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HYPERBARIC BUPIVACAINE, LEVOBUPIVACAINE AND ROPIVACAINE INTRATHECALLY FOR HEMODYNAMIC STABILITY AND POST- OPERATIVE ANALGESIA IN INFRA UMBILICAL SURGERIES - RANDOMIZED CONTROL TRIAL

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Abstract

Background: Spinal anaesthesia decreases intra-operative pain, autonomic, somaticand endocrine responses. It also provides a quick onset and effective sensory & motor blockade.

Methods: This study was conducted in the Department of Anaesthesiology, Rohilkhand medical college and hospital with the objective to compare Hyperbaric Bupivacaine, Levobupivacaine and Ropivacaine intrathecally for hemodynamic stabilityand post-operative analgesia in Infra umbilical surgeries.

Results: Both hyperbaric levobupivacaine and hyperbaric ropivacaine have better hemodynamic stability in comparison to hyperbaric-bupivacaine, whereas hyperbaric-ropivacaine shows better result among all three groups. The mean onset time of sensory-blockade was shorter in hyperbaric bupivacaine group than hyperbaric-levobupivacaine group and delayed in hyperbaric-ropivacaine group. The peak height was more in hyperbaric bupivacaine group than hyperbaric-levobupivacaine than hyperbaric ropivacaine group. The maximum duration of sensory-blockade was found more in hyperbaric bupivacaine group than hyperbaric-levobupivacaine Group and shortest in hyperbaric-ropivacaine group.

Conclusion: Both hyperbaric-levobupivacaine and hyperbaric-ropivacaine have better hemodynamic stability, equally effective, lesser duration of sensory & motor-block in comparison to hyperbaric bupivacaine.

Keywords: Hyperbaric Bupivacaine, Levobupivacaine and Ropivacaine intrathecally, hemodynamic stability, post- operative analgesia, Infra umbilical surgeries.

INTRODUCTION

Worldwide, spinal anaesthesia is widely accepted and frequently utilized. Because it is affordable and simple to administer, lower-limb operations frequently employ this technique. This is the preferred technique for many surgical operations due to the benefits of low medication expenses, awake patients, and quick patient recovery.[1]

The subarachnoid block method involves the use of different local anaesthetic drugs either alone or in conjunction with adjuvants such opioids and NMDA receptor antagonists to provide prolonged post-operative pain management during surgery whilemaintaining surgical anaesthesia. It attenuates the somatic, autonomic reactions.

It starts quickly and effectively blocks both motor function and sensory perception. August Bier administered spinal anaesthesia for the first time in 1898, and it has since become a common procedure.[2]

Bupivacaine, the widely used local anaesthetic in regional anesthesia is a racemic mixtureof its two enantiomers, levobupivacaine, S (−) isomer and dextrobupivacaine, R (+) isomer. Severe central nervous system (CNS) and cardiovascular adverse reactions reported after inadvertent intravascular injection.[3]

The quest for searching newer and safer anaesthetic agents has always been one of the primary needs in anaesthesiology practice. Levobupivacaine is a local anaesthetic amino-amide drug belonging to the family of pipecoloxylidide group. It is a pure S (−) enantiomer of bupivacaine, has strongly emerged as a safer alternative for regional anaesthesia than its racemic sibling, bupivacaine. Levobupivacaine has been found to beequally efficacious as bupivacaine, but with a superior pharmacokinetic profile. Levobupivacaine exerts its pharmacological action through reversible blockade of neuronal sodium channels. Myelinated nerves are blocked through exposure at the nodesof Ranvier more readily than unmyelinated nerves; and small nerves are blocked more easily than larger ones. Specifically, the drug binds to the intracellular portion of sodiumchannels and blocks sodium influx into nerve cells, which prevents depolarization. It blocks nerve conduction in sensory & motor nerves mainly by interacting with voltage sensitive sodium channels on the cell membrane. Levobupivacaine is an interesting alternative to bupivacaine for spinal anaesthesia. It produces subarachnoid block with similar sensory & motor characteristics and recovery like bupivacaine and less toxicity is attributed to its faster protein binding rate.[3]

Whereas Ropivacaine is a long-acting regional anaesthetic that is structurally related to

Bupivacaine. It is a long-acting local anaesthetic amide and first produced as a pure s (-) enantiomer. It produces effects similar to other local anaesthetics via reversible inhibitionof sodium ion influx in nerve fibres. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor-blockade. The reduced lipophilicity is also associated with decreased potential forcentral nervous system toxicity and cardiotoxicity.[4]

Hence the present study is planned to conduct the study of newer drugs with older drug i.e. hyperbaric bupivacaine with hyperbaric levobupivacaine and hyperbaric ropivacaine intrathecally for hemodynamic stability and post-operative analgesia in infra umbilical surgeries.

