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Comparative Evaluation of Hyperbaric Bupivacaine and Isobaric Ropivacaine for Regional Anaesthesia in Lower Abdominal and Lower Limb Surgeries

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Abstract
Background and aim*: Bupivacaine is established long-acting regional anesthetic but is associated with cardiotoxicity and neurotoxicity if given in high concentrations. Ropivacaine, it is less potent than bupivacaine but has a greater threshold for cardiovascular toxicity and neurotoxicity. The aim of the study was to evaluate and compare two local anesthetic drugs Bupivacaine and Ropivacaine intrathecally.*
Material and Methods*: This randomised, double-blinded controlled study was carried out on 40 patients, ASA grade I & II of age group between 20y & 65years, of either sex undergoing lower abdominal and lower limb surgeries under spinal anesthesia, after approval of the institutional research committee. Patients were allocated into two groups. Group A received intrathecal 0.5% 3 ml – 3.5 ml hyperabaric bupivacaine, and Group B received 0.75% 3ml 3.5ml isobaric ropivacaine. The duration and quality of sensory block, as well as motor block, duration of complete analgesia and adequate analgesia, hemodynamic changes, side effects of both the individual drugs, were observed and compared between the groups.*
Result*: The mean onset of sensory block in Bupivacaine Group A was 2.8± 0.95, and in Ropivacaine group B was 3.33 ± 2.76(P Value 0.26) The mean time to achieve the maximum level of sensory block in Bupivacaine Group A was 2.48 ± 57.08, and in Ropivacaine Group B was 3.49 ± 16.59 (P-value 0.016) P<0.05(significant). The maximum level of sensory block in Bupivacaine group A was 5.7+_1.34 and in Ropivacaine Group B was 6.85+_1.63 (P value 0.75) P > 0.05. Duration of sensory block in Bupivacaine group A was 151.75 ± 27.97 and in Ropivacaine group was 139.55 ± 28.44,(P value 0.17). Motor block onset in group A was 2.95min+-85.58 and in group B motor block onset was 5.59min+_50.46 P < 0.05 . The mean of duration of compete motor block in Bupivacaine group was 126.25min+-32.03 in bupivacaine group and 100.75min+-20.08 in ropivacaine group. P < 0.05 which was statistically significant.*
Conclusion*: Intrathecal Ropivacaine will be of particular benefit in patients who require early ambulation since the duration of motor block is significantly less than bupivacaine.*
Keywords*: Spinal Anesthesia; Sensory block; Motor block; Quality of Analgesia; Hemodynamic Parameters*.

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I. Introduction

Bupivacaine is established long-acting regional anesthetic and is widely used all over. But is associated with cardiotoxicity and neurotoxicity if given in high concentrations. Ropivacaine, it is less potent than bupivacaine but has a greater threshold for cardiovascular toxicity and neurotoxicity. So appears to be an essential option for regional anesthesia.[1]

Michela Camorcia and Giorgco Capogna Cristiana[2] studied about the relative potencies for motor block after intrathecal ropivacaine levobupivacaine and bupivacaine. It was concluded that potency for motor block is low for ropivacaine, intermediate for levobupivacaine, and high for bupivacaine.

GN Marc Malenovisky[3] conducted a randomized trial comparing ropivacaine and bupivacaine in endoscopic urological surgeries and concluded that both drugs have similar motor and hemodynamic effects, but ropivacaine is less potent than bupivacaine.

Hence the present study has been carried out with the aim to compare and evaluate 0.5% hyperbaric bupivacaine and 0.75% isobaric ropivacaine for regional anesthesia in lower abdominal and lower limb surgeries.

II. Aims And Objectives

To evaluate and compare the onset and duration of sensory and motor block using two different Local anaesthetic agents (0.5%) hyperbaric bupivacaine and 0.75% isobaric ropivacaine intrathecally.

The primary outcome was to evaluate and compare the time taken to achieve complete sensory and motor block and their maximum dermatomal level.

The secondary outcome was to evaluate and compare the quality of sensory and motor blockade with these two drugs, to evaluate and compare hemodynamic changes with 0.5% bupivacaine and 0.75% ropivacaine intrathecally and to observe any complications during the intraoperative and postoperative period with these agents.

III. Methods

A prospective randomized comparative double-blind study was carried out on forty adult patients admitted in a tertiary medical hospital for elective lower abdominal and lower limb surgeries under spinal anesthesia after approval of the Institutional Research Committee. Patients belonging to ASA I and II, 18 to 65 years of age, either sex, height between 140-160 cm, and weight 40-70 kg were included for study.

Patients with a history of headache, backache, local skin infection, any deformity of the spine, bleeding diathesis, Patient refusal and uncooperative patient were excluded from the study

All patients for elective surgery underwent pre-anesthetic checkup for fitness and were visited on the evening before the surgery. The patients were given tranquilizer 5 mg on the night before surgery and at 6 am on the morning of the day of the surgery.

