Original Research Article

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Comparision of 0.5% Ropivacaine and 0.5% Bupivacaine for Supraclavicular Brachial Plexus Block in Upper Limb Surgeries

Priyadarshini Sujata[1], Mohod Vaishali[2], Ganeriwal Veena[3]

[1]Assistant Professor [2,3]Associate Professor, Department of Anaesthesia, Grant Government Medical college and JJ Hospital, Mumbai, Maharashtra 400008, India.

Abstract

Introduction: Supraclavicular approach to brachial plexus block produces the most complete upper limb block as it blocks the brachial plexus at the level of the trunks formed by C5-T1 nerve roots.Ropivacaine is a pure S enantiomer with greater differentiation between sensory and motor block with better margin of safety due to reduced toxic potential. The aim of this study was to compare sensory and motor block effectiveness of 0.5% ropivacaine to that of 0.5% bupivacaine for supraclavicular brachial plexus block in upper limb surgeries.

Materials and Method: In this prospective randomized study total 60 patients undergoing upper extremity surgeries were given block using a peripheral nerve stimulator. Group A received 0.5% ropivacaine, 30ml and Group B received 0.5% bupivacaine, 30ml. Sucess of the block was assessed by determining loss of shoulder abduction and loss of pinprick in the C5-T1 dermatomes. The onset of action (sensory and motor) and duration of action (sensory, motor) were recorded. Post operative analgesia was assessed by using visual analog scale. The results were tabulated and statistically analyzed.

Results: There was statistically significant difference in the mean onset time to achieve maximum sensory level between group A(7.87+/-2.13mins) and group B(9.53+/-2.45mins). Duration of sensory block and analgesia was similar in both the groups. However motor block was more prolonged in group B(556+/-93.7mins) as compared to, group A(467+/-92.5 mins).

Conclusion: Ropivacaine is a suitable alternative to bupivacaine in supraclavicular brachial plexus block for upper limb surgeries.

Keywords: Supraclavicular Block; Ropivacaine; Bupivacaine.

Introduction

Brachial plexus block is a valuable and safe alternative to general anaesthesia for upper limb surgeries. Supraclavicular approach to brachial plexus block produces the most complete upper limb block as it blocks the brachial plexus at the level of the trunks formed by C5-T1 nerve roots.Today with the use of peripheral nerve stimulator (PNS), there has been a good success rate in brachial plexus block along with reduction of drug requirement [4].

Bupivacaine has many side effects which include prolonged motor weakness, cardiovascular and central nervous system toxicity [5]. Ropivacaine is a newer long acting amide linked local anaesthetic agent. It is a pure S enantiomer with greater differentiation between sensory and motor block with better margin of safety due to reduced toxic potential [1,3]. This study was conducted to compare onset of action,duration of sensory, motor block and analgesia and incidence of side effects with 0.5% Ropivacaine and 0.5% Bupivacaine in supraclavicular brachial plexus block for upper limb surgeries.

Corresponding Author: Sujata Priyadarshini, Assistant Professor, Department of Anaesthesia, Grant Government Medical College and JJ Hospital, Mumbai, Maharashtra 400008, India.
E-mail: drsujatapriyadarshini@gmail.com

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Material and Methods

After obtaining institutional ethical committee approval our prospective randomized double blind study was carried out in orthopaedic and plastic surgery operation theatre of our hospital. 60 patientswith age above 18yrs, of either sex and ASA grade I and II requiring brachial plexus block for upper limb surgeries were selected and randomised into two groups.Group A received 30 ml of 0.5% Ropivacaine and Group B received 30 ml of 0.5% Bupivacaine.Patients with weight<50kg, known allergy to local anaestheticdrugs, coagulation-disorder, peripheralneuropathy, pregnancy and lactating mother were excluded from the study.