MATERIALS AND METHODS

This was a prospective, randomized, controlled study carried out in patients scheduled for infra umbilical surgery under spinal anaesthesia in Department of Anaesthesiology, Rohilkhand Medical College and Hospital, Bareilly. Following approval by the Board ofInstitutional Ethics committee, a total of 129 patients were randomly divided in three groups in 1:1:1 allocation ratio, each comprising 43 patient. Approval and consent of patient for participation in study was taken. The study was registered in CTRI with no. **CTRI/2023/09/057381.** Duration of study was 1 November 2022 to 31 October 2023.

Inclusion criteria:

- American society of Anaesthesiologist (ASA) grade I and II.
- Age between 18-60 yrs.
- Patient undergoing infra umbilical surgery (lower abdomen & lower limbsurgery).

Exclusion criteria:

- Any known allergy to Local anaesthetic.
- Deranged coagulation profile.
- Raised ICP.
- Local infection at site of needle insertion.
- Neurological weakness in lower limb.

Methodology

The proposed study was carried out in Rohilkhand Medical College & Hospital, BareillyUP after obtaining the approval from Institutional ethics committee.**IEC/RMCH/64/2022/AUG**

Thorough pre-anaesthetic check-up was done one day prior to surgery and informed written

consent for participation in study was taken from each patient. Ranitidine 150 mgand Alprazolam 0.25mg shall be given orally in tablet form night before surgery.

On day of surgery, after entering in operating room an 18-gauge IV cannula was placedin the non-dominant hand of pateint, and 15 mL/kg of Ringer's lactate solution was given according to Holliday-Segar formula. Standard monitoring was done throughout the procedure, including non-invasive arterial blood pressure (NIBP), heart rate (HR), & pulse-oximetry (SPO2) and 12 lead ECG. Three groups were created randomly from thepatients: Groups A, B, and C. Under all aseptic precaution, spinal anaesthesia was given with 25 gauge quinkes needle in L3-L4 or L4-L5 intervertebral disc space to patient in sitting position through midline approach, a clear free flow of CSF occurred, and then 3ml syringe was attached to spinal needle and 0.5% hyperbaric bupivacaine or 3ml of 0.5% hyperbaric Levobupivacaine or 3ml of 0.75% hyperbaric ropivacaine were given according to their respective groups in subarachnoid space.

Patient received the following drugs:
Group-A –Hyperbaric Bupivacaine 0.5%, 3ml Group-B – Hyperbaric Levobupivacaine 0.5%, 3ml, Group-C – Hyperbaric Ropivacaine 0.75%, 3ml.

During the operative procedure, the patient's heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), arterial oxygen saturation (SPO2) was recorded every 3 min for 30 min and then every 5 min for next 30 minutes, then every 15 minutes until completion of the surgery. A sensory & motor blockade was checked on the patient, and the time of onset was noted, and then after every 3 min for next 30 min, every 5 min for 30 min, and then every 15 min until the sensory-block has regressed to S1 dermatome. The level of sensory-blockade was assessed from caudal to cephalad direction with loss of pin prick sensation/alcohol swabtest, and T5-T6 dermatome was used as an unblocked reference point.

The following parameters were noted:

- Time taken to onset of sensory-blockade (i.e. time from intrathecal injection ofdrug to complete loss of sensation to pin prick at T10 level).
- The highest level of sensory-block.
- Time taken to achieve the highest level of sensory-block (time from intrathecalinjection to highest level of sensory-block).

The motor-block were assesed using the Modified Bromage Scale
The following parameters were noted:

- Time to onset of motor-blockade by Modified Bromage Score [time noted from

intrathecal injection to Bromage score 2 (MB2)].

- Time taken to achieve complete motor-block by Modified Bromage Score [timenoted from intrathecal injection to Bromage score 3 (MB3)].
- Duration of motor-blockade was noted [time from Bromage score 3 (MB3) toBromage score 2 (MB2)].

After surgical anaesthesia was achieved, readiness for surgery was defined as loss of pin prick sensation ≥ T10 and with modified Bromage score ≥2. Time taken to achieve maximum sensory level, 2 segment regression and time for first rescue analgesia was noted. Sensory & motor functions during the procedure were observed on the non- operative side. If the patient complained of pain during surgery, supplemental analgesia with 0.02 mg/kg inj Butorphanol IV was given & the time of first rescue analgesia was noted.

