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"A Comparative Observational Study Of Bupivacaine 0.5% Versus Ropivacaine 0.5% In Supraclavicular Block For Upper Limb Surgeries"

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ABSTRACT

Introduction:Peripheral nerve block anaesthesia is particularly advantageous in case of prolonged orthopedic, plastic reconstructive surgeries and in emergency surgeries where the patients are full stomach, not adequately starving and in high risk patients. This technique not only provides anaesthesia but also post-operative analgesia. The present study is aimed to compare the effectiveness of 0.5% bupivacaine and 0.5% Ropivacaine in supraclavicular brachial plexus block in terms of onset and duration of sensory and motor blockade, duration of analgesia, requirement of post-operative analgesia and complications.

Aim: To compare Bupivacaine 0.5% and Ropivacaine 0.5% in brachial plexus block by supraclavicular approach

Methods: A total of 62 patients who have given a valid written informed consent were part of the study and who fulfilled the inclusion and exclusion criteria were selected and randomly allocated (sealed envelope random number table) to study Bupivacaine group and Ropivacaine group. Supraclavicular brachial plexus block givenwith drugs as per group allocated. Patients which are included in the study are observed carefully for preoperative, intraoperative and postoperative parameters [Group B] and Ropivacaine group [group R] with 31 patients in each group.

Results:In thisstudy, onset of sensory and motor blockade is significantly faster in Ropivacaine group. Duration of motor blockade is significantly longer in Bupivacaine group.

Conclusion: 0.5% Ropivacaine has faster onset of sensory and motor blockade; longer duration of analgesia with faster recovery of motor functions as compared to similar quality of block with 0.5% Bupivacaine.

Keywords:*Supraclavicular block, Ropivacaine,Bupivacaine, Upper limb surgeries*

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I. INTRODUCTION

Recently peripheral nerve block anaesthesia has become popular against general anaesthesia as it is devoid of side effects of intubation and muscle relaxants and systemic hemodynamic changes. This type of anaesthesia is particularly advantageous in case of prolonged orthopedic, plastic reconstructive surgeries and in emergency surgeries where the patients are full stomach, not adequately starving and in high risk patients. This technique not only provides anaesthesia but also post-operative analgesia.[1]

Supraclavicular block is performed where the brachial plexus is presented most compactly at the distal trunk/proximal division level. This compactness may explain the block's historical reputation for providing short latency and complete, reliable anesthesia for upper extremity surgery. [2] However it provides anesthesia and postoperative analgesia without any systemic side effects. [3]

Variety of local anesthetics can be used to perform ideal and complete block. Among them, bupivacaine provides a longer duration of action, but at high doses it may lead to cardiotoxicity and neurotoxicity. [4] Ropivacaine is a new amide local anesthetic has been shown to provide effective sensory and motor block of prolonged duration.[5] The toxicity of ropivacaine has been reported to be less than that of bupivacaine. The success rate of the block can be further enhanced by using electric nerve stimulator to identify the nerves and depositing the drug perineurally. [6]

The present study is aimed to compare the effectiveness of 0.5% bupivacaine and 0.5% ropivacaine in supraclavicular brachial plexus block in terms of onset and duration of sensory and motor blockade, duration of analgesia, requirement of post-operative analgesia and complications, if any.

AIM

To compare Bupivacaine 0.5% and Ropivacaine 0.5% in brachial plexus block by supraclavicular approach

OBJECTIVES

1. To compare time of onset of sensory and motor block.
2. To compare total duration of sensory and motor block.
3. To compare total time duration for analgesia.

STUDY DESIGN: A comparative observational hospital-based study.

STUDY SITE: Department of Anesthesia, tertiary care hospital

STUDY POPULATION: Patients posted for upper limb orthopedic and plastic surgeries under brachial plexus block.