The patients were randomly assigned to groups comprising of 20 each using computer-generated random number and opaque sealed envelope technique.

Group A	Intrathecal 2.5 – 3 ml of Hyperbaric 0.5% bupivacaine.
Group B	Intrathecal 2.5 – 3ml of Isobaric 0.75% Ropivacaine
Preloading	Patients were preloaded with 10 ml/kg body weight of lactated ringer solution.

On arrival of the patient for surgery pulse rate. Blood pressure, respiratory rate, and oxygen saturation were recorded. Preparation of drugs will be done by a person not involved in data collection.

Aseptic precautions were taken, and lumbar puncture was performed with 25 G Quincky needle L_3-L_4 or in some patients in L_2-L_3 intervertebral space in the right lateral position. Hyperbaric 0.5% bupivacaine or Isobaric 0.75% Ropivacaine was injected then skin puncture was sealed with tincture Benzion. A note was made regarding the time of injection, after which the patient was immediately placed in a supine position.

Loss of sensation was tested by the pinprick method using 23 G hypodermic needle and was recorded. Moreover, the onset, extent, and duration was also recorded. The degree of motor blockade of the lower limbs was recorded according to the modified Bromage scale (0 =no paralysis, 1= inability to raise the extended leg, 2= inability to flex the knee and 3 = inability to flex the ankle joint)

The onset of analgesia, level of analgesia achieved, the onset of muscle relaxation, level of muscle relaxation, duration of analgesia, and the duration of muscle relaxations were assessed and recorded. Assessment of pain was done according to visual analog scale by the linear analog method for assessing pain. Thus method includes the use of a 10 cm line of the patients' opinion on the severity of pain was represented ten was marked as the worst pain possible and o as no pain at all.

0-1-2-3-4-5-6-7-8-9-10

The scoring was done every 15min until the rescue analgesia was administered.

The duration of adequate analgesia (time taken from intrathecal injection to first dose of rescue analgesia was recorded). Time taken for maximum level of sensory block to two-segment regression was also recorded.

The quality of surgical analgesia was assessed by anesthesiologist, the surgeon and the patient him/ herself. It was graded as:-

Excellent	-	No supplementary drug required
Good	-	One bolus of rescue analgesic required
Poor	-	General anesthesia required

Muscle Relaxation was assessed by**:-**

Excellent	-	Complete relaxation
Good	-	Sight tightness
Poor	-	Difficult to perform surgery

Any side effects like nausea, vomiting etc.if present were noted. Time of administration of drugs i.e., rescue analgesia, anti-emetic, and vasopressor were also recorded

IV. Results

The patients were randomly assigned to groups comprising of 20 each.
Group A(bupi):- Intrathecal 2.5 – 3 ml of Hyperbaric 0.5% bupivacaine.
Group B (ropi):- Intrathecal 2.5 – 3ml of Isobaric 0.75% R

	Group A	Group B	P value
Age(yrs)	38.1± 13.84	40.4±14.97	0.91
Sex M:F	$9^{45\%}$:$11^{55\%}$	$5^{40\%}$:$12^{60\%}$	Value > 0.05
Weight	58.4±8.08	59.1±8.49	0.76
Height	161.75±9.13	163.5±8.16	0.51
Duration of Surgery	126±37.93	132±31.43	0.723

Table 1. Demographic Profile of the Patients

Both the groups were comparable statistically (Table 1)

Baseline Hemodynamic Values

Baseline Pulse Rate	**N**	**Mean**	**St. Deviation**	**Std. Error**	**P**
Group A(Bupi)	20	80.50	17.524	3.919	
Group B(Ropi)	20	82.50	10.460	2.339	**0.664**

Table 2. Baseline Pulse Rate

The mean baseline pulse rate observed before premedication in Group A (Bupi) was 80.50 ± 17.524 and Group B (Ropi) was 82.50 ± 10.460; the difference in value was statistically insignificant, and two groups were comparable. **(Table 2)**

	Group A	**Group B**	**P Value**
% change at 1min	3.16±9.65	1.82±10.03	0.74
at 2min	6.44±16.58	7.52±15.32	0.78
at 5min	0.24±9.03	0.42±13.21	0.55
at 10min	4.28±8.64	0.63±13.6	0.77
at 20min	4.65±8.14	85.12±13.0	0.48
at 25min	6.13±10.0	10.23±19.49	0.70
at 30min	8.93±11.32	10.8±19.00	0.73
at 45min	6.25±10.84	11.05±11.03	0.25
at 60min	6.75±10.87	11.08±10.55	0.73
at 75min	8.7±12.09	12.3±14.52	0.57
at 90min	7.38±1.46	12.06±9.87	0.85
at 105min	7.22±10.68	12.49±9.99	0.89
at 120min	9.35±12.69	13.57±14.67	0.97
at 135min	6.50±12.45	13.22±10.36	0.78

Table 3. Percent change of Pulse (P > 0.5)

