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A COMPARATIVE STUDY OF BUPIVACAINE 0.5% AND ROPIVACAINE 0.5% IN ULTRASOUND GUIDED AXILLARY BLOCK

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ABSTRACT

Background: patients undergoing forearm surgeries have benefited considerably with widespread use of brachial plexus block instead of general anaesthesia.They achieve near ideal operating conditions by producing complete muscular relaxation and maintaining stable intra-operative hemodynamics. traditional landmark approach to the brachial plexus blocks has now largely been replaced by use of ultrasound guidance.

Aim: comparison between bupivacaine and ropivacaine in ultrasound guided axillary block with respect to onset and duration of sensory block, motor block and duration of analgesia.

STUDY: Prospective randomized double blind controlled trial

Materials and methods : Fifty patients between 18yrs and 60yrs of ASA grade 1 and 2 undergoing elective upper limb surgeries were randomly divided into two groups. Each group consisting of 25 patients to receive USG guided axillary block with 100 mg of 0.5% bupivacaine (group B) and 100 mg of 0.5% ropivacaine (group R).

Results: Onset of motor blockade was earlier in ropivacaine group (13.2 min) as compared to bupivacaine group (20.6 min), Higher levels of motor blockade, Mean onset time for motor block was significantly shorter in ropivacaine group (20.8 min) as compared to bupivacaine group (24.2 min), Mean duration of block was significantly longer in bupivacaine group (513-+63.67min) as compared to ropivacaine group (432-+67.88min) ($p<0.05$), Onset of sensory block was observed from 8.4 min itself in ropivacaine group as compared to bupivacaine group (13.6 min), Duration of sensory block was significantly longer in bupivacaine group (532.8-/+59.56min) as compared to ropivacaine group (451-/+70.21min)

KEYWORDS : axillary block, ropivacaine, bupivacaine, ultrasound

INTRODUCTION

Brachial plexus blocks provide a useful alternative to general anaesthesia for upper limb surgeries. They achieve near ideal operating condition by producing complete muscular relaxation and maintaining stable intra-operative hemodynamics. The sympathetic block produced reduces postoperative pain, vasospasm and edema. These blocks have gained popularity because of several advantages over general anaesthesia like reduced incidence of nausea and vomiting, early mobility, adequate pain relief, early discharge.

The ultrasound-guided axillary block can be carried out on both the long and short axes. It is now recommended to access on the long axis. The positioning of the arm is no different from that of the conventional technique, that is, with abduction of the arm at ca. 90° in relation to the shoulder. On both sides of the (pulsing) artery the median nerve, lying cranial to it, and the ulnar nerve, lying caudally to it.. The radial nerve, dorsal to the artery, sometimes causes difficulties. The musculocutaneus nerve is usually to be found as a characteristic, hyperdense eye in the area of the coracobrachial muscle.

Ropivacaine being less lipophilic, it is less likely to penetrate in large myelinated motor fibres as compared to bupivacaine, resulting in a relatively earlier recovery from motor blockade without compromising duration of sensory blockade. This property of ropivacaine is helpful in earlier diagnosis of nerve injury which can occur during reduction and fixation of upper limb fractures. Ropivacaine has selective action on the pain-transmitting Aδ and C nerves rather than Aβ fibres, which are involved in motor function

MATERIALS AND METHODS

The study was conducted at Department of Anaesthesiology Grants Gov Medical College and Sir J J Groups of hospital Mumbai . The details of the study were presented before the hospital ethical committee and the approval was obtained. Fifty patients (25 in each group) in age group 18-65

years of either sex undergoing elective upper limb surgeries (forearm and distal humerus fractures) categorized under ASA physical status I & II will comprise this study pool, fulfilling the inclusion and exclusion criteria. They were divided into 2 groups using the computerized randomisation technique as follows:

1. Group R (Ropivacaine) (N=25) 20cc volume
2. Group B (Bupivacaine) (N=25) 20cc volume

INCLUSION CRITERIA: All patients undergoing surgeries of arm, forearm, wrist and hand, Age >18 years and <60 years, ASA Grade I to II

EXCLUSION CRITERIA: Patients with significant cardiovascular disease, Hypertension, renal failure, hepatic dysfunction, Diabetes and chronic pulmonary disease, Neuromuscular disorder, Morbid obesity, Bleeding disorders,Infection at the local site, Any patient on prolonged drug therapy,Uncooperative patients.