On arrival in the operation room, baseline heart rate, blood pressure, respiratory rate and oxygen saturation were recorded. An intravenous line was secured in the unaffected limb and Ringer's lactate was started. The local anaesthetic was provided in non-identified syringes, labelled with the patient's serial number, prepared by another anaesthesiologist, not related to this study. The randomization was done by doing the computerized chart and selecting one of them blindly. Under all aseptic precautions all the patients received brachial plexus block through the supraclavicular approach. Neural localization was achieved by using a nerve locator connected to a 22 G, 50-mm-long stimulating needle (Stimuplex, Braun, Germany). The location end point was a distal motor response with a current of 0.5 mA.Following negative aspiration, 30 mL of a solution containing local anaesthetic was injected in 3ml increments.

Assessment of sensory block was done by pinprick method at each minute after completion of drug injection in C5,C6,C7,C8 &T1 dermatomal areas till complete sensory blockade. Sensory onset was considered when there was a dull sensation to pin prick (grade 1) along the distribution of above dermatomes. Complete sensory block was considered when there was complete loss of sensation to pin prick.

Sensory block was graded as-

Grade 0: Sharp pin felt

Grade 1: Analgesia, dull sensation felt

Grade 2: Anaesthesia, no sensation felt.

Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade was considered when there was Grade 1 motor block. Motor block was determined according to a modified Bromage scale for upper extremities on a 3-point scale.

Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers

Grade 1: Decreased motor strength with ability to move the fingers only

Grade 2: Complete motor block with inability to move the fingers

The block was considered incomplete when any of the segments supplied by median, radial, ulnar and musculocutaneous nerve did not have analgesia even after 30 min of drug injection. When more than one nerve remained unaffected, it was considered a failed block and omitted from statistical analysis. In this case, general anaesthesia was given.

Patients were monitored for haemodynamic variables such as heart rate, blood pressure, respiratory rate and oxygen saturation every min for 5mins; every 5mins till first 30mins and then every 15mins till 2hrs and every 30mins till surgery lasted. They were also monitored in postoperative period every hourly for 6hrs and 2 hourly for 12hrs.

The patients were assessed for the total duration of sensory as well as motor block and duration of analgesia. The duration of sensory block was defined as the time interval between the onset of sensory block (grade 1) upto the complete resolution of anaesthesia on all nerves.

The duration of motor block was defined as the time interval between the onset of motor block (grade 1) upto the recovery of complete motor function of the hand and forearm. The duration of analgesia was defined as the time interval between the onset of sensory block upto time of rescue analgesia.Rescue analgesia was given in form of Inj Diclofenac sodium 75mg intramuscularly when VAS score was >5. All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, haematoma, local anaesthetic toxicity and post-block neuropathy in the intra- and post-operative periods.

The data thus obtained was tabulated & statistically analyzed by -

- Unpaired t test, paired t test , Mann whitney test and chi square test.
- The p value of < 0.05 was considered as statistically significant and the p value < 0.001 was considered as statistically highly significant.

Results

Data was collected in both groups for following parameters and observations of the analysed data were tabulated as follows.

Demographic characteristics and duration of surgery were comparable in both the groups.

Onset of sensory blockade was faster in group A(7.87 +/- 2.13 min) compared to group B (9.53 +/ - 2.37 min).By applying Mann Whitney Test this difference was found to be statistically significant (p=0.018)(Figure 1).

Mean time of onset of motor blockade was 11.1 +/- 2.5 mins in group A and 11.9 +/- 2.9 mins in group B which was comparable and there was no statistical difference (p value 0.273>0.05) (Figure 2).

The mean duration of sensory blockade in group A was 457.00 +/- 82.51 mins and in group B was 493.00 +/- 81.37 minsand this difference was statistically not significant (p=0.086) (Figure 3).

The mean duration of motor blockade was longer in group B (467.33 ±92.51min) compared to group A (556.00 ± 93.79min) and this difference was statistically significant (p=0.00035). Ropivacaine has less duration of motor blockade than Bupivacaine. (Figure 3).