Percent change at various periods in two Group of patients Group A (Bupi) and Group (B) (Ropi) was statistically insignificant, and both the groups were comparable.(Table 3)

DBP	**N**	**Mean**	**St. Deviation**	**Std. Error**	**P Value**
Group A(Bupi)	20	93.45	7.577	1.694	
Group B(Ropi)	20	93.43	9.411	2.104	**0.250**

Table 4. Baseline Mean Arterial Pressure (P>0.05)

The mean and standard deviation Baseline MAP (Mean Arterial Pressure) in Group A (Bupi) was 93.45 ± 75.77, and in Group B(Ropi) was 93.43± 9.411 'P' value > 0.05 which means the observed difference in values were statistically insignificant, and two groups were comparable.(Table 4)

	Group A	**Group B**	**P-Value**
% change MAP at 1min	6.48±34.88	0.407±12.86	.41
at 2min	1.86±21.15	3.03±13.47	0.83
at 5min	7.31±15.86	5.13±12.47	0.63
at 10min	9.60±15.19	12.38±2.75	0.57
at 20min	8.89±14.38	5.02±18.75	0.32
at 25min	7.38±1.40	5.42±12.81	0.46
at 30min	8.05±13.63	5.09±10.30	0.64
at 45min	7.26±9.42	6.24±11.36	0.44
at 60min	9.62±12.17	6.29±9.71	0.75

at 75min	6.85±11.16	7.15±9.65	0.34
at 90 min	7.95±11.68	8.18±9.52	0.92
at105 min	7.52±11.36	8.24±9.60	0.94
at120 min	8.39±11.48	6.±9.82	0.82
at 35 min	8.19±10.78	6.63±9.43	0.62

Table 4. Percent change of MAP.

Percent change at various periods in Group A (Bupi) and Group (B) (Ropi) was statistically insignificant.(Table 4)

Group	**Time(m)**					**P**
	0-3	**4-7**	**8-10**	**Mean**	**St. Deviation**	
Group A(Bupi)	$16^{80\%}$	$4^{20\%}$	0%	2.8000	.95145	**0.250**
Group B(Ropi)	$14^{70\%}$	$5^{25\%}$	$1^{5\%}$	3.5383	2.76560	

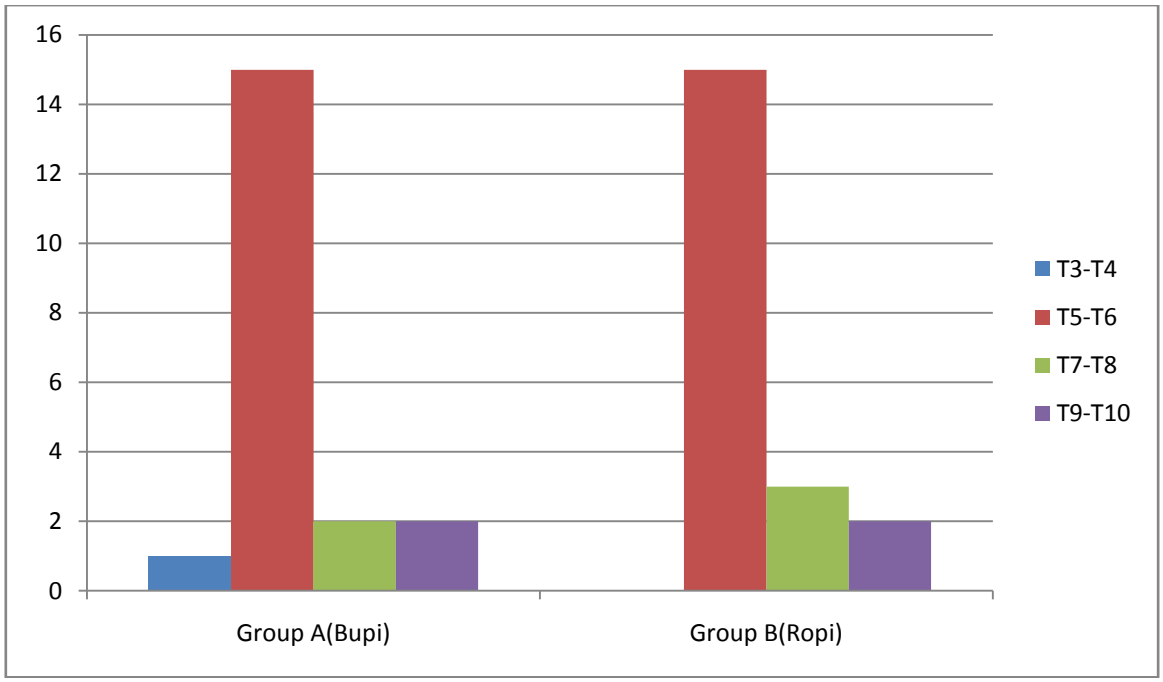
Table 5. Sensory Block Onset time (P>0.05)

