

# A Comparative Study on the Quality of Blockade by Bupivacaine and Ropivacaine for Supraclavicular Block

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## ABSTRACT

**Introduction:** Bupivacaine and Ropivacaine are the two most frequently used local anesthetics for brachial plexus blocks. There are many studies comparing the onset, duration and recovery of the patient after the anesthesia, but not many of these studies focus on the quality of anesthesia in terms of requirement of additional anesthesia intraoperatively. Therefore, this study aimed to assess the quality of anesthesia provided by the reduced concentration of both the anesthetic agents.

**Material and Method:** The study was carried out on patients in the age group of 18 to 60 years with ASA grade I and II, undergoing elective operative procedures for upper limb surgeries (i.e. elbow, forearm and hand surgeries). They were randomly divided in Group I (Bupivacaine) and Group II (Ropivacaine). The quality of anesthesia was assessed.

**Results:** While only 9 patients in Group II required additional anesthesia (1 case: general anesthesia), 20 patients in Group I required additional anesthesia (5 cases: general anesthesia). Rest all the parameters were comparable.

**Conclusion:** Both the drugs provided effective anesthesia in low concentrations. However, the quality of anesthesia was better with Ropivacaine compared to Bupivacaine.

**Keywords:** Bupivacaine, Clonidine, Quality of Anesthesia, Ropivacaine, Supraclavicular Block

Clonidine is known to be one of the adjuvants to local anesthetics.<sup>9</sup> When used in supraclavicular blocks, it may reduce the dose requirements of local anesthetic, providing a greater margin of safety, with added advantage of prolongation of sensory and motor block.

In this study, the quality of anesthesia was compared for supraclavicular brachial plexus block, in terms of requirement of additional anesthesia intraoperatively. Ropivacaine and Bupivacaine were used in low concentrations (0.25%), with Clonidine used as an adjuvant.

## MATERIAL AND METHODS

This was a randomized, double-blind, non-crossover type interventional study conducted in K.E.M. Hospital, after approval from the Institutional Ethics Committee. Patients in the age group of 18 to 60 years with ASA grade I and II, undergoing elective operative procedures for upper limb surgeries (i.e. elbow, forearm and hand surgeries) were included in the study. Patients with a history of bleeding disorders or on anticoagulant therapy, patients having local infection, respiratory disease, known allergy to local anaesthetic drugs, patients belonging to ASA grade III and IV and patients refusing to participate were excluded from the study. Pre-operative written informed consent was taken and routine investigations (CBC, ESR, blood grouping, urine examination for albumin, sugar and microscopy, random blood sugar, Bleeding time, clotting time, chest x-ray, ECG) were done. Other pre-operative routine was followed.

A total of 60 patients were included in the study which were randomly assigned to one of the following groups:

**Group – I:** Bupivacaine group received 30 ml of 0.25% Bupivacaine + Clonidine 1 microgram/kg.

## INTRODUCTION

Pain is one of mankind's oldest and most dreaded maladies. Despite increased knowledge and scientific advances, the diagnosis and effective treatment of pain remains one of the most formidable challenges with many difficulties and pitfalls. Regional nerve blocks are based on the concept that the pain is conveyed by nerve fibers; which are amenable to interruption anywhere along their pathway.

In the recent years, peripheral nerve blocks are gaining importance for their longer duration of action and postoperative analgesic effect. It avoids the side effects of general anaesthesia. Use of continuous plexus and nerve blocks addresses the wind up mechanism of pain.

