Original Research Article

Comparative evaluation of 0.5% Ropivacaine and 0.5 % Bupivacaine in Supraclavicular Brachial plexus block

Ranjeet Kumar Bihari[1], Deepak Kumar[2], Praveen Kumar Tiwary[3]

[1]Senior Resident, Department of Anesthesia and Critical Care, RIMS, Ranchi,India
[2]Senior Resident, Department of Anesthesia and Critical Care, RIMS, Ranchi,India
[3]Associate Professor, Department of Anesthesia and Critical Care, RIMS, Ranchi,India

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Abstract

Background: Brachial plexus blocks are commonly used for forearm and hand surgeries but due to adverse effect like cardiotoxicity there is lot of research going on to find more cardiostable agent. Ropivacaine is commonly tried now adays in place of bupivacaine for brachial plexus block. It is new amino amide local anaesthetic having less cardiac toxicity as compared to bupivacaine. **Aim:** The present study was performed at our Institute to compare the Clinical characteristics of 0.5% ropivacaine and 0.5% bupivacaine when used for supraclavicular brachial plexus block in forearm and hand surgeries. **Materials and Method:** In this prospective randomised study sixty patients of ASA-I and II scheduled for forearm and hand surgeries under supraclavicular brachial plexus block were randomly divided into two groups of thirty each. Group R received Ropivacaine 0.5% 20 ml + 10ml normal saline while Group B received Bupivacaine 0.5% 20 ml + 10ml normal saline. Mean pulse, blood pressure,onset of sensory and motor blockade, duration of analgesia, and side effecs of local anaesthetic used were noted in both the groups. Statistical analysis for clinical characterstics was done by student t test and ANOVA was used to analyze hemodynamic variations between two groups. $p<0.05$ considered as significant and $p<0.01$ considered as highly significant. **Results:** Mean onset time of sensory blockade was 5.5 ± 0.89 mins in Group R and 6.5 ± 0.65mins in Group B and motor blockade was 14.3 ± 2.64 mins in Group R and 12.4 ±2.06 mins in Group B. Mean duration of Analgesia in Group R was 432 ± 18.2 mins and in Group B was 492 ± 20.3 mins. There was no statistical significant difference in onset of sensory block, motor block and mean duration of analagesia between two groups ($p>0.05$). **Conclusion:** Supraclavicular brachial plexus block using either 0.5% Ropivacaine or 0.5% Bupivacaine have similar onset of sensory and motor blockade, duration of analgesia but due to potentially proven safety profile in the literatue compared to bupivacaine it may offer an advantage in modern clinical practice.

Keywords: Supraclavicular Block, Ropivacaine, Bupivacaine.

Introduction

Brachial plexus block provide a useful alternative to general anaesthesia for upper limb surgery. It results in obtaining ideal operating conditions by producing complete muscular relaxation and stable intra-operative hemodynamics. Regional Anaesthesia has a particular importance in the orthopedic surgery as compared to general anaesthesia due to better preservation of pharyngeal and laryngeal reflexes thus results in decreasing the risk of aspiration,[1] decreased stress response in compromised patients and avoidance of difficult intubation.[2] Regional Anaesthesia also results in better post- operative analgesia without undue sedation and facilitating early mobilization and discharge from the hospital.

Supra clavicular approach is commonly used for brachial plexus block because of its ease, reliability and high success rate. Moreover, this approach doesn't results in sparing of musculocutaneous or axillary nerves. Bupivacaine is a long acting local anaesthetic widely used in modern anaesthetic practice for more than thirty years but it results in severe cardiovascular and central nervous system toxicity. Hence there is a long term research is going on to find out new and safe agent for regional nerve block. Ropivacaine is a newer long acting amide local anaesthetic having improved safety profile as compared to bupivacaine.[3,4] Ropivacaine has several other advantages namely to produce differential blockade with less motor blockade along with reduced cardiovascular and neurological toxicity we hypothesized that ropivacaine can be used in supraclavicular brachial plexus block instead of bupivacaine for upper limb surgery. To test this hypothesis we compared the clinical characterstics of ropivacaine with bupivacaine at our institute on patients posted for upper limb surgery requiring brachial plexus block.

The aim of this study was to compare the efficacy and clinical characteristics of ropivacaine 0.5% and bupivacaine 0.5% in supraclavicular brachial plexus block posted for forearm and hand surgery.