Maximum number of patients in group A (Bupi) 16 (80%) and in group B (Ropi) 14(70%) had sensory Block onset in 0-3 min. All patients except one in Group B (Ropi) had onset of sensory block in 8-10min. These results were statistically insignificant and both the groups were comparable. (Table 5)

Group	**Time(Men)**					**P Value**
	0-5	**6-10**	**11-15**	**Mean**	**St. Deviation**	
Group A(Bupi)	$13^{65\%}$	$7^{35\%}$	0%	168	57.087	**0.016**
Group B(Ropi)	$7^{35\%}$	$10^{50\%}$	$3^{15\%}$	212	165.936	

Table 6.Time Taken to Achieve Maximum Sensory Block Level

P Value < 0.05 (Significant)
Maximum number of patients 13(65%) in group A (Bupi) achieved maximum level of block in 0-5min. Where as in group B (Ropi) 85% patients had achieved block in 6-10min. as compared to 100% in Group A (Bupi).Time taken to achieve sensory block between the two groups was statistically significant. (Table 6)



(Figure 1) Maximum level of Sensory Block

Maximum level of sensory block achieved by $1^{5\%}$patient in Group A (Bupi) was T4 and none in Group B(Ropi). Whereas in both Group A (Bupi) and Group B (Ropi) 75%(15) patients have achieved sensory block up to T6 level which was insignificant statistically and comparable in the two groups.(Figure 1)

Group	75-104	105-134	135-164	165-194	235-264	295-335	Mean+SD
Group A (Bupi)	$2^{10\%}$	$3^{15\%}$	$8^{40\%}$	$7^{35\%}$	0	0	113.50+_16.30
Group B (Ropi)	$4^{20\%}$	$6^{30\%}$	$8^{40\%}$	$2^{10\%}$	0	0	112.25+_22.15

Table 7.Two Segement regression of Sensory Block (P > 0.05)

Two segment regression in group A(Bupi) was 113.50+_16.30 and in group B (Ropi) was 112.25+_22.15.Which was statistically insignificant, and two groups were comparable. (Table 7)

GROUP	90-139	140-189	190-239	240-289	Mean+st deviation	P-value P-value
Group A(Bupi)	$7^{35\%}$	$12^{60\%}$	$1^{5\%}$	$0^{0\%}$	146.40+-27.36	
Group B(Ropi)	$9^{45\%}$	$11^{55\%}$	$0^{0\%}$	$0^{0\%}$	134.90+_28.49	

Table 8. Sensory Regression to L1 (P >0.05)

Mean duration of sensory regression to L1 was 143.40+656 in Group B (Bupi) and in groupB (Ropi) was 139.55+38.448.P> 0.05.observed differences were statistically insignificant and two groups were statistically comparable.(Table 8)

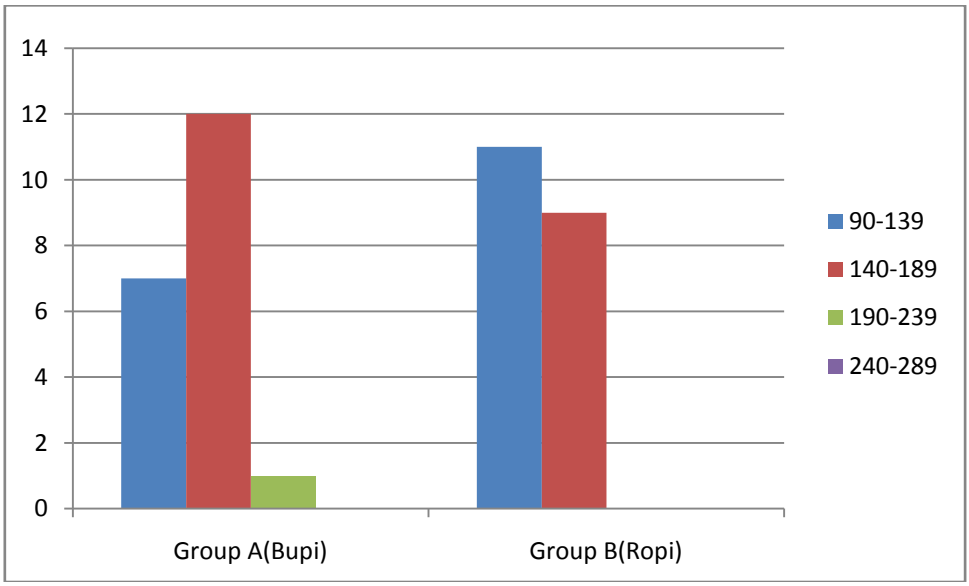


Figure 2. Duration of Sensory Block (P > 0.05)

Mean duration of sensory block in group A(bupi) was 151.75+-27.97 and group B (Ropi) was 139+-28.44.which was statistically insignificant and both the groups were comparable.(Figure 2)