Bupivacaine is commonly used in brachial plexus blocks because of its longer duration of action compared to Lignocaine. Concerns have been raised about the cardiotoxic effects of bupivacaine after accidental IV injection. Bupivacaine cardiotoxicity was more resistant to resuscitation compared to other local anaesthetics.<sup>1,2,3</sup>

Studies revealed that only one of the isomers of bupivacaine was cardiotoxic<sup>4,5</sup>, while the other brought about its clinically useful effects. So, scientists searched for a new stereo-isomer<sup>5</sup> which has less cardiotoxicity and found out Ropivacaine.<sup>6,7,8</sup>

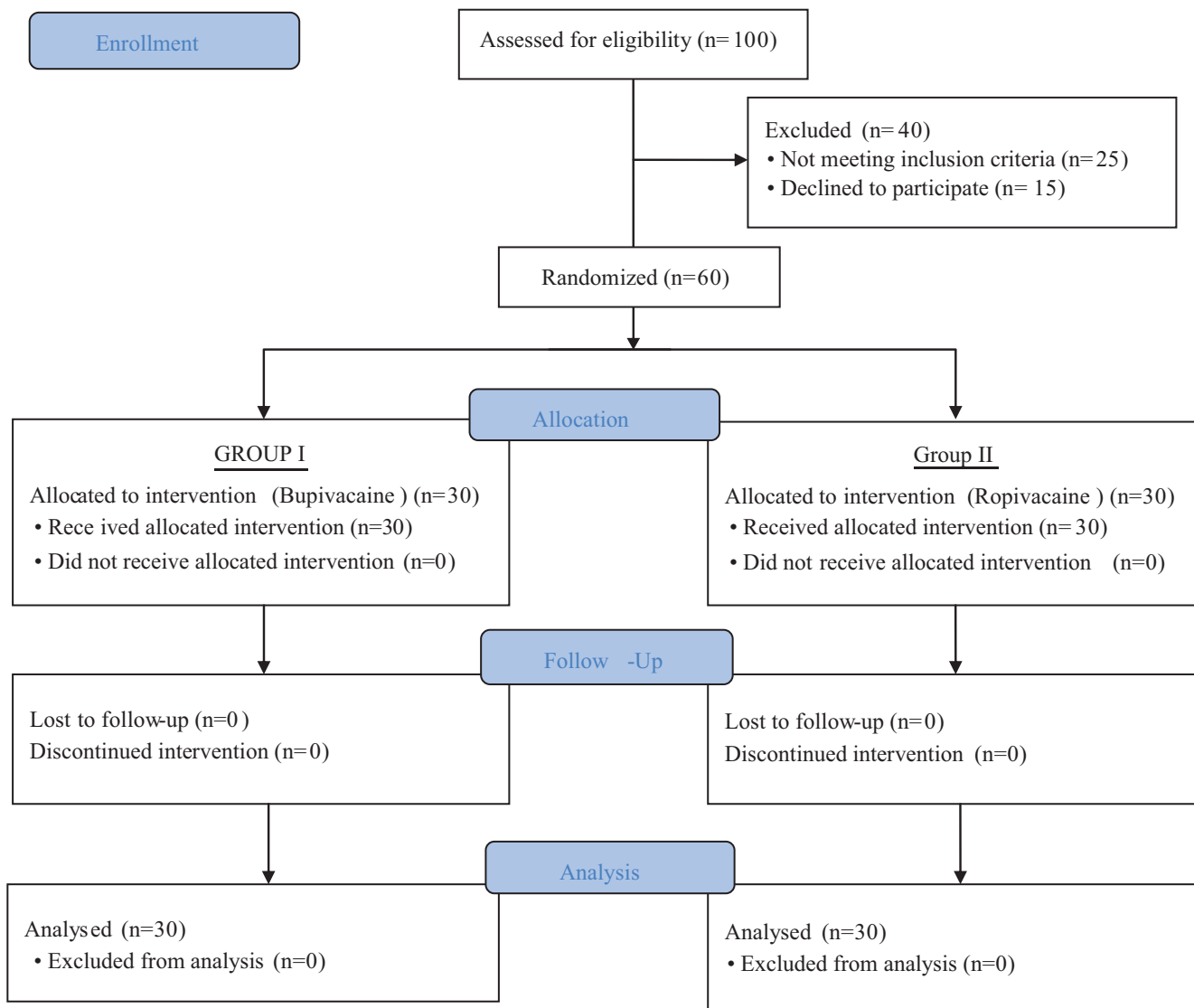
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CONSORT 2010 Flow Diagram



**Group – II:** Ropivacaine group received 30 ml of 0.25% Ropivacaine + Clonidine 1 microgram/kg.

Under aseptic conditions, supraclavicular block was given using peripheral nerve stimulator, as per the assigned Group.