After arrival in the operating room, an 18- or 20-gauge intravenous catheter was placed in the upper limb contralateral to the surgical site.. Supplemental oxygen (nasal cannulas at 4 L/min) and standard ASA monitoring i.e., ECG, pulseoximeter, respiratory rate, noninvasive bloodpressure was connected and monitored continuously in all the patients and recorded at interval of 5 minutes throughout the procedure. Patients were positioned supine, with the shoulder abducted and the elbowflexed. The US probe was applied in a sterile fashion in the axilla. After obtaining a satisfactory image, injection 20 mL of local anaesthetic in both groups, using an in-plane technique was done with a. 23(11/2) G beveled needle The needle was removed after instillation of local anaesthetic agent (either 20cc of 0.5% ropivacaine or 0.5% bupivacaine) and firm digital pressure with gauze piece was held at the site for 5minutes to assist in proximal spread of the anaesthetic solution.

Sensory and motor block were evaluated preoperatively to determine a baseline and every 5 min for 30 min or until onset of blockade was noted and thereafter every 60 min Sensory block was assessed by the pinprick method (22G hypodermic needle). Assessment of sensory block was done in the dermatomal areas

corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade was achieved. Sensory onset was considered when there was a dull sensation to pinprick along the distribution of any of the above-mentioned nerves. Complete sensory block was considered when there was complete loss of sensation to pinprick.

Sensory block was graded as-

Grade 0: Sharp pin felt
Grade 1: Analgesia, dull sensation felt
Grade 2: Anaesthesia, no sensation felt.

A modified Bromage Scale for the upper extremity was used to assess Motor function. This scale consists of the following four scores:

0 - able to raise the extended arm to 90o for a full 2 sec
1 - able to flex the elbow and move the fingers but unable to raisethe extended arm.
2 - unable to flex the elbow but able to move the fingers
3 - unable to move the arm, elbow or fingers

Onset of motor blockade was considered when there was Grade 1 motor blockade. Peak motor block was considered when there was Grade 3 motor blockade. Block was considered to have failed when sensory anaesthesia was not achieved within 30 min. General anaesthesia was given subsequently to these patients who were then excluded from the study.

Pain will be assessed by using an 11 point(0-10) verbal numeric rating scale (VNRS) in which a score of "0" indicated no pain and a score of 10 indicated worst pain imaginable. VNRS measurements will be taken at baseline (before placement of block), at skin incision , at completion of procedure and subsequently at 4.6.8.10.24 hours following block placement. Duration of post operative analgesia was taken till the time patient asked for rescue analgesia Inj.diclofenac(1.5mg/kg) intramuscularly.

OBSERVATION AND RESULTS

TABLE 1 : COMPARISON OF AGE AND WEIGHT OF THE TWO GROUP OF PATIENT.

Parameter	Group B		Group R		t Value	P value
	Mean	S.D.	Mean	S.D.		
Age(Years)	41	14.22	35	13.85	1.511	0.137
Wight (Kg)	57.32	4.34	56	4	1.09	0.2808

The demographic data showed that two groups were similar with respect to age and weight

TABLE2; COMPARISON OF ONSET OF SENSORY BLOCK

Onset of Sensory Block (mins)				
	Group B	Group R	Unpaired T test	P Value
No	25	25	6.34	0.0001
Mean	13.6	8.4		
Std.Dev.	3.00	2.83		
Median	15	10		