Groups		Mean	Std. Deviation	P-value
No Pain (0)	Group A	10.20	8.082	0.056
	Group B	5.80	5.890	
Mild (1-3	Group A	1.95	2.762	0.044
	Group B	4.55	4.850	
Moderate	Group A	2.30	2.342	0.389
	Group B	3.30	4.566	
Severe	Group A	5.55	7.877	0.742
	Group B	6.40	8.319	

Table 9. Mean VAS Score Intraoperatively

All pts in Group A (bupi) had pain relief VAS score(0) upto as compared to 95% in group B.(ropi). Mean VAS score remained <1 at 75min in Group A (Bupi) as compared to (1-3) in Group B(Ropi). The mean VAS score reached (moderate-severe) when rescue analgesia was administered.10%(2) pts received rescue

analgesia in GroupA (Bupi) and 3(15%) patients in GroupB (Ropi) received rescue analgesia at 90mi, which was statistically insignificant and two groups were comparable.(Table 9)

Group	45-74	75-104	105-134	135-164	165-194	195-224	225-254	Mean st.deviation
Group A (Bupi)	0	4	4	6	6	0	0	
Group B (Ropi)	0	6	3	10	1	0	0	145.45+_30.84 127.20+-27.64

Table 10. Administration of Analgesia (P>0.05)

There was no significant difference between the two groups in the time of administration of analgesia. (Table 10)

Group	0-4	5-9	9-13	Mean	Std Deviation	P. Value
Group A(Bupi)	$16^{80\%}$	$4^{20\%}$	$0^{0\%}$	162.75	85.586	
Group B(Ropi)	$14^{70\%}$	$5^{25\%}$	$1^{5\%}$	359.40	50.46	0.049

Table 11. Motor Block Onset, P<0.05 (Significant)

The onset of motor block in 80% of patients was within 4 min in Group A (bupi) as compared to 70% of patients in Group B (Ropi), which was statistically significant and two groups were comparable.(Table 11)

Groups	0	1	2	3	Mean ± Std. Deviation
Group A(Bupi)	0	0	0	20	3.00±0.00
Group B(Ropi)	0	0	0	20	3.00±0.00

Table – 12 Grade of Motor Block (Bromage Scale) at the time of complete analgesia

Grade of the motor block according to Bromage Scale in both Groups was 3 hence results were comparable and insignificant statically.(P-Value > 0.05) (Table 12)

Groups	60-89	90-110	111-131	132-151	152-183	184-214	Mean±SD	P Value
Group A(Bupi)	$1^{5\%}$	$7^{35\%}$	$4^{20\%}$	$5^{25\%}$	$3^{15\%}$	$0^{0\%}$	126.25± 32.03	0.005
Group B(Ropi)	$8^{40\%}$	$11^{55\%}$	$1^{5\%}$	$1^{5\%}$	$0^{0\%}$	$0^{0\%}$	100.75± 20.08	

Table 13 Duration of Complete Motor Block

P<0.05 Significant

Duration of complete motor block in 15% of patients was up to 183 min in Group A(bupi), where as 5% of patients in Group B (Ropi) had complete motor block for 151min. P-Value is <0.05, which is statistically significant.(Table 13)

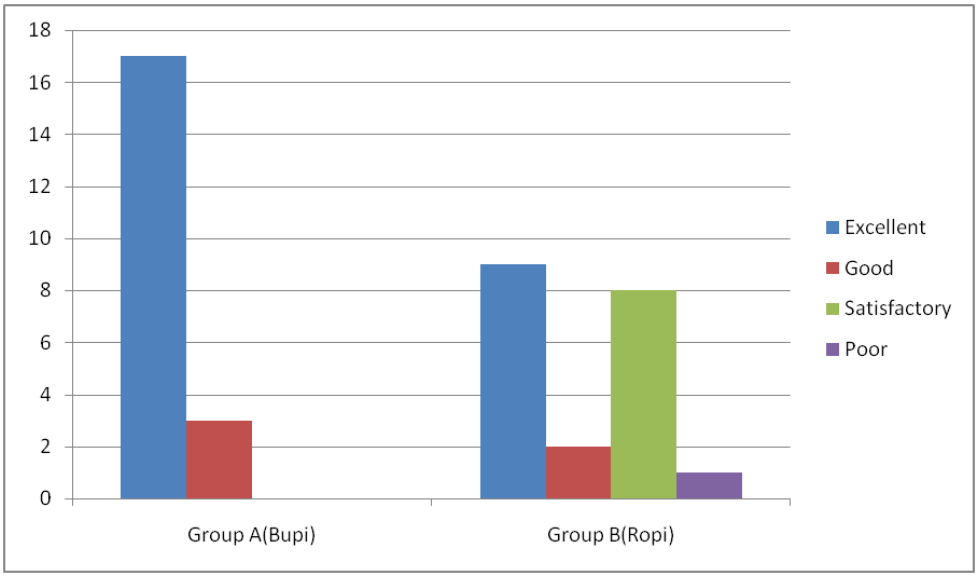


Figure 3. Quality of Anesthesia P> 0.05(Insignificant)