Sensations were assessed once every 1 minute for 30 minutes and thereafter every 30 minutes.

Onset of sensory block was considered from the analgesia to pinprick sensations. It was assessed with a short beveled 23G needle and was graded as

- 0 - no pain
- 1 - mild pain-grimace
- 2 - moderate pain-withdrawal
- 3 - severe pain screams.

Onset of motor block was considered as no movement of the anesthetized arm and was graded as follows:

- 0 - no movement
- 1 - flickering movement
- 2 - movement along gravity but not against resistance
- 3 - movement against gravity
- 4 - movement against resistance

5 - normal movement of upper limb

Grades 1 and 2 of sensory block and Grades 1, 2 and 3 of motor block were considered as partial block. Grade 3 of sensory block and grade 4 and 5 of motor block were considered as complete failure of block.

The quality of the block was graded as:

Grade I : No adjuvant used throughout the study.

Grade II : Opioids used in the intraoperative period.

Grade III : Surgery had to be done under General Anesthesia.

Patients were monitored for cardiac, pulmonary and other complications.

### STATISTICAL ANALYSIS

Data was analyzed using SPSS. P value was calculated using Chi square test (for non-parametric data) and t-test (for parametric data). P value of less than 0.05 was considered to be significant.

### RESULTS

Both the Groups were comparable in terms of age, sex and

Diagnosis	Group I	Group II	Total	P value	Statistical significance
Fracture	12	14	26	0.93	Not significant
Crush injury forearm/hand	7	7	14		
AV Fistula creation (Chronic Kidney disease)	8	7	15		
Others	3	2	5		
Total	30	30	60		

Table-1: Distribution of patients according to the diagnosis

Parameter	Group I Mean $\pm$ S.D	Group II Mean $\pm$ S.D	P value	Statistical significance
Duration of surgery	71.0 $\pm$ 21.11	73.0 $\pm$ 23.54	0.73	Not significant

Table-2: Mean duration of surgery in minutes

Grades	Group I	Group II	Total	P value	Statistical significance
I	10 (33.33%)	21 (70%)	31	0.0129	Statistically significant
II	15 (50%)	8 (26.67%)	23		
III	5 (16.67%)	1(3.33%)	6		
Total	30	30	60		

Table-3: Quality of blockade

weight. After the onset of action (sensory and motor block), the quality of anesthesia was studied. The distribution of the patients according to the surgeries performed is as per Table 1. Both the Groups were also comparable in terms of mean duration of the surgery ( $P$  value  $>0.05$ ) (Table 2). Quality of blockade, studied in terms of requirement of additional anesthesia intraoperatively, showed statistically significant difference between the two Groups (Table 3).

## DISCUSSION

In 1970, Alon P Winnie, introduced interscalene brachial plexus block and emphasized that scalene muscles are more accurate landmarks to the nerves than the subclavian artery or midclavicular line. Continuous infusions into the roots of brachial plexus have been introduced and can provide long lasting analgesia after surgeries on arm and shoulder.<sup>10</sup> Thus, Brachial plexus blockade for upper limb surgeries is the most common peripheral nerve block technique used.

