ORIGINAL ARTICLE

COMPARISON OF THE MOTOR AND SENSORY BLOCK BY ROPIVACAINE AND BUPIVACAINE IN COMBINATION WITH LIGNOCAINE IN SUPRACLAVICULAR BLOCK

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ABSTRACT

Introduction: With the introduction of newer and safer local anaesthetics and better advancement in technique for regional anaesthesia, brachial plexus block has taken over. Ropivacaine is a new amino amide local anaesthetic with less cardiotoxicity when compared to Bupivacaine. The aim of our study is to compare ropivacaine 0.75% with bupivacaine 0.5% when both of them are combined with xylocaine 2% in upper limb surgeries under supraclavicular block.

Material and Method: In this prospective double blind study, sixty patients of ASA- I and II scheduled for upper limb orthopaedic surgeries were randomly divided into two groups. Group R received Ropivacaine 0.75% 20 ml plus Xylocaine 2% 10 ml while Group B received Bupivacaine 0.5% 20 ml plus Xylocaine 2% 10 ml via supraclavicular route.

Results: Group Bupivacaine showed prolonged duration of sensory and motor block and prolonged duration of analgesia compared to Group Ropivacaine but the difference was statistically insignificant. ($p>0.05$)

Conclusion: Ropivacaine 0.75% and bupivacaine 0.5% showed similar onset and duration for sensory and motor block when used for supraclavicular brachial plexus block along with xylocaine. They also provide almost equal duration of analgesia. Because Ropivacaine has a potentially proven safety profile compared to Bupivacaine, it may offer an advantage.

Keywords: Supraclavicular Block, Ropivacaine, Bupivacaine, Xylocaine

INTRODUCTION

Brachial plexus block provide a useful alternative to general anesthesia for upper limb surgery. They achieve ideal operating conditions by producing complete muscular relaxation maintaining stable intraoperative hemodyanamics and the associated sympathetic block.

Regional Anesthesia has more to offer in orthopedic surgery than in any other surgical specialty, either alone or as part of an anesthetic sequence. With Regional Anesthesia there are[1] better preservation of mental functions in elderly; intact pharyngeal and laryngeal reflexes, thus decreasing the risk of aspiration; it ensures a decreased stress response in compromised patients and avoidance of difficult intubation[2]; it also decreases post operative complications associated with intubation; and it provides better postoperative pain relief without undue sedation facilitating early mobilization and discharge.

Bupivacaine has been in clinical use for more than 30 years. It is widely used foranaesthesia but it is associated with a number of side effects, including motor weakness, cardiovascular and central nervous system toxicity[4].

This has resulted in the continuing search for new and safer local anaesthetic Agents.

Ropivacaine has several properties which may be useful in practice, namely thepotential to produce differential neural blockade with less motor block andreduced cardiovascular and neurological toxicity[3].

The present study is to compare the effect of ropivacaine 0.75% 20 ml plus xylocaine 2% 10 ml versus bupivacaine 0.5% 20 ml plus xylocaine 2% 10 ml in upper limb surgeries under supraclavicular block.

AIMS AND OBJECTIVES

To compare the effect of Ropivacaine 0.75% 20 ml plus lignocaine 2% 10 ml versus bupivacaine 0.5% 20 ml plus lignocaine 2% 10 ml in upper limb surgeries under supraclavicular block including onset and Duration of sensory block; onset and duration of motor block; duration of post operative analgesia; hemodynamic changes; and any side effects or complications.

MATERIAL AND METHOD

We studied 60 patients of Grade-I and Grade -II of American Society of Anesthesiologist's (ASA) classification and allocated them randomly into equal groups. The study was prospective and interventional in nature. All the patients participating in the study were explained clearly about the purpose and nature of the study in the language they could understand. They were included in the study only after obtaining a written informed consent.

Allocation of Groups: All 60 patients were divided into two groups of 30 each randomly.

Group R: Patients receiving 20ml of 0.75% of **Ropivacaine** plus Xylocaine 2% 10 ml by supraclavicular route.

Group B: Patients receiving 20ml of 0.5% of **Bupivacaine** plus Xylocaine 2% 10 ml by supraclavicular route.

Patients in the age range 18-70years, 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, while those patients with severe pulmonary, cardiac, renal or endocrine disease(ASA> Or equal to 3)with local skin infections at site of injection, with coagulopathy.on potent antiplatelet, or on anticoagulants, allergy to the trial drugs, with hemidiaphragmatic paralysis on contralateral side of surgery, with psychological disorder and not willing to sign the consent were excluded from the study.