Onset of sensory block was earlier in groupR than groupB

TABLE 3: Comparison of onset of motor block

SCALE	Group B				Group R				Unpaired T test	P Value
	n	Mean	SD	Median	n	Mean	SD	Median		
GRADE1	25	20.6	3.62	20	25	13.2	4.97	12.5	6.017	0.0001
GRADE2	25	23.4	2.38	25	25	17.4	4.81	20	5.59	0.0001
GRADE3	25	24.2	1.87	25	25	20.8	4	20.00	3.850	0.0003

Onset of motor block was significantly faster in groupR than groupB to achieve all three Bromage grades.

TABLE 4: Comparison of duration of motor block

Motor block duration (min)				
	Group B	Group R	Unpaired T test	P Value
No	25	25	4.383	0.0001
Mean	513.6	432		
Std.Dev	63.67	67.88		
Median	480	480		

Duration of motor block was significantly longer in groupB as compared to groupR (P<0.05)

TABLE 5: Comparison of sensory block duration between group B & group R

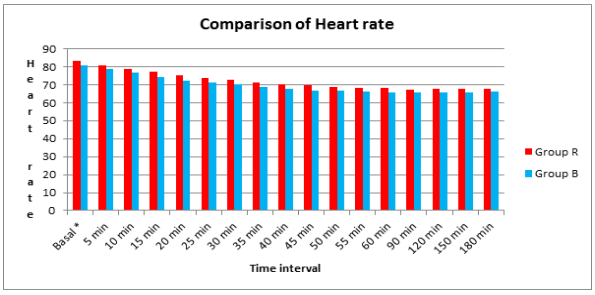
Sensory duration (mins)				
	Group B	Group R	Unpaired t test	P value
No	25	25	4.314	0.0001
Mean	532.8	451.2		
Std.Dev	59.56	70.21		
Median	480	480		

Duration of sensory block was significantly more in groupB as compared to groupR (p<0.05)

TABLE 6 : Comparison of analgesia with VNRS between group B and R

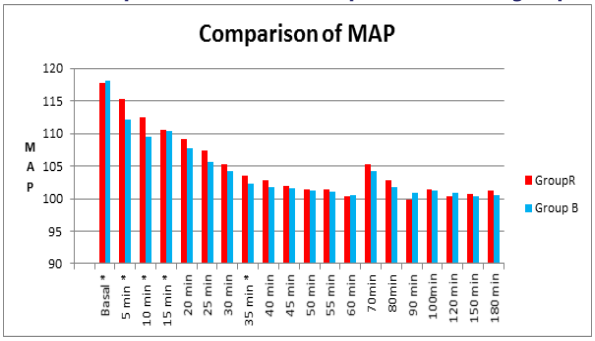
VNRS	Group B		Group R		P value
	Mean	SD	Mean	SD	
Basal	2.2	1.041	2.24	1.091	0.895
At incision	0.2	0.408	0.16	0.374	0.72
At end of surgery	0.04	0.2	0.04	0.2	1
At 4 hour	0.04	0.2	0.04	0.2	1
At 6 hour	0.44	0.583	0.48	0.586	0.81
At 8 hour	1.6	0.707	1.68	0.748	0.699
At 10 hour	3.04	0.539	3.08	0.493	0.785
At 12 hour	3.44	0.507	3.48	0.51	0.782

Chart 1 : Comparison of Heart rate response at different time intervals



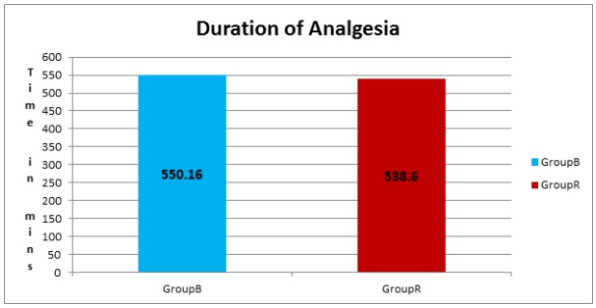
The changes in Heartrate were not significantly different in both groups.