A variety of Local anaesthetics have been used to bring about adequate blockade for intra and post-operative analgesia. Bupivacaine is most commonly used because of its longer duration of action extending into the post-operative period.<sup>11</sup> There are many studies comparing the onset, duration and recovery of the patient after the anesthesia, but not many of these studies focus on the quality of anesthesia in terms of requirement of additional anesthesia intraoperatively. Thus, this study was undertaken to study the quality of anesthesia with Ropivacaine and Bupivacaine in low concentrations (0.25%) with clonidine as an adjuvant.

Out of the patients given supraclavicular block, 10 (33.33%) patients in Group I and 21 (70%) patients in Group II had adequate block. 15 (50%) patients in Group I and 8 (26.67%) patients in Group II required intraoperative opioids due to incomplete block. 5 (16.67%) patients Group I and 1 (3.33%) patient in Group II had to be converted to general anesthesia due to complete failure of block. Reasons encountered were

inadequate motor blockade and failure rate associated with peripheral nerve stimulator.

Though generally studies are performed with 0.5% or higher concentration of anesthetic drug, Rosemary Hickey et al<sup>12</sup> performed subclavian perivascular block using 0.25% Ropivacaine and 0.25% Bupivacaine. They found it inadequate to provide optimal operating conditions. This is in contrast to the present study, where adequate blockade was achieved with the same concentration, possibly due to:

1. Use of peripheral nerve stimulator ensuring drug delivery very close to the nerve bundle (0.5 mA current strength used).
2. Use of an adjuvant (clonidine) to overcome the reduction in concentration of local anesthetics used.

Also, in the present study, it was clearly evident that Ropivacaine provides better quality of anesthesia compared to Bupivacaine in terms of intraoperative requirement of additional anaesthesia.

This was similar to the study by Laura Bertini et al<sup>13</sup> which found Ropivacaine to be better than Bupivacaine at 0.5% concentration. Also it was found that increasing the concentration of Ropivacaine to 0.75% did not have any significant impact on the quality of anesthesia.

Similarly in the study by D Tripathi et al<sup>14</sup>, the blockade achieved by Ropivacaine was better than Bupivacaine. But the concentration used was 0.75% Ropivacaine against 0.5% Bupivacaine.

Capnogna G. et al<sup>15</sup> compared relative potencies of Bupivacaine and Ropivacaine for analgesia in labor. They found Ropivacaine to be better than Bupivacaine. They also found that 7 patients in Bupivacaine Group and 6 patients in Ropivacaine Group required rescue top ups. However, this difference was not found to be statistically significant.

However, Kooloth R et al<sup>16</sup> in their study, did not find any significant difference in the quality of blockade by Bupivacaine and Ropivacaine for supraclavicular blocks.

Similarly, study by Vainionpaa VA et al<sup>17</sup> compared the clinical and pharmacokinetic profiles of 0.5% Ropivacaine with 0.5% Bupivacaine in 60 patients in supraclavicular brachial plexus block. No statistically significant difference was found between the two drugs in the clinical and pharmacokinetic profiles.

Similar were the conclusions of the study by Himat Vaghadia et al<sup>18</sup>, which compared 0.75% Ropivacaine with 0.5% Bupivacaine and did not find any significant difference in the quality of anaesthesia.

There was no side effects in both the Groups. This may be attributed to the low concentration of the anesthetic agent used in the study.

**Limitations:** This study was limited to the OPD attendance of the patients for elective upper limb surgeries requiring supraclavicular block. Therefore, the results may not be generalised.

## CONCLUSION

From the present study, the following can be effectively concluded:

Ropivacaine and Bupivacaine, in the concentration of 0.25%, can provide adequate anesthesia/blockade, provided the use of proper technique of targeted administration of the anesthetic agent alongwith addition of adjuvant preoperatively. The quality of anesthesia was better with Ropivacaine compared to Bupivacaine in terms of intraoperative requirement of additional anesthesia. The low concentration of the anesthetic agent eliminates any side-effects. Thus, evidently Ropivacaine (0.25%) provides adequate blockade, especially for upper limb surgeries requiring Supraclavicular block.

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