A routine pre-anaesthetic evaluation of each case was done after noting the medical history. A thorough systemic examination was carried out to detect the presence of any systemic disorder. Routine and special investigations were carried out accordingly.

Local examination of block site was done to exclude any sign of sepsis, previous injury or previous deformity. Patients were kept nil orally 6-8 hours prior to induction and Tab. Alprazolam 0.25 mg was given on the night prior to surgery. The patients were reassured, the procedure of block was explained and a written informed consent was obtained from them.

On arrival of the patient in the operation theatre, BPL Multipara monitors were applied and base line respiratory rate, pulse rate, non invasive blood pressure, SPO_2 and ECG were recorded. Intravenous line was secured with 18G intracath and the patients were given I.V. Fluids according to the requirement.

Premedication of Inj. Ondansetron 4 mg, Inj Ranitidine 50 mg and Inj Midazolam 1mg were given intravenously 5 minutes before giving supraclavicular brachial plexus block.

Technique: After proper positioning, cleaning and draping,using classic technique approach, 22-gauge one and half inch needle was inserted at the point of entry above the midpoint of clavicle in the backward-inward-downward direction (BID) until paraesthesia was elicited in the forearm or hand and after negative aspiration for air or blood, 30 ml of a solution containing local anaesthetic was injected and a 3 minute massage was performed.

The drugs were prepared by another investigator and the anaesthesiologist performing the block was blinded to the study drug.

ASSESSMENT OF THE BLOCK

1. **Onset of Sensory and Motor Blockade** was monitored every minute for first 10 minutes then every 2 minutes till 30 mins.

   Sensory blockade: Assessment of sensory block was done after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve. Sensory block was measured with pin prick test at a three point scale. 0 - Sharp pain; 1 - Dull pain (analgesia); 2- No pain (anaesthesia)

   Onset of Sensory Block was considered when there was complete loss of sensation to pin prick. The block was judged to have **failed** if anaesthesia was not present in 2 or more peripheral nerve distributions and such patients were excluded from the study.

   Motor Blockade: Onset of motor block was considered as time from injection to the inability of the paient to move his/her fingers or raise their hand. Motor block was measured at every minute for first 15 minutes and then every 2 minutes for next 45 minutes by assessing the following motor functions: Flexion at the elbow(musculocutaneous nerve); Extension of the elbow and wrist(radial nerve); Opposition of thumb and index finger(ulnar nerve).

   It was graded according to the following scale: 0 – no block(full muscle activity); 1 –partial block(decreased muscle activity); 2 – Complete block(no muscle activity).

   In case of both sensory and motor blockade a score of two denote complete onset of block.

2. The **duration of sensory blockade**, defined as the time between onset of sensory block and return of dull pain and VAS<3, was assessed every 30 minutes postoperatively in at least 3 major nerve distributions

3. The **duration of motor block**was assessed every 30 minutes till the ability of the patient to move his/her fingers.

4. The **duration of analgesia**, defined as the time between onset of action and onset of pain(VAS MORE THAN OR EQUAL TO 4), was the time when patients received the first dose of analgesic in form of injection diclofenac sodium 75 mg.

During surgery pulse, arterial blood pressure and peripheral oxygen saturation and ECG were monitored. Pulse, systolic BP and diastolic BP were recorded every 15 minutes till end of surgery and Oxygen was routinely administered via oxygen mask at the rate of 4L/min. Maximum duration of all surgeries was not more than 120 minutes.

The patients were monitored for side effects and complications like confusion, auditory and visual disturbances, convulsion, arrhythmias, sedation and respiratory depression.

OBSERVATION

Demographic Data: There is no statistical difference in age, weight and sex distribution between two groups.

Sensory onset of group R is nearly 6.6 minutes while in Group B it is 7.4 minutes, and motor onset in group R is 12.9 minutes while that in Group B is 11.5 minutes.

The sensory onset is faster in Group R than in Group B but the motor onset is faster in Group B than in Group R, but statistically and clinically there is no significant difference between two groups.

There is no significant difference in intraoperative pulse, SBP and DBP

The duration of sensory block in Group R is nearly 9.13 hours while that in Group B is 9.81 hours, the duration of motor block in Group R is 8.9 hours while in Group B it is 9.93 hours and total duration of analgesia in Group R is 9.2 hours while that in Group B is 9.86 hours.