Materials and Method

This prospective randomized study was conducted at Department of Anesthesia and Critical Care, at RIMS, Ranchi. The study was approved by the institutional research and ethical committee. The study was conducted between September 2019 and March 2020. An informed and written consent was taken from the participating subjects prior to the commencement of the study.

The present study was done on 60 cases of either sex of ASA Class I or II between age group of 18 and 50 years, weighing between 40 to 60 kilograms, scheduled for upper limb surgeries under supraclavicular brachial plexus block after approval by institutional ethical committee.

**Correspondence*
Dr.Praveen Kumar Tiwary
Associate Professor, Department of Anesthesia and Critical Care, RIMS, Ranchi,India
E-mail: drpkt80@gmail.com

A detailed history was taken and the patients were thoroughly examined on the previous day before the surgery. The procedure to be performed was explained to each patient.

Exclusion criteria

History of respiratory, cardiac, hepatic or renal disease, convulsions, pregnant women. Patient with the history of bleeding disorders, local infection at the site of injection, anomalies of neck and shoulder, fracture clavicle. Patients sensitive or allergic to lignocaine or bupivacaine.Baseline BP and Pulse were measured in preanaesthesia room, ringer lactate infusion was started after peripheral intravenous cannulation. Patients were premedicated with Inj. Glycopyrollate 0.01 mg per Kg of body weight intramuscularly half an hour before performing the block. Patients were shifted to operation theatre and monitor was connected. Inj. Midazolam 0.1 mg per Kg of body weight was given intravenously before administering brachial plexus block. The patients were randomly and equally divided into two groups of thirty each by computer generated randomization. The group R (Ropivacaine) patients were given 20 ml of 0.5% ropivacaine plus 10 ml normal saline while Group B (Bupivacaine) patients received 20 ml of 0.5% bupivacaine plus 10 ml normal saline. After turning the head to opposite side, painting and draping of the supraclavicular region was done. The supraclavicular block was performed by classical approach with a 23 gauge 4 cm long needle. The neurovascular bundle was located with peripheral nerve locator and the drug was injected on obtaining parasthesia after negative aspiration for blood.

During Surgery pulse, systolic blood pressure, diastolic blood presure, oxygen saturation and ECG were monitered. Pulse, systolic blood presure, diastolic blood presure were recorded every 15 mins till the end of surgery. Oxygen was routinely administered via oxygen face mask at the rate of 4 litre per min. Maximum duration of all the surgeries were upto 90 mins.

Sensory blockade was assessed by 3 point sensory score:

0-Sharp pain on pinprick,

1-Touch sensation on pinprick,

2-Not even touch sensation on pinprick.

Onset of sensory blockade was taken as the time between injection and the complete ablation of pinprick test (sensory score-2). Duration of sensory block will be defined as the time from complete block to return of the parasthesia (sensory score-0). If a sensory score of 2 was not achieved even after 30 minutes or if there was sparing in any segment, the sensory analgesia was deemed to be not satisfactory and these patients were excluded from the study. Complications of brachial plexus block and side effects of local anaesthetics used were also noted.

Motor blockade was also assessed by a 3 point motor score described by Bromage:

0-Full flexion and full extension of elbow, wrist and fingers,

1-Ability to move fingers only,

2-Inability to move fingers.

Onset of motor blockade was considered as the time from performance of block to the time when a complete inability to move fingers (score-2) was achieved. Duration of motor blockade was considered as time from complete motor blockade to the restoration of full flexion and extension of elbow, wrist and fingers (score-0).

Postoperative analgesia was assessed by the 10 point visual analogue scale.

No pain = 0

Mild pain = 1-3

Moderate pain = 4-7

Severe = more than 7

Injection Diclofenac Sodium (1.5 mg/kg intramuscularly) was administered when VAS > 5. Total duration of Analgesia (time from onset of sensory blockade to time when patient has a visual analogue scale of >5) was also recorded between two groups.

The results were expressed as mean±SD. Statistical analysis for clinical characterstics was done by student t test. Mann witney test was used to analyse sex variation and ANOVA was used to analyze hemodynamic variations between two groups. $p<0.05$ considered as significant and $p<0.01$ considered as highly significant.

