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Original Research Article

A comparative study on the effectiveness of bupivacaine and ropivacaine for supraclavicular block

Nekee Navin Sejpal[1]*, B. D. Bande[2], Kapil Navin Sejpal[3], Ravi Nirmalkumar Rajdeo[4]

[1]Department of Anaesthesiology, Govt. Medical College and Superspeciality Hospital, Nagpur, Maharashtra, India
[2]Department of Anaesthesia, Medicine and Critical Care, King Edward Memorial Hospital, Pune, Maharashtra, India
[3]Department of Nephrology, JIPMER, Pondicherry, India
[4]Consultant Radiologist and Director, Photon Scan Pvt. Ltd., Nagpur, Maharashtra, India

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***Correspondence:**
Dr. Nekee Navin Sejpal,
E-mail: dr.nekeesejpal@yahoo.com

ABSTRACT

Background: Bupivacaine and Ropivacaine have been extensively studied &their properties with respect to onset, duration and quality of block. This study aims to detect whether addition of clonidine to both of them changes their properties. This study also aims to use lower than usual dosages for both the local anesthetics to prevent adverse effects of local anesthetics.
Methods: After obtaining ethical approval, the study was carried out on patients undergoing elective upper limb surgeries. They were randomly divided into two Groups: Group B and Group R. The onset and duration of sensory and motor blockade and other parameters were assessed.
Results: The onset of blockade, both sensory & motor was earlier in Ropivacaine as compared to Bupivacaine group. Mean duration of blockade, both sensory & motor, was more in the Bupivacaine group.
Conclusions: Addition of Clonidine enabled the use of low concentrations (0.25%) of both the anesthetics. Also, Ropivacaine (0.25%) has faster onset of sensory and motor blockade, shorter duration of action and less motor blockade compared to Bupivacaine.

Keywords: Bupivacaine, Motor block, Ropivacaine, Sensory block, Supraclavicular block

INTRODUCTION

The history of alleviation of pain for surgery goes far back. The idea that pain is conducted in the nervous system, originated with the specific theory of Johannes P Muller, described in 1826.[1] This was followed by the alternate intensity theory of Erb in 1874; an idea that later culminated in the gate theory of pain by Melzack and Wall in 1965.[2,3] In 1855, Rynd described the idea of introducing a solution of morphine hypodermically around a peripheral nerve.[4]

Wood, in 1855 was the first person to perform a subcutaneous injection with a graduated glass syringe and a hollow needle, a device developed initially by Pravaz for injection of ferric chloride into an aneurysm to produce coagulation.[5,6]

Trephination was practiced by Incas, and their tradition holds that the 'Shaman', performing the procedure chewed Cocoa Leaves and Spat into the wound producing local anaesthetic effect.[7]

In 1881, Carl Koller demonstrated ocular surface anaesthesia with cocaine.[8] Ester local anaesthetics which were developed later lost their value due to short duration of action, allergic reaction and systemic toxicity. Later amide anaesthetics were synthesized. In the recent years, peripheral nerve blocks are gaining importance for their longer duration of action and post-operative analgesic effect. It avoids the side effects of general anaesthesia. Use of continuous plexus and nerve blocks addresses the wind up mechanism of pain.

Some agents that do not have pain-alleviating property per se, but when added to the anesthetic agent, help in prolonging the block while reducing the quantity of the anesthetic required are called adjuvants. Clonidine is one such adjuvant to local anesthetics.[9] It is a centrally acting, selective alfa 2 adrenoceptor agonist which reduces central sympathetic outflow.[10] It has sedative, analgesic properties, it provides perioperative haemodynamic & sympathoadrenal stability.[9-11]

This study was undertaken to compare the effectiveness (in terms of sensory and motor blockade) of Bupivacaine and Ropivacaine in supraclavicular brachial plexus block with Clonidine as an adjuvant.

METHODS

With the approval of the Institutional Ethics Committee, a double blind, randomized, non-crossover type interventional study was carried out at K.E.M Hospital, Pune between August 2014 to November 2014.

The patients were included in the study based upon the following criteria:

Inclusion criteria

- Patients of age group between 18 and 60 years
- ASA grade I and II,
- Patients admitted for elective operative procedures for upper limb surgeries.

Exclusion criteria

- Refusal to participate
- Systemic co-morbidities like history of bleeding disorders or patients on anticoagulant therapy,
- Local infection,
- Respiratory disease,
- Known allergy to local anaesthetic drugs
- ASA grade III and IV patients.