The duration of all ie sensory block, motor block and analgesia is more in Group B than in Group R but it is statistically not significant.

DISCUSSION

In our prospective randomized double blind clinical study we have compared 0.75% injection ropivacaine 20 ml plus 10 ml of injection lignocaine 2% in 30 patients (Group R) versus 0.5% injectionbupivacaine 20 ml plus 10 ml of injection lignocaine 2% in another 30 patients(Group B).

When administered as a bolus, *Casati et al* reported that ropivacaine 0.5% had similar pain relief with bupivacaine 0.5%[12,16], while ropivacaine 0.75% showed similar effects with bupivacaine 0.5% in the study by *Hoffman-Kiefer et al*[16]. According to study of *Laura Bertiniet al*[10], the higher concentration of ropivacaine added a little value to the clinical features of ropivacaine.Thus, there is no confirmed equipotent dose. Therefore, we selected the concentration of drugs according to our clinical practice using commercially available preparation in our country.

Table 1: Demographic characteristics of study population

Variable	(R group)	(B group)	p-value
Age (yrs)	37.13 ± 2.859	39.17 ± 2.501	0.5945
Weight (kg)	60.60 ± 2.031	56.63 ± 1.259	0.1023
Sex			
Male	23 (76.67%)	24 (80.00%)	
Female	7 (23.33%)	6 (20.00%)	

Table 2: Onset of Sensory and Motor Block in two groups (min) (Mean ± SD)

	Group R	Group B	p-value
Sensory block	6.600 ± 0.9230	7.467 ± 0.5045	0.4134
Motor block	12.93 ± 1.548	11.57 ± 0.7282	0.4277

Table 3: Intraoperative Monitoring of Pulse in two groups (min) (Mean ± SD)

Time (min)	Group R	Group B	p-value
15	87.87 ± 2.083	80.93 ± 2.979	0.0614
30	92.33 ± 1.916	87.37 ± 2.802	0.0548
45	91.00 ± 2.328	86.77 ± 2.651	0.0553
60	86.83 ± 1.878	81.86 ± 2.779	0.1388
90	83.71 ± 2.859	78.53 ± 2.773	0.2024
120	80.67 ± 5.022	74.50 ± 4.031	0.4638

Table 4: Intraoperative Monitoring of SBP in two groups (mm of Hg) (Mean ± SD)

Time (min)	Group R	Group B	p-value
15	128.7 ± 2.590	126.7 ± 2.130	0.5401
30	127.6 ± 2.102	124.8 ± 1.470	0.2738
45	126.9 ± 1.732	125.3 ± 1.840	0.5291
60	129.1 ± 2.660	123.1 ± 1.807	0.0715
90	125.7 ± 2.407	124.2 ± 1.866	0.6296
120	127.3 ± 2.357	131.5 ± 3.775	0.3565

Table 5: Intraoperative Monitoring of DBP in two groups (mm of Hg) (Mean ± SD)

Time (min)	Group R	Group B	p-value
15	81.83 ± 1.580	80.27 ± 1.512	0.4767
30	83.60 ± 1.222	78.70 ± 1.418	0.0113
45	81.60 ± 1.180	76.77 ± 1.411	0.011
60	81.53 ± 1.271	78.04 ± 1.094	0.0429
90	78.67 ± 1.726	79.58 ± 1.150	0.6694
120	81.11 ± 2.312	81.00 ± 3.317	0.979

Table 6: Duration and Analgesia of Sensory and Motor Block in two groups (min) (Mean ± SD)

	sGroup R	Group B	p-value
Sensory block	548.2 ± 24.62	589.2 ± 27.74	0.2735
Motor block	534.4 ± 27.65	596.0 ± 24.70	0.102
Analgesia	555.4 ± 20.73	592.6 ± 24.03	0.2458

In our study there was no significant difference regarding age, weight and sex distribution between two groups.

The ***Sensory onset*** of group R is nearly 6.6 minutes while in Group B it is 7.4 minutes and the ***motor onset*** in group R is 12.9 minutes while that in Group B is 11.5 minutes.. The sensory onset was found to be faster in Group R than in Group B while the motor onset was faster in Group B than in Group R but there is no clinical and statistical significant difference between two groups(p>0.05) (Table 4)

The time of onset of sensory and motor block in study conducted by *Tomoki Nishiyama*[16] was as follows:

Sensory and motor onset in ropivacaine group was was 11 and 14 minutes while that in bupivacaine it was 10 and 11 minutes respectively. Like our study it was statistically insignificant(p>0.05) and onset was similar as ours.