STUDY DURATION: 18 months from January 2021 to June 2022

SAMPLE SIZE:

Highest sample size calculated was 62, with an alpha value of 0.05 and a power of 80%. Considering 10% drop out rate, selected a sample size of 31 in each group satisfying inclusion and exclusion.

RANDOMISATION OF PATIENTS:

Randomization was performed using Excel (Microsoft USA) then proforma is labeled either group B or group R according to randomization and was put in concealed envelope.

INCLUSION CRITERIA

1. Patients aging between 18-70 years
2. ASA risk category I and II
3. No known history of allergy, sensitivity or other form of reaction to local anesthetics of the amide type
4. Patient willing to sign informed consent

EXCLUSION CRITERIA

1 ASA Grade >III
2 Local skin infections at site of injection.
3 Coagulopathy
4 Potent antiplatelet, or on anticoagulants.
5 Allergy to the trial drugs.
6 Hemi diaphragmatic paralysis on contralateral side of surgery.
7 Psychological disorder.

II. METHODS

Stratified simple randomization technique would be used to allocate patients.
Later study subjects divided into 2 equal groups.

A total of 62 patients who have given a valid written informed consent were part of the study and who fulfilled the inclusion and exclusion criteria were selected and randomly allocated (sealed envelope random number table) to study Bupivacaine group [group B] and Ropivacaine group [group R] with 31 members in each group.

Patients were made familiar with the visual analog scale (VAS) and pre-operative pain was assessed and documented using the same.

1.After obtaining ethical and institutional committee approval, total 62 patients of the age group of 18 to 70 years, belonging to ASA physical status I or II, willing to sign informed consent scheduled to undergo elective arm, forearm and hand surgery under regional anaesthesia in this Institution were included in this study. Cases were divided randomly into two groups:

Group B: Receiving Inj. Bupivacaine hydrochloride 0.5% 25 ml and
Group R: Receiving Inj. Ropivacaine hydrochloride 0.5% 25 ml

2. A thorough preoperative evaluation was performed. The patients were subjected to thorough general and systemic examination and were investigated hemoglobin, complete blood count, bleeding time, clotting time, chest X ray, ECG, RFT and LFT.

3. After this patient was taken on operation table, and monitored using pulse oximeter, ECG and noninvasive blood pressure monitors. An intravenous access was secured using an in-dwelling cannula of appropriate size.

4. Brachial Plexus Block Technique:

The patient placed in supine position, with the head turned about 30 degree to contra-lateral side. The interscalene groove, midpoint of the clavicle and subclavian artery was identified. 22 gauge, 50 millimeter-stimuplex needle with nerve simulator was directed just above and posterior to the subclavian pulse and directed caudally at a very flat angle against the skin. The needle was advanced till the desired evoked motor response was observed (flexion and extension of fingers) the stimulator voltage was decreased to 0.5 mA, then 25 ml of study drug was injected in 3 ml increments.

The sensory block was tested by sensation of pinprick and compared with same area on contralateral arm.

It was assessed by the 'Hollmen Scale'

Motor block was evaluated by movement at the fingers, wrist, elbow and shoulder joints and assessed by the 'Modified Bromage Scale'

1. Onset of sensory block: This was defined as minimum of grade 2 of Hollmen scale in the distribution of any one of the four major nerves.

2. Onset of motor block: This was defined as minimum of grade 1 of Modified Bromage scale.

Failure to lose shoulder abduction after 30 min was considered to be block failure and hence general anaesthesia was given and patient was excluded from study.

Various parameters like heart rate, blood pressure, SpO2, onset and duration of sensory and motor block, quality of block and complications if any was noted during and after the procedure every 3 min for the first 30 min and then every 10 min thereafter till the end of surgery. Postoperatively patients were monitored every hourly for 12 hours and they were asked to note the time of requirement of first rescue analgesic, complications in the form of neurotoxicity will be assessed.