Parameters assessed (quantitative)

- Onset of sensory blockade
- Onset of motor blockade
- Duration of sensory blockade
- Duration of motor blockade

Each patient was visited preoperatively, the procedure was explained and informed written consent was obtained. Routine pre-operative investigations were done.

Each patient was randomly assigned to one of the two groups of 30 patients each, Group B or Group R.

Group - B i.e., Bupivacaine group received 30 ml of 0.25%Bupivacaine + clonidine 1microgram/kg.

Group - R i.e., Ropivacaine group received 30 ml of 0.25% Ropivacaine + clonidine 1microgram/kg.

Each patient was made to lie supine without a pillow, arms at the side, head turned slightly to the opposite side with the shoulders depressed posteriorly and downward by moulding the shoulders over a roll placed between the scapulae. The supraclavicular area was aseptically prepared and draped. The anesthesiologist stands on the side of the patient to be blocked, facing the head of the patient, since this position allows better control of the needle.

An intradermal wheal was raised with local anaesthetic approximately 1cm above the midclavicular point. The subclavian artery palpable in supraclavicular fossa was used as landmark. The tip of index finger was rested in supraclavicular fossa directly over the arterial pulsation. A filled 10ml syringe attached to a 23 gauge, 32mm needle, was held in right hand and the needle was connected to the peripheral nerve stimulator. The needle was inserted through skin and advanced slowly downward (caudal) rolled slightly inward (medially) and slightly backward (posteriorly).

Response to electrical stimuli ranging from 2mA, gradually reducing to 0.5mA was tested, & when twitches were seen in forearm muscles, the needle was fixed in position. After confirming negative aspiration of blood, 30ml of the drug solution was injected.

Intraoperative and postoperative monitoring:

Time of onset of sensory block was recorded using pinprick in skin dermatomes C4-T2 once in every 1 minute for the first 30 minutes after injection and thereafter every 30 minutes till patient regained normal sensations. The same observer assessed the motor block at same time intervals.

Onset of sensory block was from the time of injection of drug to time of loss of pain on pinprick. Onset of motor block was from the time of injection to time of complete loss of movement.

The heart rate, saturation, respiratory rate and blood pressure were recorded at intervals of 5 minutes. Patients were observed for complications such as bradycardia, convulsions, restlessness, disorientation or drowsiness.

Statistical analysis

P value of less than 0.05 was considered significant. It was calculated by SPSS using Chi square test for non-parametric data and t-test for parametric data.

RESULTS

The present study was conducted on 60 consenting patients aged between 18-60 years. Group B received 30ml of 0.25% Bupivacaine + clonidine 1 microgram/kg.

Table 1: Comparison of onset of sensory blockade in Group B and Group R.

Group B			Group R			p value	Significance
Minimum duration (minutes)	Maximum duration (minutes)	Mean ± S.D (minutes)	Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)		
18	22	19.37±1.07	16	20	18.4±1.43	0.0043	Statistically significant

Table 2: Comparison of onset of motor blockade in Group B and Group R.

Group B			Group R			p value	Significance
Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)	Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)		
20	27	24.07±1.93	20	26	23.13±1.63	0.047	Statistically significant

Table 3: Comparison of duration of sensory blockade in Group B and Group R.

Group B			Group R			p value	Significance
Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)	Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)		
225	567	429.1±86.55	210	483	368.57±63.75	0.0031	Statistically significant

Table 4: Comparison of duration of motor blockade in Group B and Group R.

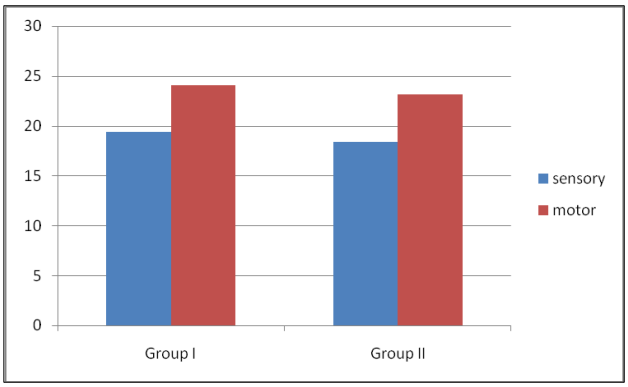
Group B			Group R			p value	Significance
Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)	Minimum duration (minutes)	Maximum duration (minutes)	Mean±SD (minutes)		
159	555	357.87±103.72	150	403	248.9±69.04	<0.0001	Statistically significant

Group R received 30 ml of 0.25% Ropivacaine+clonidine 1 microgram/kg for brachial plexus block by supraclavicular approach.