Similar observations were found in the studies conducted by *HimatVaghadia et al*[9]*, Stephen M Klein et al*[8]*, Raeder J Cetal*[11]*,Misiolek et al*[14] where there was no statistically significant difference between the onset of sensory block among ropivacaine group and bupivacaine group(p>0.05).

In the study of *Hicker R et al*[7] *and Eroglu A et al*[13] the onset in ropivacaine group was 9-15 minutes and 18±12 minutes while that in bupivacaine group was 11-31 minutes and 21±13 minutes respectively. Like our study there was no statistically significant difference between two groups(p>0.05) but the onset was slower compared to our study which may be due to the use of plain ropivacaine and bupivacaine in their study and use of lignocaine in ours.

In the study conducted by *Misiolek et al*[14] which was done in patientswith end stage renal disease scheduled for surgical creation of arterio-venousfistula for hemodialysis, the onset of sensory block in both ropivacaine group and bupivacaine group is delayed compared to our study. This is probably because of these patients having metabolic acidosis as a result of Chronic end stage renal disease where ionized portions of both ropivacaine and bupivacaine will be decreased.

The ***duration of sensory block*** in Group R is nearly 9.13 hours(548.2 ± 24.62 minutes) while that in Group B is 9.81 hours(589.2 ± 27.74 minutes) and the ***duration of motor block*** in Group R is 8.9 hours(534.4 ± 27.65 minutes) while in Group B it is 9.93 hours(596.0 ± 24.70 minutes).Statistically no significant difference was found between the two groups(p>0.05).

In the study of *Nagia M Abd El Moeti et al*[15] the block duration was nearly 10.7 hours with ropivacaine and that with bupivacaine it was 10.9 hours. Like our study there was no significant difference between the two groups for duration of the block, however the duration was longer compared to ours probably due to the use of plain ropivacaine and bupivacaine(p>0.05).

As compared to this in the sudy of *Tomoki Nishiyama*[16] the duration of motor block in ropivacaine group was 7.5 hours and in bupivacaine group it was 5 hours while duration of sensory block in ropivacaine group it was 9 hours while that in bupivacaine group it was 6 hours. These results are statistically insignificant(p>0.05) but the duration is less compared to our study, the reason being use of less volume ofbupivacaine and ropivacaine(15 ml) and more volume of lignocaine(15 ml) compared to ours.

The ***total duration of analgesia*** in Group R is 9.2 hours(555.4 ± 20.73 minutes) while that in Group B is 9.86 hours(592.6 ± 24.03 minutes).(table 8). Statistically there was no significant difference between the two groups(p>0.05).

The duration of analgesia in the studies conducted by *Stephen M Klein et al*[8] and*Vaghadia et al*[9], like ours showed no statistically significant difference between ropivacaine and bupivacaine group for brachial plexus block(p>0.05). The longer duration of analgesia in the above studies compared to ours may be due to larger volume of study drugs (32to40ml) or use of plain ropivacaine and bupivacaine drugs.

In the study conducted by *Misioleket al*[14] the duration of analgesia in ropivacaine group is 450±156 minutes and in bupivacaine group is 528±192 minutes. In both groups the duration of analgesia was shorter compared to our study. This can be attributed to the smaller local anaesthetic concentration of drugs used and the chronic renal failure of the patients in this group. The hyperdynamic cardiovascular system and acidosis secondary to chronic anemia increase the elimination rateof local anesthetics and in turn cause 40% reduction in the duration of analgesia[17,18]

Studies comparing acute toxicity of ropivacaine to bupivacaine found that ropivacaine was at least 25% less toxic than bupivacaine with regard to tolerated doses with the threshold for CNS toxicity for ropivacaine being twice that of Bupivacaine. In many studies, maximum dose of ropivacaine up to 5mg/kg was reported to be safe without any toxic effect[6,8]. Also *Geiger and colleagues*[5]reported safe use of 225 mg (0.75%) ropivacaine to produce satisfactory sensory and motor blockade with stable hemodynamic profile and no sign of CVS and CNS toxicity. So we can say Ropivacine can produce equal and comparable block with Bupivacaine with reduced risk of complication even when used in higher concentration.

In this study, we have fixed the doses of ropivacaine and bupivacaine which were not based upon patient's body weight, that may have influenced the results described herein[19].

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