Maximum no of pts 17(85%) in groupA(BupI) had an excellent quality of anesthesia whereas in group B(Ropi) only 9(45%)pts had an excellent quality of anesthesia, but in both groups, no patient had poor quality of anesthesia.which was statistically insignificant, and two groups were comparable (Figure 3)

Groups	0	Mild	Moderate	Severe
Group A(Bupi)	$19^{95\%}$	$1^{5\%}$	0	0
Group B(Ropi)	$18^{90\%}$	$2^{10\%}$	0	0

Table 14.Side Effects Shivering (P-Value > 0.05)

In Group A (Bupi)19(95%) had not experienced shivering whereas in Group B(Ropi) 2(10%) Patients had experienced shivering. the difference observed in the two groups was statistically insignificant, and two groups were comparable. (Table 14)

The requirement of Antiemetic was10% patients of Group B as compared to 0% patients of Group B, which was statistically insignificant, and two groups were comparable. (Table15)

Groups	Required Antiemetic	Not Required
Group A(Bupi)	0%	$20^{100\%}$
Group B(Ropi)	$2^{10\%}$	$18^{90\%}$

Table 15. Requirement of antiemetic P > 0.05 (Insignificant)

V. Discussion

The present study was undertaken in 40 pts of age group between 18-60 years of both sexes belonging in ASA I and II undergoing lower abdominal and lower limb surgery. Spinal anesthesia is currently more popular than before, with advantages of ease of administration, rapid onset, and high reliability. The anesthetized area can be limited to the surgical site, the common side effects of GA are reduced, and the risk of GA are minimised, and improved postoperative analgesia.[4]

Bupivacaine long duration of action and high potency. Many studies indicate that bupivacaine 0.5% alone causes TNS, but less than lignocaine.[5]Ropivacaine been found to be less potent than spinal bupivacaine but has significantly less risk of TNS and cardiovascular side effects than bupivacaine. The present study had been carried out with the aim to evaluate the quality of anaesthesia during the intraoperative period, hemodynamic changes & postoperative analgesia, between 0.5% hyperbaric Bupivacaine and 0.75% isobaric ropivacaine.

DA Mc Namee et al[6] randomized 68 pts to receive an intrathecal injection of either Ropivacaine, Group R (n=34), or hyperbaric bupivacaine, Group B (n=34). Both groups received 3.5 ml of either drug. The onset, duration of sensory block at dermatomal level T_{10}, maximum upper and lower spread of sensory block intensity, and duration of motor block were recorded. It was observed that the onset of sensory & motor block was rapid, with no significant differences between the two groups. The median time of onset of sensory block at T_{10} dermatome was 2 min (range 2-5min) in group R and 2 min (range 2-9min) in group B. The duration was 3 hrs (1.5 – 4.6 hrs) in group R & 3.5 hrs (2.5– 5.2h) in group B. The median motor block was significantly shorter in the ropivacaine group as compared to the bupivacaine group.

In another study by Rajni Gupta,Jaishri Bogra et al.,[7] 52 women were randomly allocated into two groups to administer either 10mg of 0.5% plain bupivacaine (group B) or 15mg of 0.75% plain ropivacaine (group R) with 25 micro gm fentanyl & 100 micro g morphine for spinal anaesthesia. It was observed that sensory block at T6 was significantly faster in group B than in group R(8.1±4.1vs 11.6±5.6). Sensory regression to L1 dermatome was significantly short in group B (118.2±24.2 & 145.5±28.1) .as in group R(135±32.1m & 162.5±32.5m) motor block duration was longer in group B than in group R(165.8±32.5m vs. 135±45.7m). Hence it was concluded that intrathecal plain ropivacaine with opioids might be superior to bupivacaine in terms of a more extended sensory block and shorter in terms of motor block duration for Cesarian Section.

The groups were statistically comparable concerning demographic data-age, sex, and type of surgeries. There had been no significant change in pulse rate from baseline values in group A 80.50±17.524, and group B 82.50±10.460 P>0.05 and two groups were comparable. The mean percent change in pulse rate in the bupivacaine group was 6.50±12.45 and 3.22±10.38 in the ropivacaine group; values were statistically insignificant P > 0.05 groups were comparable.

Kotka K Uludag et al[8] used intrathecal bupivacaine and intrathecal ropivacaine, in their study, they reported no significant change in heart rate, no significant fall in pulse rate, in both the ropivacaine and bupivacaine groups. Hence our results are comparable with their study. Hannu Kokki et al.[9] reported bradycardia and hypotension in one patient in their study. However, they had given spinal anesthesia in children who may warrant further studies.