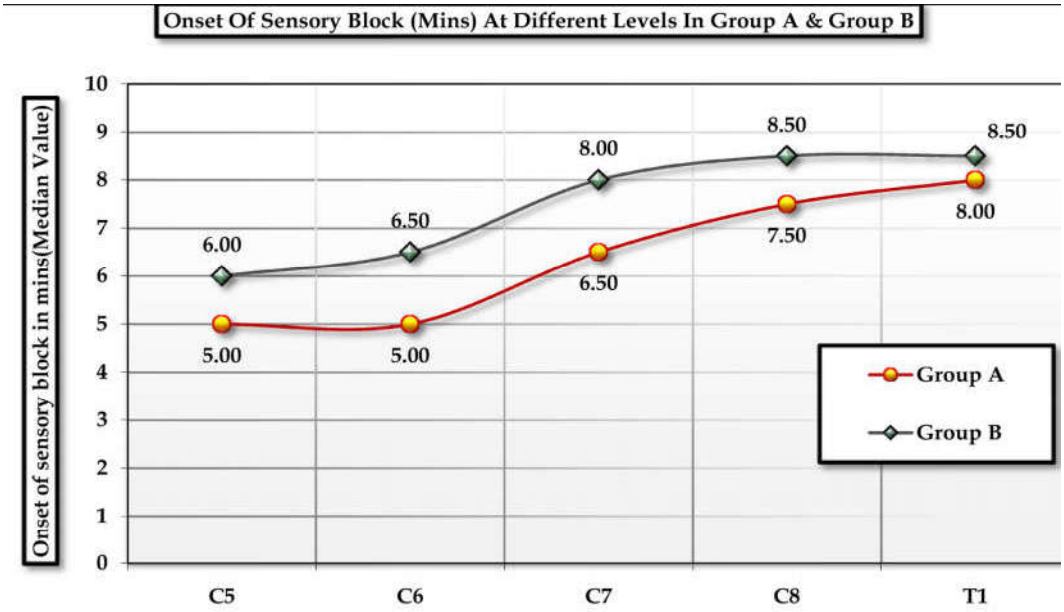

Fig. 1:

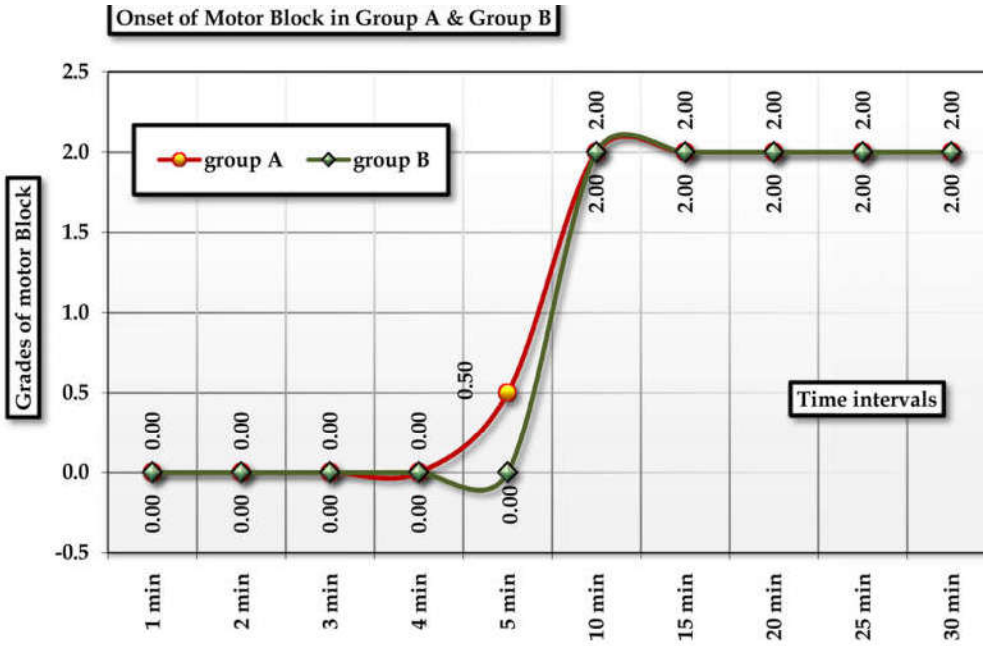

Fig. 2:

Fig. 3:

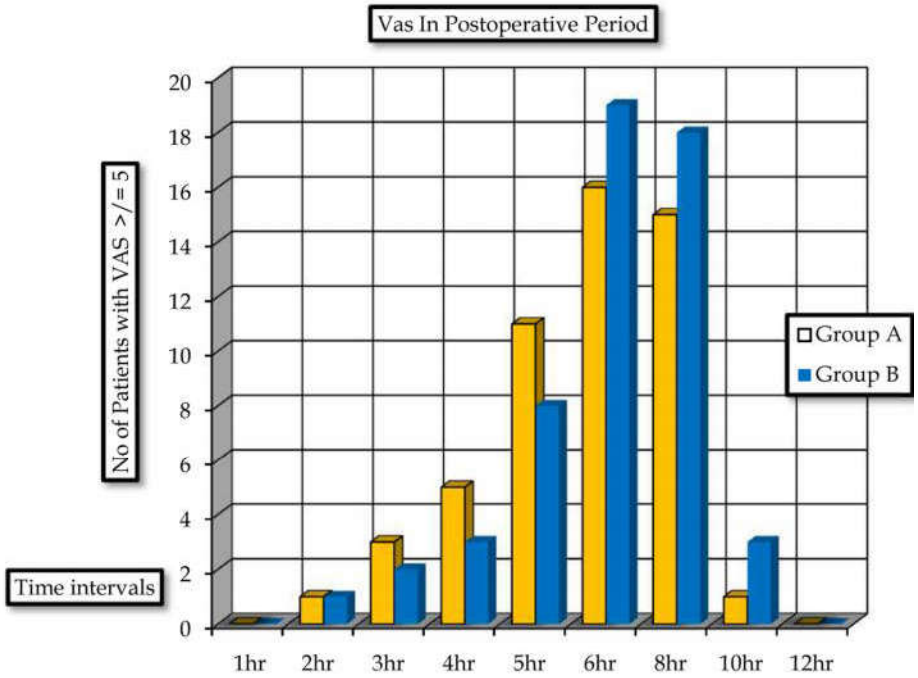

Table 1: Comparison of total duration of action

Total Duration (min)	Group A			Group B			Unpaired t-test applied		
	Mean	SD	Median	Mean	SD	Median	t-value	p-value	Difference is-
Sensory Block (mins)	457.00	82.51	435.00	493.00	81.37	480.00	-1.719	0.086	Not significant
Motor Block (mins)	467.33	92.51	420.00	556.00	93.79	600.00	-3.58	0.00035	Significant
Analgesia by VAS(mins)	521.67	76.30	525.00	557.33	81.96	555.00	-1.745	0.09	Not significant

*p<0.05:significant

Table 2: Comparison of vas score in postoperative period in group a & b

Time interval	No of Patients with VAS Score >/= 5	
	Group A	Group B
1hr	0	0
2hr	1	1
3hr	3	2
4hr	5	3
5hr	11	8
6hr	16	19
8hr	15	18
10hr	1	3
12hr	0	0

The mean duration of analgesia in group A was 521±76.30mins and in group B was 557.33±81.96 mins. This difference was statistically not significant (p= 0.09). Ropivacaine and Bupivacaine have similar duration of analgesia (Figure 3).

No significant difference in VAS Scores of two groups was observed at any time interval.At 6hrs, 16 patients in group A (53.3%) had VAS score > 5 and required rescue analgesia while in group B, 19 patients (61%) had VAS score of > 5 and did require rescue analgesia.At 8hrs, 15 patients in group A(50%) had VAS score > 5 andrequired rescue analgesia while in group B, 18 patients (60%) had VAS score of > 5 and did require rescue analgesia (Figure 4). So there was analgesia for 6-8 hrs in the postoperative period in both the groups and the total duration of analgesia was similar in both the groups (Figure 5).

There was no statistically significant difference between two groups in terms of haemodynamic

parameters at different time intervals till 12 hours of administration of brachial plexus block.