Assessment of Analgesia:

Visual analogue scale[5] (VAS) score, was assessed hourly till 6 hours of post-operative period and at 12, 18, 24 hours post-operatively. Rescue analgesia was given when VAS score > 4 or if the patient complained of pain, the time for first rescue analgesia was noted. Analgesia was given by inj. Diclofenac 75mg intravenously. 24 hour Post- operative nausea vomiting (PONV) score was assessed. Any side effects/ complications like nausea, vomiting, bradycardia & hypotension was noted.

- Pain score '0'- No Pain.
- Pain score '10' –Severe Pain.

Statistical Analysis

The data were entered on a Microsoft Excel spreadsheet and imported into Statistical Package for Social Sciences (SPSS) version 23 for statistical analysis. Qualitative data was present in frequency and percentage and quantitative data was presented in mean & standard deviation. Descriptive statistics was performed by calculating mean & standard deviation for the continuous variables. Nominal categorical data between the groups were compared using chi-square goodness-to-fit test.

One Way ANOVA test was performed to find significant difference in different variables between three groups. A *P*-value less than (< 0.05) was considered statistically- significant and a *P*-value less than (< 0.001) was considered statistically highly significant.

RESULTS

In current study the mean age of patients in Group-A was 38.5 ± 11.14 years, in Group-B was 37

± 7.18 years and in Group-C was 36.95 ± 10.36 years. There is no significant difference in mean age of patients in between Group-A, Group-B, and in Group-C (P value=0.524).

In current study the mean weight of patients in Group-A was 68.1 ± 8.85 kg, in Group-B was 69.1 ± 7.11 kg and in Group-C was 68.4 ± 8.91 kg. There was no significantdifference in mean weight of patients in between Group-A, Group-B, and in Group-C (Pvalue=**0.927**)

In the present study gender comparison was done and there were 28 male (65.1%) and 15 females (34.9%) in Group-A and 32 male (74.4%) and 11 females (25.6%) in Group- B and 32 males (74.4%) and 11 female (25.6%) in Group-C. There was no significant difference in mean weight of patients in between Group-A, Group-B, and in Group-C (Pvalue =**0.533**).

In present study, ASA grade comparison was done, in Group-A there were 30 patients with ASA GRADING I and 13 patients with ASA GRADING II and in Group-B there were 32 patients with ASA GRADING I and 11 patients with ASA GRADING II and inGroup-C there were 29 patients with ASA GRADING I and 14 patients with ASA GRADING II which were randomly chosen and the result was statistically not-significant(P value = **0.786**). (TABLE-1)

TABLE-1 ASA Grade.

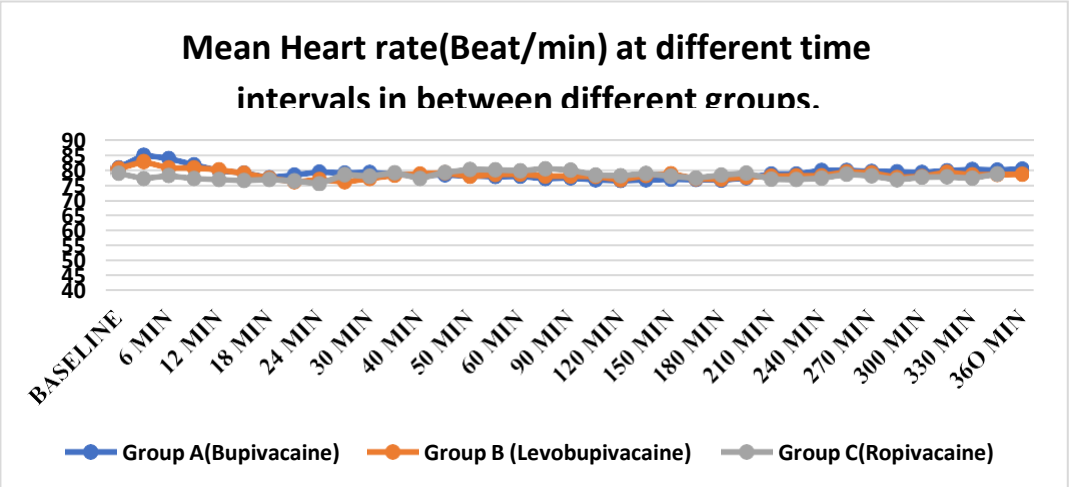
ASA GRADE	**Group-A Bupivacaine)**	**Group-B Levobupivacaine)**	**Group-C (Ropivacaine)**	**P-Value (Result)**
I	30(69.8%)	32(74.4%)	29(67.4%)	**0.786# (not significant)**
II	13(30.2%)	11(25.6%)	14(32.6%)	

#Not significant.

