5.5	78.7	5.9	0.90 NS
90 min	79.9	5.7	80.4	6.2	0.69 NS
120 min	80.2	5.8	81.0	6.3	0.50 NS
180 min	80.7	6.5	82.2	6.5	0.25 NS
*Student's unpaired t Test					

Table 20: Comparison of Pulse rate (per min) between the 2 groups

There was no significant change in pulse rate following subarachnoid block in both groups. The pulse rates were comparable in both groups without any clinical or statistical significance.

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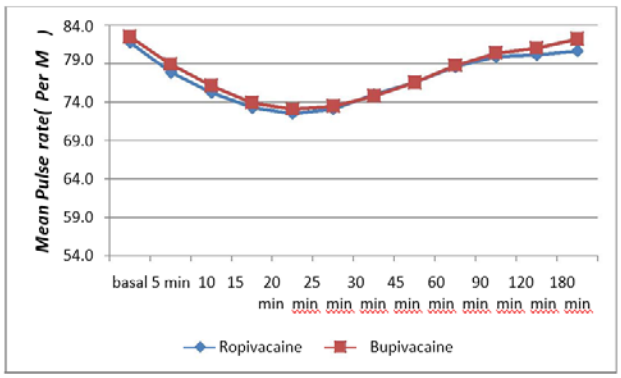


GRAPH 15: Comparison of pulse rate (per min) between the 2 groups

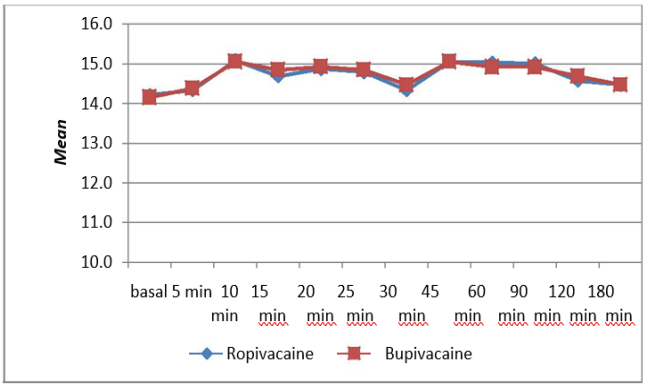
Comparison of Respiratory rate (per min) between the 2 groups

	Ropivacaine		Bupivacaine		
Respiratory Rate(per Min)	Mean	SD	Mean	SD	P* Value
basal	14.2	1.3	14.2	1.1	0.80 NS
5 min	14.3	1.1	14.4	1.2	0.86 NS
10 min	15.1	1.3	15.1	1.2	0.87 NS
15 min	14.7	1.2	14.9	1.1	0.49 NS

20 min	14.9	0.8	14.9	0.9	0.72 NS
25 min	14.8	0.8	14.9	0.8	0.71 NS
30 min	14.3	1.1	14.5	1.1	0.53 NS
45 min	15.1	1.0	15.1	1.0	1.00 NS
60 min	15.0	1.1	14.9	0.9	0.55 NS
90 min	15.0	0.8	14.9	0.8	0.55 NS
120 min	14.6	0.9	14.7	0.9	0.52 NS
180 min	14.5	0.9	14.5	1.0	1.00 NS
*Student's unpaired t test					

TABLE 21: Comparison of Respiratory rate (per min) between the 2groups

There was no significant change in respiratory rate following subarachnoid block in both groups. The respiratory rates were comparable in both groups without any clinical or statistical significance.



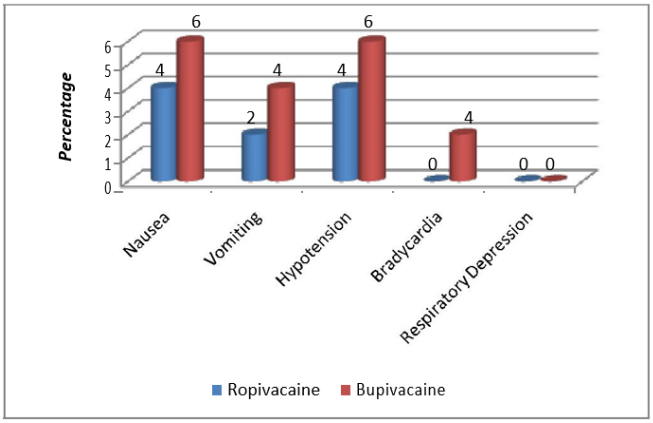
Graph 16: Comparison of respiratory rate (per min) between the 2 groups

Comparison of side effects between the 2 groups

Side effects	Group R	Group B
Nausea	4 (4%)	6(6%)
Vomiting	2(2%)	4(4%)
Hypotension	4(4%)	6(6%)
Bradycardia	0	4(4%)
Respiratory		
	0	0
Depression		

Table 22: Comparison of side effects between the 2 groups

Nausea was seen in four patients (4%) of the group R and six (6%) patients of the group B. Vomiting was seen in two patient (2%) of the Ropivacaine group and four patients (4%) of the Bupivacaine group. four patients in the Ropivacaine group had hypotension, whereas six patients of the Bupivacaine group had hypotension. Bradycardia was seen in four patients of the Bupivacaine group. No cases of allergy, respiratory depression were reported. There was no clinical or statistical significance in the incidence of side effects in both groups.