Post-operative pain was also assessed by using Visual Analog Scale (VAS)

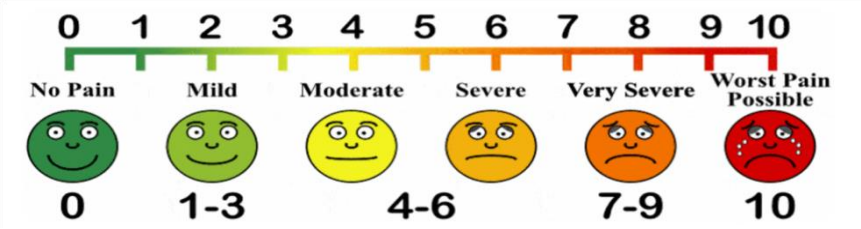

FIGURE 1. VISUAL ANALOG SCALE

Patient's satisfaction regarding the blockade was noted and that are graded as
Grade 4 -Excellent - no complaints from patients
Grade3-Good-minor complaints with no need for supplement or rescue analgesia
Grade 2-Moderate - complaint that require rescue analgesia
Grade 1-Unsuccesful-patient requiring general anaesthesia

STATISTICAL ANALYSIS:

Patients which are included in the study are observed carefully for preoperative, intraoperative and postoperative parameters. All the data was collected using a predesigned pretested questionnaire, data was entered in Microsoft excel 2016, and was analyzed using Epi info 7.2.1. Data is shown in frequencies and percentages, mean and standard deviation.Chi square test was used to see association and student's t test was used to see the difference between the study parameters in the two groups. Significance level was considered at $p < 0.05$.

III. RESULTS

Table 1: Distribution of cases according to age**:**

Mean age (Years)	Group B	Group R	P value
	Mean ±SD (n=31)	Mean ±SD (n=31)	
Age	41.51 ±14.22	41.54 ±13.34	0.91

(P>0.05 statistically not significant by unpaired t test)

The mean age in group B was 41.51 ±14.22 years and group R was 41.54 ±13.34 years. There was no significant difference in age distribution among two groups. (p>0.05)

Out of total 62 patients, 39 were males while 23 were females. There were 21 (67.74%) and 18 (58.06%) male patients among Group B and Group R respectively. There was no gender difference when two groups were compared statistically. (p>0.05)

Table 2: Comparison of time for onset of motor block in two groups:

Onset of motor block	Group B	Group R	P value
	Mean ±SD (n=31)	Mean ±SD (n=31)	
Mean time for onset of motor block (minutes)	17.03 ±3.44	15.45 ±3.32	0.092

(P>0.05 statistically not significant by unpaired T test)

The mean time for onset of motor block of group B was 17.03 ±3.44 minutes and that of group R was 15.45 ±3.32 minutes. The mean time for onset of motor block was earlier in Group R compared to Group B with no statistically significant difference. (p>0.05)

GRAPH 1: Comparison of time for onset of motor block in two groups

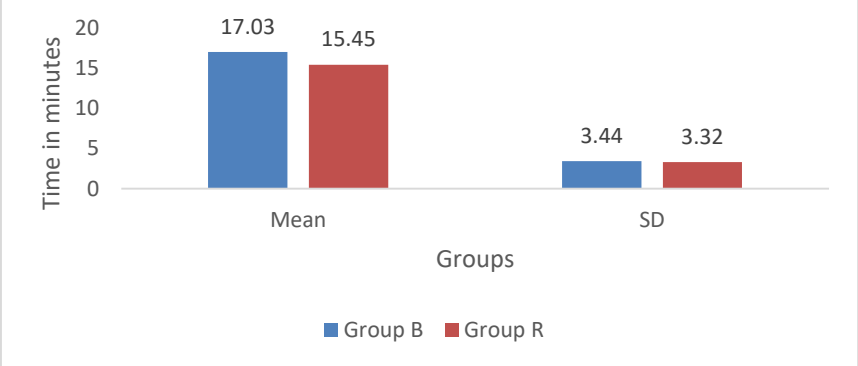

Table 3: Comparison of total duration of motor block in two groups:

Total duration of motor block	Group B	Group R	P value
	Mean ±SD (n=31)	Mean ±SD (n=31)	
Mean total duration of motor block (hours)	9.06 ±3.32	5.74 ±2.21	<0.001

(P<0.05 statistically significant by unpaired T test)

The mean total duration of motor block in group B was 9.06 ±3.32 hours and that of group R was 5.74 ±2.21 hours. The total duration of motor block was less in Group R compared to Group B with statistically significant difference. (p<0.05)

GRAPH 2: Comparison of total duration of motor block in two groups:

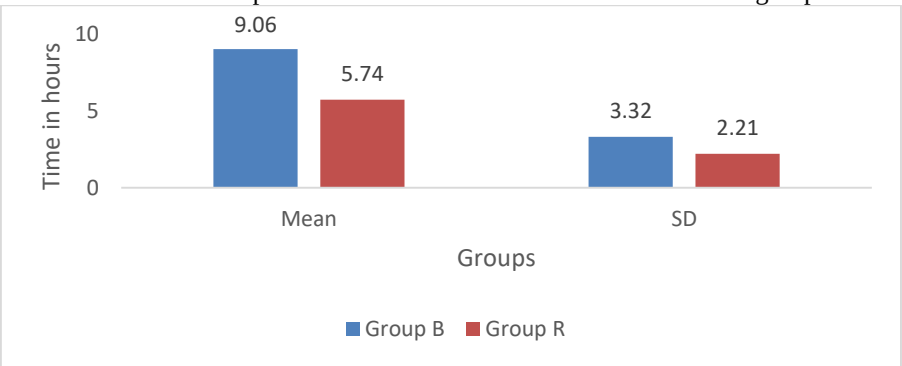

Table 4: Comparison of onset of sensory block in two groups:

Onset of sensory block	Group B	Group R	P value
	Mean ±SD (n=31)	Mean ±SD (n=31)	
Mean onset of sensory block (minutes)	14.35 ±1.69	6.87 ±2.08	0.013

(P<0.05 statistically significant by unpaired t test)

The mean time for onset of sensory block of group B was 14.35 ±1.69minutes and that of group R was 6.87 ±2.08minutes. The mean time for onset of sensory block was earlier in Group R compared to Group B with statistically significant difference. (p<0.05)

GRAPH 3: Comparison of onset of sensory block in two groups

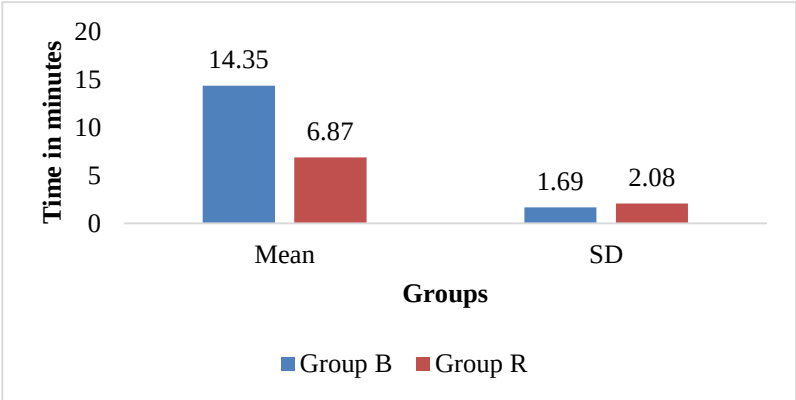

Table 5: Comparison of total duration of sensory block in two groups:

Total duration of sensory block	Group B	Group R	P value
	Mean ±SD (n=31)	Mean ±SD (n=31)	
Mean total duration of sensory block (hours)	7.29 ±2.41	9.03 ±2.46	<0.001

(P<0.05 statistically significant by unpaired T test)