Comparison of Mean Heart rate (Beat/min) at different time intervals in between different groups.

In our study, At baseline the heart rate in Group-A, Group-B and Group-C was 80.98 ± 8.42, 80.65 ± 8.77, 79.21 ± 6.28 respectively with (P value =0.547) which is statisticallynot significant. After 12 minutes of spinal anaesthesia the heart rate begins to decline in all three groups which was statistically not significant. (Graph-1)

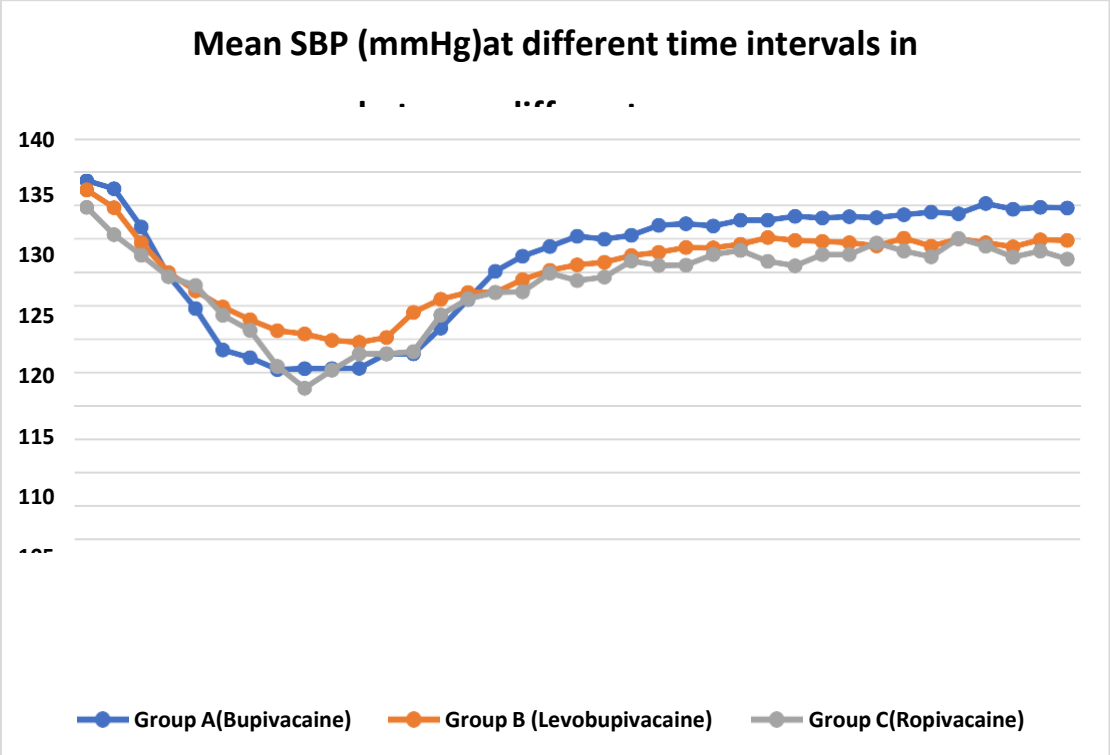
GRAPH-1



Comparison of Mean SBP (mmHg) at different time intervals in between differentgroups.

In current study the mean systolic blood pressure at baseline in Group-A, Group-B and Group-C was 133.63 ± 5.64, 132.23 ± 6.51, 129.63 ± 6.24 mmhg respectively with (P=0.107, >0.05) showing statistically insignificant difference in between all three groups, The SBP after 15 min of spinal anaesthesia in Group-A, Group-B, and Group-C was 108.33 ± 14.3, 114.74 ± 13.47, 113.49 ± 6.08 mmhg respectively with (P=0.032, <0.05) which was statistically-significant and the fall was more in Group-A than Group-B and Group-C and after 35 minutes of administration of drugs the SBP start to increase107.72 ± 14.88mmhg in Group-A, 110.19 ± 14.45 mmhg in Group-B and 107.72 ± 8.29in Group-C with (P value=0.594) which was statistically not significant. (graph-2)