Graph 17: Comparison of side effects between the 2 groups

Discussion

Subarachnoid block is a commonly employed anaesthetic technique for performing surgeries of the lower abdomen and lower limb. It is a safe, inexpensive and easy-to-administer technique which also offers a high level of post–anaesthesia satisfaction for patients. The technique is simple, has rapid onset and is reliable. The risk of general anaesthesia, including mishaps due to airway management is avoided by this technique. Bupivacaine is the local anaesthetic used routinely for spinal anaesthesia because of its high potency and minimal neurological symptoms. Though cardiotoxicity is not a concern in subarachnoid block, the quality of sensory blockade, motor blockade, hemodynamic changes and side effect profile are some of the considerations in selecting a drug for spinal anaesthesia.

Ropivacaine, a S-enantiomer[11] of bupivacaine is being increasingly used for spinal anaesthesia in lower abdominal and lower limb surgeries. The advantages claimed are shorter duration of motor block[6] with similar sensory block properties compared to bupivacaine (Mc Donnald SB)[56].Thus it minimizes the psychological discomfort of being immobile for a long time and the patients can be ambulated early. Also its major advantage is lesser cardiotoxic property[5,7,11] compared to bupivacaine hence this study was conducted to assess the sensory and motor characteristics of ropivacaine for spinal anaesthesia in patients coming for surgeries of lower abdomen and lower limb.

The equipotent ratio between Ropivacaine and Bupivacaine is considered to be 3:2 or 2:1(Mc Donald et al, Gautier et al) [17]. Hyperbaric Bupivacaine 10 mg is the commonly used dose in our institution for such surgeries of lower abdomen and lower limb. Hence a equipotent dose of 15 mg (2ml of 0.75%) of Ropivacaine was used for the study. Since hyperbaric Ropivacaine is not available in the market we chose isobaric solutions of both Ropivacaine 0.75% (15 mg) and Bupivacaine 0.5% (10 mg) for this study.

A prospective randomized controlled study was done at Panjabrao memorial medical collage and hospital, Amravati (maharashtra) involving 200 ASA I and II patients who underwent lower abdominal and lower limb surgeries under subarachnoid block.

Group R (Ropivacaine group) received 0.75% isobaric Ropivacaine 15 mg (2 mL) intrathecally.

Group B (Bupivacaine group) received 0.5% isobaric Bupivacaine 10 mg (2mL) intrathecally.

The following parameters were observed:

1. **Sensory and motor blockade** - Onset, Highest level of sensory blockade, time to achieve peak sensory blockade and grade of motor blockade.
2. **Recovery parameters** - time for two segment regression and time for complete sensory and motor recovery.
3. **Analgesia** - Quality of analgesia
4. **Side effects / complications**

Demographic Profile across the Group

In our study, majority of patients were middle aged in both the groups. In group R there were 50 males and 50 females and in group B there were 52 males and 48 females. The mean height and the mean weight in either

group were also identical. The types of surgeries performed were also identical in both the groups. These parameters were kept identical in both the groups to avoid variations in intraoperative and postoperative outcome of patients.

Onset of Peak Sensory Block

Onset of sensory block at the highest dermatomal level using pin prick method was noted in both groups.The mean time for onset of peak sensory block in Group R was 8.28 ± 2.2 minutes and in Group B was 7.98±2.2 minutes, with p value 0.49, which was statistically not significant.

This observation was comparable to the study done by **Malinovsky et al**[13],who compared intrathecal isobaric Ropivacaine 15 mg and isobaric Bupivacaine 10 mg for transurethral resection of bladder or prostrate. It was found that the onset of sensory blockade was similar and was 13±8 min for Ropivacaine group compared to 11±7 min in the Bupivacaine group. This was statistically not significant.

In another study done by **Helena kallio et al**[12]**,** 90 patients undergoing ambulatory lower extremity surgery received either 2 ml of 0.75% ropivacaine, or 2 ml of 0.5% bupivacaine. It was found that median onset of sensory block was similar in both groups and was 10 minutes which is similar to the observation in our study.

HIGHEST LEVEL OF SENSORY BLOCK:

Malinovsky et al[13] in their study noted similar trend for maximum cephalad spread and variation of sensory block between the ropivacaine 15 mg group and bupivacaine 10 mg group for trans urethral resection of bladder or prostrate. In our study, highest level of sensory blo ckade achieved was similar in both groups. Highest level of block achieved in group R was T6 with 2 (4%) patients achieving it. Highest level of block achieved in group B was also T6 with 5 (10%) patients achieving it. 56% of patients of group R achieved a sensory block upto T10 whereas 50% of patients of group B achieved a maximum sensory block upto level of T10. These findings were clinically and statistically not signicant.