Chart 2 : Comparison of Mean arterial pressures in both groups



The changes in mean arterial pressures in both groups were found to be not significant both intraoperatively and postoperatively.

Chart 3: Comparison of duration of Analgesia



No significant difference in the duration of postoperative analgesia.

DISCUSSION

Axillary block is one of the many upper extremity blocks and has proved useful in routine as well as emergency orthopedic procedures,

Using ropivacaine is said to have better safety profile as compared to bupivacaine. Bupivacaine is cardiotoxic and also causes prolonged motore block.

In this study we have compared the two drugs by dividing them into two groups using 0.5% bupivacaine and 0.5% ropivacaine in ultrasound guided axillary block in forearm surgeries, comparison between duration of onset of sensory and motor block and duration of action and post operative analgesia along with hemodynamic stability has been made.

The mean(median) onset of sensory block in Group B was 13.6(15) minutes and in Group R was 8.4(10). It was found that onset of sensory blockade was delayed in Group B compared to Group R. This findings are statistically significant (p value < 0.05).

Anupreet Kaur et al observed onset of sensory block at 5mins in ropivacaine and 10mins in bupivacaine.

The mean duration of sensory block in Group B was observed to be 532.8(-/+59.56) minutes and in Group R was 451(-/+70.21) minutes. It is statistically significant. Similar results were seen by Anupreet Kaur etal in 2015 and Surendra Raikwar in 2013.

Motor block to grade 3 of Modified Bromage Scale was achieved in 24.2(25) [mean (median)] minutes in bupivacaine group and 20.8 (20) [mean (median)] minutes in ropivacaine group. It was found that onset of motor block (Bromage scale 1,2,3) was achieved earlier in Group R as compared to Group B. This was a statistically significant difference (p < 0.05).

The duration of motor block in Group B is 513(-+63.67) minutes and in Group R is 432(-+67.88) minutes. This is statistically significant (p<0.05)

This correlates well with study done by **Anupreet Kaur et al** in which Onset of motor block was observed to be initiating at 5 min interval itself in Group II whereas in Group I, onset of motor block was observed from 20 min interval onwards.

Many different studies used different doses and approaches to compare ropivacaine and bupivacaine and results have been quite variable. In 2015 **R A Kooloth et al**[60] compared 0.5% bupivacaine with 0.5%ropivacaine and found that mean duration of motor block was 480.43±55.26 min and 507.70±56.07 min in group R and group B respectively but not significant. In 2015 **G.Visala et al**[57] compared Ropivacaine and Bupivacaine for Interscalene block in 60 patients.They found the time of onset of motor block was 12.667 ± 3.516 mins in Group-B and 13.033 ± 3.746 mins in Group-R which is not significant.

Intraoperatively the median MAP range from 100-112mmHg in group B and from 99-115 mmHg in group R. This difference betweeen MAP at various time intervals was also found to be not significant statistically, Intraoperatively, the median heart rates range from 70-88 in group B and from 70-83 in group R. This difference betweeen heart rates at various time intervals was also found to be not statistically significant

Both groups did not show any adverse effects and this may be due to use of ultrasound guidance and reduced volume of drug.

CONCLUSION:

Ropivacaine 0.5% has an early onset of sensory blockade as well as motor blockade compared bupivacaine 0.5% and has a longer duration of sensory blockade and duration of motor blockade is lessthan bupivacaine 0.5% .Use of ultrasound for performing brachial plexus block allows accurate nerve localization and reduces the dose and volume of drug. Analgesia due to ropivacaine 0.5% and bupivacaine 0.5% is of similar durations. This study suggests that Ropivacaine is a suitable alternative to Bupivacaine for forearm surgeries under ultrasound guided Axillary Block.

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