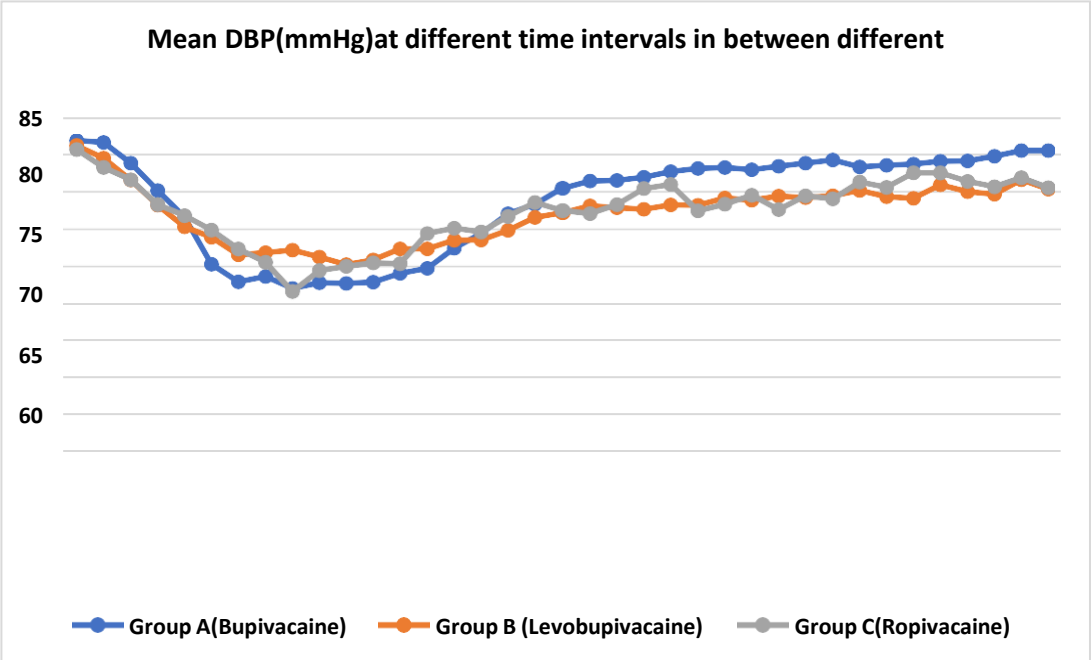
GRAPH-2


Mean SBP (mmHg)at different time intervals in
140
135
130
125
120
115
110
Group A(Bupivacaine)
Group B (Levobupivacaine)
Group C(Ropivacaine)

Comparison of Mean DBP (mmHg) at different time intervals in between differentgroups.

In current study the mean diastolic blood pressure at baseline in Group-A, Group-B andGroup-C was 81.77 ± 6.16, 81.07 ± 6.12, 80.56 ± 4.17 mmhg respectively with (P value =0.600) showing statistically insignificant difference in between all three groups. The mean DBP after 15 min of spinal anaesthesia in Group-A, Group-B, and Group-C was 65.26 ± 9.33, 68.86 ± 10.17, 69.84 ± 4.97 mmhg respectively with (P value =0.033) which was statistically-significant and the fall was more in Group-A than Group-B and Group-C and after 40 minutes of administration of drugs the mean DBP start to increase
64.05 ± 9.73 mmhg in Group-A, 67.3 ± 8.06 mmhg in Group-B and 65.35 ± 5.53 in Group-C with (P value =0.166) which was statistically not significant. (graph-3)

