ANALYSIS OF ROPIVACAINE AND BUPIVACAINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES: A PROSPECTIVE RANDOMISED STUDY

1Vaibhav Tewari, 2Mayank Mahendra, 3Sachin Tyagi, 3Mohit Arora and 3*Tarun Kumar Pandey

1Department of Anesthesiology, King George’s Medical University, Lucknow
2Department of Orthopaedic Surgery, King George’s Medical University, Lucknow
3Department of Anesthesiology, Sanjay Gandhi Memorial Hospital Mangolpuri, New Delhi

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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. Presently, the use of peripheral nerve stimulator (PNS) has a good success rate in brachial plexus block and further minimize the drug requirement (Eckelaert et al., 1984).

As per Eroglu et al., in a study, Bupivacaine has many side effects like prolonged motor weakness, cardiovascular and central nervous system toxicity (Eroglu et al., 2004). Ropivacaine is a newer long acting amide linked local anaesthetic agent (Bertini et al., 1999). Several studies reveal the advantage of Ropivacaine as a pure S enantiomer with greater differentiation between sensory and motor block with better margin of safety due to reduced toxic potential (Arthur et al., 1988; De et al., 1996). In the present study, we planned a comparative study to analyse the effectiveness of 0.5% Ropivacaine and 0.5% Bupivacaine in supraclavicular brachial plexus block for upper limb surgeries.

MATERIALS AND METHODS

In the present prospective randomized double blind study, total 104 patients with age above 18yrs, of either sex and ASA grade I and II requiring brachial plexus block for upper limb surgeries were enrolled. However, patients with weight<50kg, known allergy to local anaesthetic drugs, coagulation disorder, peripheral neuropathy, pregnancy and lactating mother were excluded from the study.

The enrolled patients were further randomised into two groups:
Group-I (n=52) received 0.5% ropivacaine (30ml) and Group-II (n=52) received 0.5% bupivacaine (30ml). Loss of shoulder abduction and loss of pinprick in the C5- T1 dermatomes confirm the success of block. Mean onset time to achieve maximum sensory level between Group-I and Group-II were (8.60±2.11 mins) and (9.50±2.4 mins) respectively and had statistically significant differences (p=0.044). Significant differences while analysing motor block were found, which was more prolonged in Group- II (549.04±78.43 mins) as compared to Group- I (464.64 ± 88.71 mins). In upper limb surgeries, Ropivacaine is a suitable alternative to bupivacaine in supraclavicular brachial plexus block.
location end point was a distal motor response with a current of 0.5 mA.

Pinprick method was used to assess the sensory block was done 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 and Grade 2: Anaesthesia, no sensation felt.

Same observer was assessed the motor block 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 as per followings. 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 and Grade 2: Complete motor block with inability to move the fingers.

When any of the segments supplied by median, radial, ulnar and musculocutaneous nerve did not have analgesia even after 30 min of drug injection, the block was considered incomplete. And it was considered a failed block when more than one nerve remained unaffected. In these cases, 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 assed 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) up to 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) up to 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 up to 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 postblock neuropathy in the intra- and post-operative periods.

Statistical analysis

Statistical analysis was performed using SPSS software (SPSS Inc., Chicago, IL, USA) for Windows program (15.0 version). The continuous variables were evaluated by mean (=standard deviation) or range value when required. For comparison of the means between the two groups, analysis by Student t test with 95% confidence interval, Mann-Whitney U test was used. A p value of < 0.05 or 0.001 was regarded as significant.

RESULTS

All the demographic characteristics and duration of surgery were non-significant differences in both groups. Mean onset time to achieve maximum sensory level between Group-I and Group-II were (8.60±2.11mins) and (9.50±2.4 mins) respectively and had statistically significant differences (p=0.044) (Figure 1). Mean time of onset of motor blockade in Group-I was 11.32 ± 2.6 mins and in Group-II was 11.97 ± 2.8 mins and found no statistical significant difference (p =0.2316) (Figure 2).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Total Duration(Min)</th>
<th>Mean±SD</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory Block</td>
<td>Group-I (n=52)</td>
<td>461.25 ± 76.95</td>
<td>489.06± 78.43</td>
<td>-2.379 to 58.019</td>
</tr>
<tr>
<td>Motor Block</td>
<td>Group-I (n=52)</td>
<td>489.06± 78.43</td>
<td>549.04± 92.53</td>
<td>119.66</td>
</tr>
<tr>
<td>Analgesia by VAS</td>
<td>Group-II (n=52)</td>
<td>491.42 to 56.517</td>
<td>551.98 ± 79.81</td>
<td>-4.817 to 56.517</td>
</tr>
</tbody>
</table>

* Significant, Unpaired t-test

In-significant differences (p=0.0706) was observed while analyzing the mean duration of sensory blockade in Group-I (461.25 ± 76.95 mins) and Group-II (489.06± 78.43 mins) (Table-1). Significant differences while analysing motor block were found, which was more prolonged in Group-II (549.04±78.43 mins) as compared to Group- I (464.64 ± 88.71 mins). Thus, Ropivacaine has significantly less duration of motor blockade than Bupivacaine (Table-1).
DISCUSSION

Ropivacaine provided comparable duration of postoperative limb orthopedic surgery. Both 0.5% Bupivacaine and 0.75% Bupivacaine. Tripathi potentially improved safety profile when contrasted to Ropivacaine is a long acting amide local anesthetic agent with As per Hickey occurs due to required heavy doses of the drug. anesthetic, Bupivacaine, neurotoxicity and cardiotoxicity may alternative to general anesthesi block. Till date, the brachial plexus block provides a suitable alternative to bupivacaine in supraclavicular brachial plexus block in upper surgeries as it avoids airway instrumentation. While the use of existing local anesthetic, Bupivacaine, neurotoxicity and cardiotoxicity may occurs due to required heavy doses of the drug.

As per Hickey et al., (1990) and McClellan et al., (2000), 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. Tripathi et al., (2012) compared Ropivacaine and Bupivacaine in supraventricular 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 (Klein et al., 1998; Vaghadia et al., 1999). There was no significant difference in postoperative VAS score in both the groups.

Previously in a study by Misiolek et al., (2005), 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% opivacaine have a similar onset time of motor blockade. In another recent study by Modak et al., (2016), in was observed that onset of sensory blockade was significantly faster in Ropivacaine group than bupivacaine with a significant difference in mean time of onset of motor blockade. Our study relies on both of the study observations by Modak et al., and Misiolek et al., (2005). The present study observations was also comparable to the study done by Patel et al., (2015), who compared the efficacy of 0.5% Ropivacaine with 0.5% Bupivacaine for supraventricular brachial plexus block for upper limb surgeries. There was no statistically significant difference in onset and duration of sensory block. However, small sample size and single centric study was the limitation. Author recommends large multi-centric study with large sample size to increase in reliability and generalizability.

CONCLUSION

In conclusion, the Ropivacaine is appropriate alternative to bupivacaine and can be used for supraventricular brachial plexus block for upper limb surgeries.

Conflicts of interest

There are no conflicts of interest.

References

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