The mean total duration of sensory block in group B was 7.29 ±2.41 hours and that of group R was 9.03 ±2.46 hours. The total duration of sensory block was more in Group R compared to Group B with statistically significant difference. (p<0.05)

GRAPH 4: Comparison of total duration of sensory block in two groups:

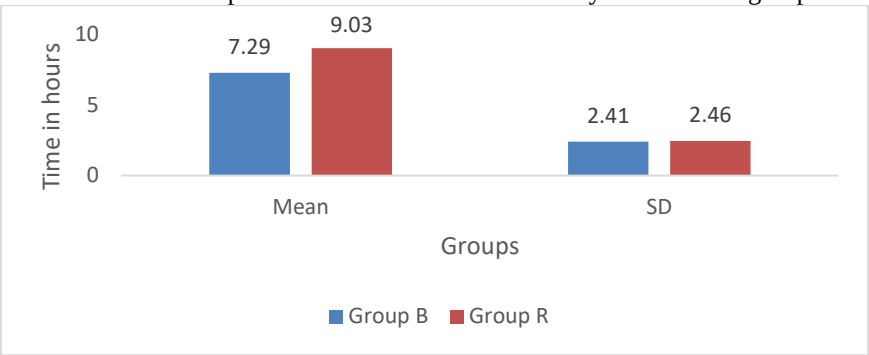

Table 6: Comparison of mean time for Rescue analgesia in two groups:

Time for Rescue analgesia	Group B	Group R	P value
	Mean ±SD (n=31)	Mean ±SD (n=31)	
Mean time for Rescue analgesia (hours)	8.74 ±2.40	9.35 ±2.05	<0.001

(P<0.05 statistically significant by unpaired t test)

Comparison of mean time for Rescue analgesia in two groups

The mean time for Rescue analgesiain group B was 8.74 ±2.40hours and that of group R was 9.35 ±2.05hours. The mean time for Rescue analgesiawas more in Group R compared to Group B with statistically significant difference. (p<0.05)

Out of total 62 patients, no patients show complications of nausea, vomiting and shivering. There was no complications difference when two groups were compared statistically. (p>0.05)

IV. DISCUSSION

The present prospective observational study was conducted to compare bupivacaine 0.5% and ropivacaine 0.5% in brachial plexus block via supraclavicular approach.

The study was conducted during the period of January 2021 to June 2022 at Department of Anesthesiology, in tertiary care hospital.

All the patients presenting to the Department of Anesthesiology undergoing for upper limb surgeries were included as study population. Patients aging between 18-70 years, ASA risk category I and II, with no known history of allergy, sensitivity or other form of reaction to local anesthetics of the amide type and willing to sign informed consent were included in the study.

A total sample size of 62 patients was included in the study. The computer assisted randomization of patients were done and divided into 2 groups of 31 subjects each. Group B (Bupivacaine); 31 patients (n=31) and Group R (Ropivacaine); 31 patients (n=31)

After taking proper consents subjects were included in the study. The study was done after getting clearance from the ethical committee of the institute.

DEMOGRAPHIC CHARACTERISTICS:

In the present study, the mean age in group B was 41.51 ±14.22 years and group R was 41.54 ±13.34 years. There was no significant difference in age distribution among two groups. (p>0.05)

Anupreet Kaur et al [8] studied comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries observed mean age in Group B and Group R was 36.6 and 33.12 years with no statistically significant difference. This present study has the similar finding.

Out of total 62 patients, 39 were males while 23 were females. There were 21 (67.74%) and 18 (58.06%) male patients among Group B and Group R respectively. Gender difference between two groups when compared statistically was insignificant. (p>0.05)

R Hickey et al [7] studied compares the effectiveness of 0.25% ropivacaine and 0.25% bupivacaine in brachial plexus block for upper extremity surgery observed no difference in sex among two groups.