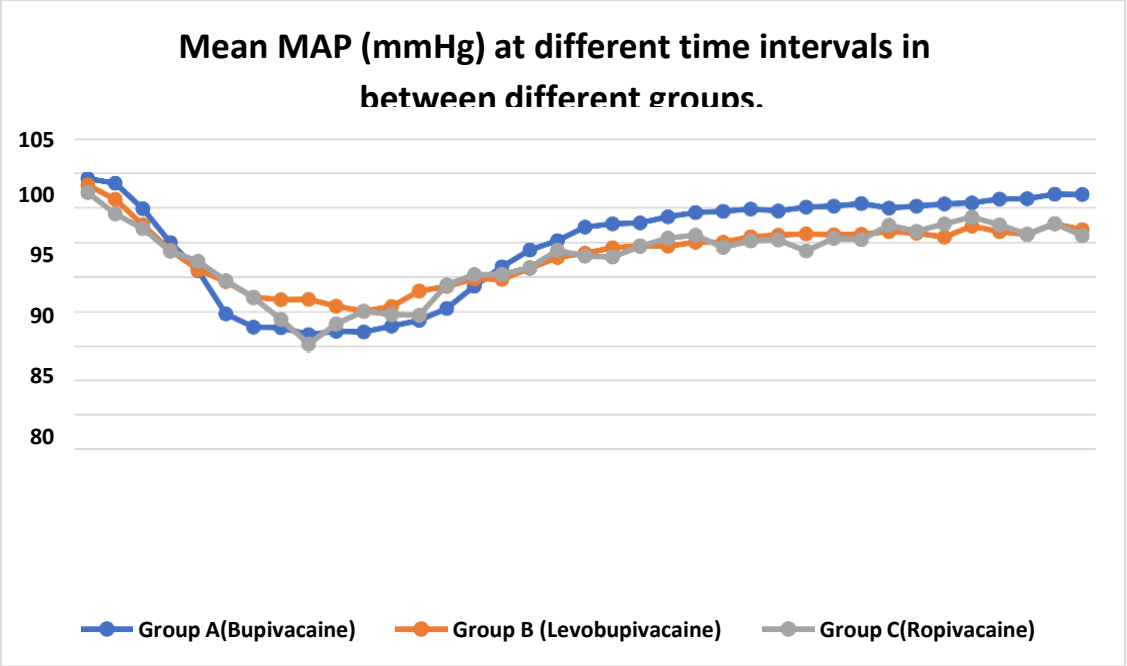
GRAPH-3



Comparison of Mean MAP (mmHg) at different time intervals in between differentgroups:

In current study the mean arterial pressure at baseline in Group-A, Group-B and Group-C was 99.07 ± 5.3, 98.14 ± 5.43, 97.05 ± 4.13 mmhg respectively with (P value=0.174) showing statistically insignificant difference in between all three groups. The mean MAP after 15 min of spinal anaesthesia in Group-A, Group-B, and Group-C was 79.56 ± 10.34,
84.21 ± 10.79, 84.35 ± 4.92 mmhg respectively with (P value =0.023) which was statistically-significant and the fall was more in Group-A than Group-B and Group-C and after 35 minutes of administration of drugs the mean MAP start to increase 77.81 ±
10.9 mmhg in Group-A, 80.65 ± 10.95 mmhg in Group-B and 79.47 ± 6.3 in Group-C with (P value =0.393) which was statistically not significant. (graph-4)

GRAPH-4



Onset of Sensory-block Upto T10 Dermatome:

In our study the mean onset time for sensory-blockade was 3.19 ± 0.39 min in Group-A and 3.74 ± 0.44 min in Group-B and 3.95 ± 0.69 min in Group-C with (P <0.001), which was statistically highly significant. (TABLE-2)

TABLE-2. Onset of Sensory-block Up to T10 Dermatome.

	Group-A (Bupivacaine)	**Group-B (Levobupivacaine)**	**Group-C (Ropivacaine)**	
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**P-Value (Result)**
ONSET OF SENSORY-BLOCKADE UPTO T10	3.19 ± 0.39	3.74 ± 0.44	3.95 ± 0.69	<0.001*

*Highly significant.

Peak Height of Sensory-blockade:

In our study the peak height for sensory-blockade was T4 in 39 patients (90.7%), T6 in 4 patients (9.3%) and T8 in 0 patients (0%) in Group-A where as in Group-B it reached T4 in 10 patients (23.3%), T6 in 33 patients (76.7%) and T8 in 0 (0%) patients where as in Group-C it reached T4 in 2 patients (4.7%), T6 in 32 patients (74.4%) and T8 in 9 patients (20.9%) with (P value <0.001) which is highly significant. (TABLE-3)

TABLE-3 Peak Height of Sensory-blockade.

HIGHEST LEVEL OF SENSORY-BLOCKADE	**Group-A (Bupivacaine)**		**Group-B (Levobupivacain)**		**Group-C (Ropivacaine)**		**P-Value**
	Number	%	Number	%	Number	%	
T4	39	90.7	10	23.3	2	4.7	

T6	4	9.3	33	76.7	32	74.4	
T8	0	0	0	0	9	20.9	
Total	43	100	43	100	43	100	<0.001*

Time Taken to Achieve the Highest Level of Sensory-block:

In our study the time taken to achieve highest level of sensory-blockade was 4.19 ± 0.39min in Group-A and 4.86 ± 0.6 min in Group-B and 5.7 ± 0.64 min in Group-C with (P value <0.001) which was highly significant. (TABLE-4)

TABLE-4. Time Taken to Achieve the Highest Level of Sensory-block.

	Group-A (Bupivacaine)	**Group-B (Levobupivacaine)**	**Group-C (Ropivacaine)**	
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**P-Value (Result)**
TIME TAKEN TO ACHIEVE THE HIGHEST LEVEL OF SENSORY-BLOCK	4.19 ± 0.39	4.86 ± 0.6	5.7 ± 0.64	<0.001*

*Highly significant.

Duration of Sensory-blockade Till S1:

In our study the mean duration of sensory-blockade was 242.44 ± 12.22 min in Group- A, 211.05 ± 11.98 min in Group-B and 184.19 ± 14.39 min in Group-C with (P value < 0.001) which is highly significant. (TABLE-5)

TABLE-5. Duration of Sensory-blockade Till S1.