Baseline MAP in bupivacaine group A was 93.45±7.57, and in ropivacaine group, B was 93.43±9.41 p>0.05, which was statistically insignificant, and both the groups were comparable. The mean percent change of MAP in bupivacaine group A was 8.1977± 10.78, and in ropivacaine group, B was 6.63 ± 9.43, which was statistically insignificant P>0.05 and two groups were comparable. Jean-Marc Malinovsky[10] reported no change in SBP, DBP, and MAP. In our study, hydration was maintained by IV fluids, which was effective in both the study groups, no reports of fall in BP. No vasopressor was required in both the groups.

We found that 80% pts in bupivacaine group A and 70% of patients of group B had onset of the sensory block within 3min. Except for one patient in group, B had onset of the sensory block within 8min.The mean onset of sensory block, in bupivacaine group A, was 2.30 min ±. 951 and in ropivacaine group B 3.33min ±2.765 (P-value 0.26,) P > 0.05, which was statistically insignificant, and two groups were comparable. Jean-Marc Malinovsky D et al[10] and Mc Namee et al.[6] in their study had not observed a significant difference in the onset of sensory block in between the two groups. Hence our study is comparable with there study. Nevel Boztug et al. [11] reported sensory block onset of 20 mg isobaric ropivacaine was shorter than isobaric 10mg Bupivacaine, however, in their study, they have used isobaric bupivacaine, whereas in our study we have used hyperbaric bupivacaine.

In our study, time taken to achieve the maximum level of sensory block in bupivacaine group A was 2.48 min ± 57.087, and Ropivacaine group B was 3.49 min ± 165.9,(P-value 0.016) P < 0.05, which was statistically significant. These results are comparable with the results of DA Mc Namee et al.[6] Nevel Boztug [12] M. Mantouvalous et al[13] In their study, reported that time taken to achieve the maximum level of the block was rapid with bupivacaine group as compared to ropivacaine group. Helena Kallis Ejaz, Veli et al. [13](2004) in their study reported, there was no significant difference in time taken to achieve the maximum level of block. However, they used different concentration, 2ml of 1% & 0.75% ropivacaine & bupivacaine 0.5% in lower extremity ambulatory surgery.

In our study, 75% of the patients in both the study groups achieved a maximum level of block up to the T_6 level, whereas in group A, one patient had achieved block up to the T_4 level. The mean level of maximum sensory block achieved in group A was 6.7 ±1.34, and in the ropivacaine group, B was 6.85 ±1.63 (p-value 0.75) P > 0.05, which was statistically insignificant, and both groups were comparable. DA Mc Namee[6] Peter Marhof[14]. In their study, they reported that the maximum level of block achieved by the two groups was the same, which was statistically insignificant; hence our study is comparable with their study.

Mantouvalou M, Ralli S et al. .[15] in their study reported the maximum extent of the block was up to T_8 in plain ropivacaine and hyperbaric ropivacaine up to T_4, which was statistically significant P < 0.05 however, they had used plain solution or with glucose 50mg/ml.

The level of sensory block was assessed by the pinprick method during the intraoperative period every 15min, and post-operative period till the level of block regressed to L_1 level. Two segment regression group A was 113.50 min±16.31, and in the group, B was 112.25 min ± 22.15, P > 0.05, which was statistically insignificant, and the two groups were comparable. Hellina Kallio [13](2004), in their study, reported that there was no significant difference between the two-segment regression in the bupivacaine group and the ropivacaine group. Hence our study is comparable with their study. W. Van Kleef[16] reported that two-segment regression in their study groups was significant P < 0.05, however they have used 0.5% ropivacaine in there study. Whereas we have used 0.75% ropivacaine in our study.

Sensory regression to L1 in bupivacaine was 146.40 min ± 27.36 and in the ropivacaine group was 134.90 min ± 28.49(P-value 0.20) P < 0.05, Which was statistically insignificant and both the groups were comparable. M. Mantouvalou[12]. McNamee et al. .[6] Gautier et at [17] in their study reported that there was no significant difference between the sensory regression of two groups. Hence our study is comparable with their study. Luck JF et al[17] 2008, Jack W Vankleef et al., [16] Hannu Kokki et al[9], Peter Marhof et al[14], S. Sanli A et al. [19], Helena Kallio et al[13] reported that the sensory regression is faster in ropivacaine group as compared to bupivacaine group. However, they have used plain ropivacaine 5mg/ml and 5mg/ml bupivacaine in their study.

In our study mean duration of complete analgesia in the bupivacaine group was 151.75 min ± 75 and in the ropivacaine group was 139.55 min ± 28.44 (p-values 0.17) which was statistically insignificant and two groups were comparable. Helena Kallio[13], Arici G [20] reported that in their study, there was no significant difference in between the duration of complete sensory block. Nevel Boztug[11], in their study they had reported that duration of sensory block was significant in between the two groups; however, in their study, they had used 15mg isobaric ropivacaine or 7.5 mg of isobaric bupivacaine.