MOTOR BLOCK:

The mean time for onset of motor block of group B was 17.03 ±3.44 minutes and that of group R was 15.45 ±3.32 minutes. The mean time for onset of motor block was earlier in Group R compared to Group B with no statistically significant difference. (p>0.05)

Anupreet Kaur et al [8] studied comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries observed onset of motor block was observed to be initiating at 5 min interval itself in Group R whereas in Group B, onset of motor block was observed from 20 min interval onwards with statistically significant difference in motor blockade scores.

Klein et al. [9] observed onset time of <6 min for both sensory and motor blockade in bupivacaine as well as ropivacaine groups among patients undergoing interscalene brachial plexus block. The difference might be due to difference in approach used for the procedure.

The mean total duration of motor block in group B was 9.06 ±3.32 hours and that of group R was 5.74 ±2.21 hours. The total duration of motor block was less in Group R compared to Group B with statistically significant difference. ($p<0.05$)

Anupreet Kaur et al [8] studied comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries under axillary brachial plexus block observed total duration of motor block in bupivacaine group is longer as compared to ropivacaine group with statistically significant difference.

The mean duration of motor block to be significantly longer in bupivacaine group as compared to ropivacaine group which is similar to the findings of Mc Glade et al. [10] who found shorter duration of blockade in ropivacaine group as compared to bupivacaine group using axillary approach.

R Hickey et al [7] studied comparison of the effectiveness of 0.25% ropivacaine and 0.25% bupivacaine in brachial plexus block for upper extremity surgery observed duration of motor block was not significantly different between the two groups

SENSORY BLOCK:

The mean time for onset of sensory block of group B was 14.35 ±1.69 minutes and that of group R was 6.87 ±2.08minutes. The mean time for onset of sensory block was earlier in Group R compared to Group B with statistically significant difference. ($p<0.05$)

Anupreet Kaur et al [8] studied comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries observed onset of sensory block in Group B and Group R was 12.04 and 8.88 minutes respectively with statistically significant difference which is similar to present study.

The mean total duration of sensory block in group B was 7.29 ±2.41 hours and that of group R was 9.03 ±2.46 hours. The mean total duration of sensory block was more in Group R compared to Group B with statistically significant difference. ($p<0.05$)

Anupreet Kaur et al [8] studied comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries observed mean total duration of sensory block in bupivacaine group was significantly longer as compared to ropivacaine group but contradictory to present study where mean total duration of sensory block was significantly longer in Group R compared to Group B.

Shailendra Modak et al [11] comparative study of 0.5% ropivacaine and 0.5% bupivacaine for brachial plexus block by supraclavicular approach for upper limb surgeries observed that maximum duration of sensory blockade was found for ropivacaine group as compared to bupivacaine group which is similar to the present study.

Tomoki Nishiyama et al [12] observed in their study that mean onset time of sensory block in ropivacaine group was 11 minutes and in bupivacaine group was 10 mins but the data was statistically insignificant.

RESCUE ANALGESIA:

The mean time for Rescue analgesia in group B was 8.74 ±2.40 hours and that of group R was 9.35 ±2.05 hours. The mean time for Rescue analgesia was more in Group R compared to Group B with statistically significant difference. ($p<0.05$)

V. COMPLICATIONS

In the present study, out of total 62 patients, no patients show complications of nausea, vomiting and shivering. There was no complications difference when two groups were compared statistically. ($p>0.05$) Anupreet Kaur et al [8] studied comparison between bupivacaine and ropivacaine in patients undergoing forearm surgeries observed no side effects pertaining to either of the studied drugs were noted.

VI. CONCLUSION

The present study concludes that 0.5% Ropivacaine has faster onset of sensory and motor blockade; longer duration of analgesia with faster recovery of motor functions as compared to similar quality of block with 0.5% Bupivacaine.

This study suggests that Ropivacaine is a better alternative to Bupivacaine for upper limb surgeries under Brachial Plexus Block by Supraclavicular approach.

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