	Group-A (Bupivacaine)	**Group-B (Levobupivacaine)**	**Group-C (Ropivacaine)**	
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**P-Value (Result)**

DURATION OF SENSORY BLOACKADE TILL S1.	242.44 ± 12.22	211.05 11.98 ±	184.19 14.39 ±	<0.0 01*

*Highly significant.

Duration of 2 Segment Regression Time:

In our study the 2 segment-regression time is 124.88 ± 13.38 min for Group-A, 111.63 ±11 min for Group-B and 88.6 ± 9.72 min for Group-C with (P value < 0.001) which is highly significant.

Onset of Motor-blockade Upto Modified Bromage Grade 2

In our study the mean onset time for motor-blockade upto modified bromage scale 2 was 4.19 ± 0.39 min in Group-A and 4.74 ± 0.44 min in Group-B and 5.02 ± 0.71 min inGroup-C with (P < 0.001) which is highly significant.

Time Taken to Complete Motor Paralysis Upto Modified Bromage Grade 3

In our study time taken to complete motor paralysis upto modified bromage scale 3 was 5.23 ± 0.43 min in Group-A, 5.77 ± 0.43 min in Group-B, and 6.79 ± 0.99 min in Group-C with (P value < 0.001) which is highly significant.

Duration of Motor-blockade (From MB3 To MB2)

In our study the mean duration of motor-blockade from Grade 3 to Grade 2 is 191.16 ± 8.08 min in Group-A, 165 ± 11.34 min in Group-B and 121.05 ± 11.52 min in Group-C with (P value < 0.001) which is highly significant.

Duration of Motor-blockade (From MB3 to MB0):

In our study the mean duration of motor-blockade from grade 3 to grade 0 is 216.51 ± 9.23 min in Group-A, 184.30 ± 12.56 min in Group-B and 149.42 ± 16.19 min in Group-C with (P value < 0.001) which is statistically-significant.

VAS Score:-

In our study the vas score was less than 3 in Group-A whereas more than 3 in both groupsB & C which is highly significant with (P value < 0.001).

TABLE-6 VAS Score

	Group-A (Bupivacaine)	**Group-B (Levobupivacaine)**	**Group-C (Ropivacaine)**	
	Mean ± SD	Mean ± SD	Mean ± SD	P-Value (Result)
VAS Score	2.79 ± 0.71	3.26 ± 0.44	3.7 ± 0.46	<0.001*

* Highly Statistically-significant.

Post-operative Analgesia:

In our study, the mean time for first rescue analgesia was more in Group-A. It was 296.49 ± 17.23 min in Group-A and 244.19 ± 10.74 min in Group-B and 220.47 ± 10.74 min inGroup-C with (P value <0.001) which is highly significant.

Discussion: There is no significant difference in mean age, mean weight of patients in between Group-A, Group-B, and in Group-C (P=**0.524**). There was no significant difference in age, sex, weight and ASA grading in between Group-A and Group-B and Group-C.

Hemodynamic changes

The Heart rate increases in all three groups at 3min, 6min and 9 min with p value (<0.05)which was statistically-significant and then start to decrease after 12 minutes with (P > 0.05) which was statistically insignificant.

The Systolic Blood pressure start to decline after 15 minutes administration of spinal anaesthesia; the fall was more in Group-A > Group-B > Group-C with (P < 0.05) which was statistically-significant and then start to increase after 35 minutes with (P > 0.05) which is non-significant.

The diastolic blood pressure declined after 15 minutes of spinal anaesthesia in Group-A> Group-B > Group-C which was statistically-significant with (P < 0.05).

The Mean Arterial Pressure declined in all three group, but the decline was more in Group-A as compared to Group-B > Group-C which was statistically-significant after 15minutes of spinal

anaesthesia with (P > 0.05).

R. Herrera *et al* (2014) [6] conducted a observational pilot study in 2014 to assess the hemodynamic parameters of subarachnoid anaesthesia with isobaric-levobupivacaine versus hyperbaric-bupivacaine for hip fracture surgeries found that the incidence of hypotension was more in bupivacaine group then levobupivacaine group with p-value <0.05 which was statistically-significant, whereas the decrease in heart rate was more in bupivacaine group as compared to levobupivacaine.

Onset of Sensory-block

In **P. Oraon *et al* (2022)** [7] study, the mean onset time for sensory-blockade at T8 was earliest in Group-Bupivacaine 2.30±0.48 min, 2.35±33.91 min in group levobupivacaine and 3.02±0.48 min in the ropivacaine group with p value 0.732, 0.0001, 0.0001 respectively which is similar to our study.