Time for Two Segment Regression

Gautier et al[14] in their study noted the time for two segment regression was similar between the two groups and was 89±33 minutes in the Ropivacaine group and was 98±30 minutes in the Bupivacaine group. This correlates with the finding in our study.

In our study, the time taken for two segment regression of sensory block was 95.98 ±8.2 min in the group R and 98.04±8.5 min in the group B. P value was 0.22 and statistically not significant. **Malinovsky et al**[13] in their study also noted similar duration for two segment regression between the two groups which correlates with our study.

Duration of Sensory Block (Regression To S1)

Gautier et al[14], found similar duration of sensory block between Bupivacaine 8mg and Ropivacaine 12 mg when used for ambulatory surgeries like knee arthroscopy.

Chan-Jong Chung [19] and others noted that time of regression of block to S1 was longer

(188.56±28.2min) in Bupivacaine group when compared to Ropivacaine group (162.56 ±20.2min). However, we observed that regression of block to S1 was comparable in both the groups in our study and concurs with observations of **Kim S. Khaw et al** [18] who also noted that regression to S1 was comparable when either intrathecal isobaric Bupivacaine or Ropivacaine was used for casaerean delivery.

Onset of Complete Motor Block

Malinovsky et al[13] found that onset of motor blockade was similar in the two groups receiving ropivacaine and bupivacaine intrathecally for transurethral resection of bladder or prostrate,.

Helena kallio et al[12] and **McNamee et al**[16] also found similar time to onset of complete motor block. This correlates with the results obtained in our study, where we

found similar time to onset of maximum motor blockade.

Degree of Motor Block

Chan Jong Chung and colleagues[19] observed complete motor block in all patients receiving either bupivacaine or ropivacaine for caesarean section. **N Boztug**[22] and others observed complete motor blockade in 88% of patients receiving ropivacaine and 100% patients receiving bupivacaine when administered for knee arthroscopy. All patients in our study receiving either ropivacaine or bupivacaine developed complete motor block and is in agreement with above mentioned studies

Duration of Motor Block

McNamee et al[16] noted that duration of motor block was significantly shorter in the ropivacaine group(2.1hr) as compared to the bupivacaine group(3.9 hr). **Helena kallio et al**[12] also noted the duration of motor block was significantly shorter with ropivacaine (150 min) as compared to bupivacaine (210 min).

Mantaouvalou et al[23] also noted that the duration of motor block was significantly shorter in the ropivacaine group when compared to the bupivacaine group. This correlates with the findings in our study where we found the time to recovery of complete motor block (grade 3 to grade 0) was 152.5±13.1 min in the ropivacaine group and 208.5±12.5 min in the bupivacaine group. This was statistically highly significant (p value < 0.001). Our findings are in affirmation with that of **Chan Jong Chung et al**[19] and

Kim S. Khaw et al[18]

Quality of Intra Operative Analgesia

Quality of intra operative analgesia was satisfactory in most of the patients in both groups and the anaesthesia was well accepted by most of the patients in both groups.

Hemodynamic Parameters

In our study hypotension occurred in 4% of the cases in the ropivacaine group and 6% of the cases in bupivacaine group and was easily managed by mephentermine boluses, bradycardia was seen in none of the cases in ropivacaine group and 4 of the cases in bupivacaine group. The hemodynamic parameters including pulse rate, systolic and diastolic blood pressures were comparable between both groups and no significant hemodynamic alteration was seen in the two groups. This correlates with the study done by **Ogun et al**[21] and **McNamee et al**[16]

Side Effects

Incidence of nausea and vomiting were comparable between both groups in our study. No other side effects were noted in the study.

Conclusion

Our study reveals that 15 mg of isobaric Ropivacaine (2 ml of 0.75%) when administered intrathecally provides adequate anaesthesia for lower abdomen and lower limb surgeries and is an alternative to Bupivacaine. Ropivacaine is similar to Bupivacaine in onset of sensory and motor block, quality of analgesia, degree of motor block and duration of sensory block.

But there is shorter duration of motor block with Ropivacaine compared to Bupivacaine. Hence Ropivacaine can be used successfully as an alternative to Bupivacaine for surgeries of lower abdomen and lower limb where early ambulation is appreciated.

List of Abbreviations Used

ASA	American Society of Anesthesiologists
α	Alpha
CSF	Cerebrospinal Fluid
C *T* *L* *S*	Cervical Thoracic Lumbar Sacral
EEG	Electroencephalogram
G	Gauge
Group B	Bupivacaine
Group R	Ropivacaine
h/ hr	Hour
mins	Minutes
secs	Seconds
PR *RR* *SpO2*	Pulse rate Respiratory rate Oxygen saturation
i . v *mg* *mL* *mm Hg*	Intra venous Milligram Milliliter Millimeter of mercury
MAP *SBP* *DBP*	Mean arterial pressure Systolic Blood Pressure Diastolic Blood pressure
pKa *VDSS*	Dissociation constant Volume of distribution at steady state
% *ED*	Percentage Effective dose
yr	Years
Kg *SD*	Kilogram Standard

Sl.No	Serial number
VS	Versus
P	Page number
OT	Operating theatre

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