The duration of analgesia in our study was considered as time from onset of the sensory blockade to the onset of pain of moderate degree and the requirement for rescue analgesia, In our study mean VAS score in Bupivacaine group remained zero in 100% pts in Bupivacaine group as compared to 95% pts in Ropivacaine group at 75min. When VAS reached moderate (4 – 6), rescue analgesia was given. In our study at 90 min, 10% of patients in the Bupivacaine group and 15% of patients in the ropivacaine group received rescue analgesia. Mean VAS score reached (4-6) in 85% patients at 180min. in the bupivacaine group as compared to 150 min.

in the ropivacaine group (rescue analgesia administered). The requirement of rescue analgesia in the bupivacaine group was at 145.45 min±30.84 as compared to 127.20min±27.64 in the ropivacaine group (P-value 0.056) P > 0.05, which was statistically insignificant, and two groups were comparable.

Our results are comparable to those of Koltka et al[21,] and D A Mc Namee et al[22] also reported that the requirement of rescue analgesia was the same in the bupivacaine & ropivacaine group. Jean-Marc Malinovsky[10] also reported that the requirement of rescue analgesia was almost the same in both the group.

Our results are in contrast to that of Gautier P et al. [23,] who reported that the requirement of rescue analgesia was more in the ropivacaine group because of inadequate intraoperative analgesia as compared to bupivacaine (P < 0.05.) However, they have used 10 mg ropivacaine as compared to 8 mg bupivacaine.

In our study, the onset of motor block in 80% of pts in bupivacaine group A was within 4min, whereas in ropivacaine group B 70% pts had onset of the motor block within 7min. The mean onset time of motor block in the bupivacaine group was 2.95min ±85.58 min, whereas, in Ropivacaine group B, it was 5.59±50.46min (P-value 0.04) P > 0.05, which was statistically significant. DA Mc Namee[6] DA M. Mantouvalous[12], S. Sanli A Yegin[19] and Nevel Boztug[11] in their study reported that onset of motor block was shorter in bupivacaine as compared to ropivacaine group .hence our study is comparable with their study, Helena Kalio[13] and Gautier et al[17] in their study they reported that onset of motor block in both the groups was statistically insignificant. However, in their study, they have used 8mg of ropivacaine and 8mg of bupivacaine.

Grade of motor blockade, according to Bromage Scale in both the groups, was 3, which was statistically insignificant, and two groups were comparable.

The mean duration of motor block in bupivacaine group A was 126.25±32.03 and in ropivacaine group B was100.75+20.08 P < 0.05, which was statistically significant. DA Mc Nameeet al.[6], Helena Kallio et al. .[13] and Ozgurel et al. .[24]In their study, and they reported that the duration of motor block was less in ropivacaine as compared to bupivacaine. Hence, our study is comparable to their study. Jean Merc Malinovsky et al. .[10] and Hanna Kokki[9] in their study had used 10 mg isobaric bupivacaine (0.2%) and 15 mg of ropivacaine 0.5% in which they found that duration of motor block was not different in between the two groups.

In our study, 85% of patients had an excellent quality of anesthesia, whereas, in the ropivacaine group, only 75% of patients had an excellent quality of anesthesia. However, no patient had poor quality of anesthesia in both the groups.which was statistically insignificant and both the groups were comparable.Ph.E Gautier et al[17] and Anjali Mehta et al[25], in their study reported no difference in between the quality of anesthesia in between the two study groups bupivacaine and the ropivacaine group. Hence there study is comparable with their study. In contrast to the study of Cemile Oztin et al[26], in which they reported that the quality of anesthesia could be improved by adding adjuvants. However, they have used isobaric ropivacaine in comparison to isobaric ropivacaine- clonidine for Caesarean delivery.

In our study, 95% of pts in the bupivacaine group had not experienced shivering whereas, in the ropivacaine group, 90% had not experienced shivering P > 0.05, .which was statistically insignificant and two groups were comparable.

100% pts in the bupivacaine group had not used antiemetic, whereas in ropivacaine, 10% of patients had used antiemetic p > 0.05, which was statistically insignificant, and two groups were comparable. Cemile Oztin et al[26] and Mc Namee et al[6] reported no significant difference in the requirement of an antiemetic in between the two study groups.

Thus both ropivacaine and bupivacaine have similar onset times ropivacaine takes significantly more time for the block to reach its maximal level as compared to bupivacaine. Levels of sensory block achieved are similar to the two agents. The mean duration of complete analgesia, adequate analgesia, and the need for rescue analgesia is similar to the two agents. Intrathecal Ropivacaine has significantly delayed the onset of motor blockage and lesser duration as compared to Bupivacaine. The quality of sensory and motor blockade was similar in both groups. Both Ropivacaine and Bupivacaine produce negligible hemodynamic changes and negligible side effects such as nausea, vomiting, and shivering.

VI. Conclusion

Intrathecal isobaric Ropivacaine provides efficient and safe anesthesia and analgesia as that of Hyperbaric Bupivacaine. However, intrathecal Ropivacaine will be of particular benefit in patients who require early ambulation since the duration of motor block is significantly less than Bupivacaine.

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