CK Naren *et al* (2015)[8] also conclude in his study that the mean onset time of sensory-blockade was shorter in bupivacaine group (6.16 min) than ropivacaine group (9.04min) with P-value-0.0211 which is highly significant and similar to our study.

CK Naren *et al* (2015) [8] in his study found that maximum height sensory-blockade was T7 in bupivacaine Group-And T8 in ropivacaine group with P-value 0.001 which was statistically-significant.

P. Oraon *et al* (2022) [7] study, the peak height for sensory-blockade was 4.4±0.621 for bupivacaine group, 5.2±0.76 for levobupivacaine group, and 5.33±0.66 for ropivacaine group with p-value 0.0001 both for Group-B vs group L, & Group-B vs group R which is highly significant and similar to our observations.

Time Taken to Achieve the Highest Level of Sensory-block:

C K Naren *et al* (2015)[8] study the time needed to get highest level of sensory-blockade was 13.16 ± 1.49 min in group ropivacaine and 12.2 ± 1.35 min in Group-Bupivacaine with p value-0.0211 which is statistically-significant.

The observations from above studies shows that the time required for maximum sensory-blockade was shorter in bupivacaine Group-And delayed in ropivacaine group which supports our observations.

Duration of Sensory-blockade:

Casati A *et al* (2004)[9] in his study found that complete regression of spinal anaesthesia was faster in patients receiving ropivacaine (166 ± 42 min) than in those receiving levobupivacaine 210±63 min and 190 ± 51 min for patients receiving bupivacaine with P-value < 0.05 which is significant.

In above studies, maximum duration of sensory-blockade was found in bupivacaine group than levobupivacaine and least in ropivacaine group showing similarities with ourresult.

Duration of 2 Segment Regression Time:

In **P .Oraon *et al* (2022)**[7] study, the two-segment regression time from highest block is 104±10.77 min for bupivacaine group, 96.67±18.30 min for levobupivacaine group, and 90.83±9.01 for ropivacaine group with significant result between Group-B and R, and between group L and R with p value 0.001 and 0.0046 which is similar to our study.

J.F. Luck *et al* (2008) [10] in their study found that the sensory regression upto T10 level was 129 min, 131min and 84min for Group-Bupivacaine, levobupivacaine and ropivacaine with p value < 0.005 between Group-B & R and group L & R which is statistically-significant.

The findings of above studies is somewhat similar to our observations and support our result showing that the two-segment regression time was shorter in ropivacaine group and prolonged in bupivacaine group, which supports our result.

Onset of Motor-blockade Upto Modified Bromage Grade

J.F Luck & P.D. Fettes *et al* (2008)[10] their study found that the onset of motor-blockadewas 5(2-25) min for bupivacaine group, 5(2-20) min for levobupivacaine group, and 10(5-20) min for ropivacaine group stated that "the motor onset was delayed in group ropivacaine as compared to Group-Bupivacaine with P value < 0.05 which is statistically- significant and similar to our study.[11]

CK Naren *et al* (2015) [8] also found in their study that the onset of motor-blockade was shorter in bupivacaine group (6.16 ± 1.25 min) as compared to ropivacaine group (9.04± 1.20 min) with P-value0.001 which is highly significant and support our study.

Duration of Motor-blockade:

J.F. Luck & P.D. Fettes *et al* (2008)[10] also found that the duration of motor-blockade was maximum for Group-Bupivacaine 180(90-360) min, less for group levobupivacaine 180(90-210) min and least in group ropivacaine 90 (60-120) min with p value <0.05 which is significant which is similar to our study.[11]

CK Naren *et al* (2015) [8] study found that the duration of motor-blockade was more (162.8 ± 8.91 min) in bupivacaine Group-And lesser (131.76 ± 5.65 min) in ropivacaine group with P-value <0.001 which is highly significant.

The result of all above studies is similar and support our study.

Post operative Analgesia

In our study the mean time for first rescue analgesia was more in Group-A. It was 296.49 ± 17.23 min in Group-A and 244.19 ± 10.74 min in Group-B and 220.47 ± 10.74 min inGroup-C with (p <0.001) which is highly significant.

The result from above studies shows that the time required for first rescue analgesia wasshorter in ropivacaine Group-And prolonged in bupivacaine which is similar to our result.

CONCLUSION

Both hyperbaric-levobupivacaine and hyperbaric-ropivacaine have better hemodynamic stability, equally effective, lesser duration of sensory & motor-block and fewer adverse effects in comparison to hyperbaric bupivacaine and can be used as an alternative to bupivacaine for intermediate and short duration of surgeries, whereas ropivacaine may be a better option for short term procedures where early mobilization and recovery is required.

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