The two Groups were comparable in terms of demographic variables (viz. age and sex) and physical attributes (viz. weight). The onset of sensory blockade was earlier in Group R compared to Group B and the difference was statistically significant (Table 1).

Similarly, the onset of motor blockade was also earlier in Group R compared to Group B with statistically significant difference (Table 2). But the duration of blocks: sensory (Table 3) and motor (Table 4) was significantly more in Group B than in Group R. Thus, though Group R had earlier onset of action/shorter duration of induction of both: sensory and motor blockades, however the duration of both the blockades was more sustained in Group B.

Figure 1 shows Mean onset of sensory and motor block, in minutes, in group Bupivacaine and group Ropivacaine. Figure 2 shows Mean duration of sensory and motor block, in minutes, in group Bupivacaine and Ropivacine.



*Group 1 = group Bupivacaine, Group 2 = group Ropivacaine.

Figure 1: Mean onset of sensory and motor blockade in minutes.

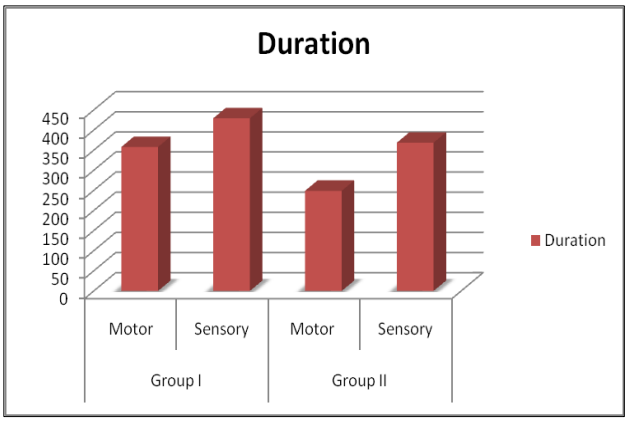


Figure 2: Mean duration of sensory and motor blockade in minutes.

DISCUSSION

Peripheral nerve blocks have become important in clinical practice because of their role in post-operative pain relief and shortening outpatient recovery.[12]

Different drugs are being used to achieve adequate sensory and motor blockade with fewer side effects. Over the years, various studies have been conducted to compare the efficacies of these drugs, in the zest to find the most suitable anesthetic agent. This study compares two such drugs: Bupivacaine and Ropivacaine, in low concentrations. In this study, the onset of sensory and motor blockade was faster in Group R as compared to Group B. This is similar to the study by Laura Bertini et al, D Tripathi et al, Modak S Basantwani S and Anupreet Kaur et al.[13-16] In the study by Hickey R, Hoffman J et al, and Vainionpaa et al, no significant differences were found in the onset of blockade by both the local anesthetics.[17,18] This may be due to the fact that in the present study peripheral nerve stimulator guidance was used, which enabled targeted drug delivery and hence, the difference in the results.

In this study, the duration of motor and sensory blockade was lesser with Ropivacaine compared to Bupivacaine. This was similar to the study by D Tripathi et al, Modak S Basantwani S, Anupreet Kaur et al and Iwao Sakonju et al, which reported shorter duration of action with Ropivacaine.[14-16,19]

However, it is in contrast to the study by Himat Vaghadia et al, which found that both drugs were comparable in duration of action.[20] However, in this study, different concentrations of the anesthetic agents were used, which might have led to the comparable results.

In another study, Casati et al, compared the onset and quality of interscalene brachial plexus block using 30 ml of 0.5% Levobupivacaine with 0.5% Ropivacaine.[21] The onset was found to be similar in both groups which does not match with the present study. None the less, their study also found that when starting patient controlled infusion analgesia, motor blockade was more profound in patients of group Levobupivacaine than Ropivacaine, after 4 hours of initial bolus. This was in accordance with the present study. The study, however, does not provide adequate information on time for complete resolution of nerve block as the interscalene patient controlled infusion was started before complete resolution of nerve block induced by first bolus.[21]

None of the patients developed any significant side effects during the course of this study.

This study was limited to elective upper limb surgeries. Also, the study was limited by the OPD attendance of patients. Therefore, the results may not be generalised.

CONCLUSION

On the basis of this study, it can be concluded that addition of Clonidine and the use of peripheral nerve stimulator enabled the use of Ropivacaine and Bupivacaine in low concentrations (0.25%), which provided adequate analgesia for supraclavicular block. It is further concluded that Ropivacaine (0.25%) with clonidine has faster onset of sensory and motor blockade, shorter duration of action and less motor blockade compared to 0.25% Bupivacaine with clonidine in supraclavicular brachial plexus block.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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