Discussion

Brachial plexus block provides an useful alternative to general anesthesia for upper surgeries. It avoids airway instrumentation, use of large number of anesthetic drugs and hemodynamic consequences of general anesthesia. Patient satisfaction, a growing demand for cost effective anesthesia and a favorable postoperative recovery profile have resulted in increased demand for regional techniques. Supraclavicular brachial plexus block is the preferred regional anaesthesia technique for upper limb surgeries. Here, the brachial plexus is presented most compactly at the proximal division or at the trunk level that provides most reliable anaesthesia for upper limb surgeries by anaesthetising the middle and lower plexus over 80% of the times (median, radial and ulnar). Existing local anesthetic, Bupivacaine, is known for its propensity for neurotoxicity and cardiotoxicity when large volume of the drug is required. Ropivacaine is a long acting amide local anesthetic agent with greater differentiation between sensory and motor block and potentially improved safety profile when contrasted to Bupivacaine [6,10].

In this study we found that the onset of sensory block was faster in patients receiving Ropivacaine than Bupivacaine.Similar result was observed in the study by Modak S & et al. who compared 0.5% ropivacaine and 0.5% bupivacaine for brachial plexus block by supraclavicular approach for upper limb surgeries [12]. Onset of sensory blockade was significantly faster in Ropivacaine group than bupivacaine. Mean time of onset of motor blockade in the present study was comparable in both the groups. The results in our study correlate with the study done byMisiolek, H.D. & et al. [11]. They compared 0.75% Ropivacaine and 0.5% Bupivacaine in brachial plexus block for the formation of arteriovenous fistula in patients with end-stage renal failure and found that 0.5% Bupivacaine and 0.75% Ropivacaine have a similar onset time of motor blockade.

The duration of sensory block was defined as the time interval between the onset of sensory block upto the complete resolution of anaesthesia on all nerves. The mean duration of sensory blockade in group A was 457.00 +/- 82.51 mins and in group B was 493.00 +/- 81.37 minswhich was statistically not significant (p=0.086). This result was comparable to the study done by S Patel et al [9] who compared the efficacy of 0.5% Ropivacaine with 0.5% Bupivacaine for supraclavicular brachial plexus block for upper limb surgeries.There was no statistically significant difference in onset and duration of sensory block.

The duration of motor block was defined as the time interval between the onset of motor block upto the recovery of complete motor function of the hand, forearm and arm. The mean duration of motor blockade was longer in group B (467.33±92.51min) compared to group A (556.00±93.79min). Ropivacaine had less duration of motor blockade than Bupivacaine.Thisresult is comparable with the study done by Misiolek, H.D. et al.whocompared 30 mL of 0.75% Ropivacaine and 30 mL of 0.5% Bupivacaine in supraclavicular brachial plexus block for the formation of arteriovenous fistula in patients with end-stage renal failure [11]. In this study Ropivacaine had less duration of motor blockade than Bupivacaine.

The duration of analgesia was defined as the time interval between onset of sensory block upto the time of rescue analgesia. The mean duration of analgesia in group A was 521±76.30mins and in group B was 557.33±81.96mins. In our study we found that Ropivacaine and Bupivacaine had similar duration of analgesia. D.C. Tripathi & et al. [14]compared Ropivacaine and Bupivacaine in supraclavicular brachial plexus block for upper limb orthopedic surgery. Both 0.5% Bupivacaine and 0.75% Ropivacaine provided comparable duration of postoperative analgesia.When the various studies were compared, it was observed that ropivacaine in concentration of 0.5% and 0.75% provide similar duration of post operative analgesia [8,15].

There was no significant difference in postoperative VAS score in both the groups.There was analgesia for 6-8 hrs in the postoperative period in both the groups. In our study there was no difference in the incidence of side effects in both the groups. S Patel & et al [9] compared 30 mL of 0.5% Ropivacaine and 30 mL of 0.5% Bupivacaine in supraclavicular brachial plexus block.They didn't observe any side effects in both the groups.There was no clinically important difference between using 0.5% Ropivacaine and 0.5% Bupivacaine for supraclavicular brachial plexus block.

Conclusion

Ropivacaine is a suitable alternative to bupivacaine in supraclavicular brachial plexus block for upper limb surgeries.

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