Results

There was no statistical significant difference in age, weight & sex distribution between two groups. Onset and duration of Sensory and Motor Block As [Table 1] shows, mean duration of onset of sensory block in ropivacaine group was 5.5 ± 0.89 mins and in bupivacaine group was 6.5 ± 0.65mins.Mean duration of onset of motor block in ropivacaine group was 14.3 ± 2.64 mins and in bupivacaine group was 12.4 ± 2.06. but on inter group comparison there was no statistical significant difference in Onset of sensory block, Onset of motor block between two Groups ($p>0.05$).

Table 1: Onse of Sensory and Motor Block in two Groups (min) (Mean ± SD)

Variable	Group R (Ropivacaine)	Group B (Bupivacaine)	p-value
Sensory Block	5.5 ± 0.89	6.5 ± 0.65	> 0.05
Motor Block	14.3 ± 2.64	12.4 ± 2.06	> 0.05

Intra-operative Parameters: There was no statistical significant difference in intra- operative parameters namely pulse, systolic blood pressure and diastolic blood pressure between two groups ($p>0.05$).

Duration of Analgesia: Duration of Analgesia in Ropivacaine Group was 420 ± 18.2 mins and in Bupivacaine group was 462 ± 20.3 mins, but data was statistically insignificant ($p>0.05$).

Comparison of Complications: In our study, 13.3% of patients have incidence of nausea and 3.3% have Horner's Syndrome in Ropivacaine group as compared to patients having 20% incidence of nausea and 6.6% Horner's Syndrome in Bupivacaine group ($p>0.05$).

Table 2: Comparison of Complications between two Groups

Complication	Group R (Ropivacaine)	Group B (Bupivacaine)
Nausea	4 (13.3%)	6 (20%)
Horner's Syndrome	1 (3..3%)	2 (6.6%)

Discussion

In our prospective randomised clinically study we compared 30 patients (Group R- 20ml of 0.5% ropivacaine with 10 ml normal saline) with 30 patients of (Group B- 20ml of 0.5% bupivacaine with 10ml normal saline). There was no statistical significant difference regarding age, weight and sex distribution between two groups .The onset of Sensory Block in Group R was 5.5 mins while in Group B was 6.5 mins and the onset of Motor Blockade in Group R was 14..3 mins and in Group B was 12.4 mins. Although Sensory onset was faster in Group R than in Group B, Motor onset was faster in Group B than in Group R but there was no statistical significant difference between two groups ($p>0.05$).

Similar observations were found by Tomoki Nishiyama[5] as follows: Sensory and motor onset in ropivacaine group was 11 & 14 mins and in bupivacaine group was 10 & 11 mins respectively but the data was statistically insignificant ($p>0.005$).

Himat Vaghadia et al,[6] Stephen M Klein et al,[3] also found in their study that there was no statistical significant difference between

the onset of Sensory block and motor block among ropivacaine and bupivacaine group (p>0.05).

We found that total duration of analgesia in Group R was 7.0 hours (420 ± 18.2 mins) while in Group B was 7.6 hours (460 ± 20.3 mins). Statistically there was no significant difference between two groups (p>0.05).

Similar observations were found by Stephen M Klein et al and Vaghadia et al,[3,6] in their study regarding total duration of analgesia and showed no significant difference between ropivacaine and bupivacaine group for brachial plexus block (p>0.05).

There was no statistical significant difference of variation in intra-operative pulse, SBP, DBP between two Groups. Rosemary et al,[9] also didn't observe significant variation in mean, heart rate, systolic blood pressure between 0.5% Ropivacaine and 0.5% Bupivacaine at different time intervals.It is theoretically proved that Ropivacaine has lessor potential for cardiotoxicity as compared to Bupivacaine. In isolated rabbit purkinje's fiber muscle preparation effect of Ropivacaine on the transmembrane action potential was generally less than that of Bupivacaine.[10] Intact animal studies have also demonstrated that Ropivacaine having lesser arrythmogenic potential than Bupivacaine.[11] Scott et al,[12] also demonstrated depression of conduction on ECG and contractility (M-mode ECHO) at lower doses of Bupivacaine as compared to Ropivacaine.

So in view of lesser potential to toxicity in case of Ropivacaine in animal model it may be useful option in Brachial plexus block and other peripheral nerve blocks where risk of intravascular injection is very high.

Conclusion

Ropivacaine can produce equal and comparable supraclavicular brachial plexus blockade to bupivacaine with reduced risk of complications.

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