Comparison Of 0.5% Bupivacaine Versus 0.75% Ropivacaine- Onset, Duration And Quality Of Brachial Plexus Block Through Ultrasound Guided Interscalene Approach

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Abstract

**Background:** The brachial plexus block can be employed for upper limb surgeries of soft tissue and bone. Local anaesthetics used, reversible block the nerve conduction. The aim of this study is to compare the efficacy of 0.5% Bupivacaine and 0.75% Ropivacaine with 40 mcg dexmedetomidine in each, with respect to time of onset, duration and the quality of the block through USG guided interscalene approach.

**Materials and Methods:** The study was conducted in the department of Anaesthesiology at MGM Hospital, Navi Mumbai. A total of 50 patients belonging to ASA 1 and 2 between 20 to 60 years of age of either sex were included in the study. The onset of sensory and motor blockade was tested every 1 min up to 30 minutes after injection of local anaesthetic through interscalene block. All patients were observed for 24 hours.

**Results and Conclusion:** It was concluded that there was no much difference clinically in onset, duration and analgesia in 0.5% Bupivacaine and 0.75% Ropivacaine when injected in equal volumes for brachial plexus block via USG guided interscalene approach

**Keywords:** Bupivacaine, Ropivacaine, Dexmedetomidine, Ultrasound, Interscalene block

Introduction

The brachial plexus block can be used for upper limb surgeries both soft tissue and bone. The advantage of regional blocks is that it is safe in patients in whom General Anaesthesia has high risk. It also has the added advantage of prolonged post op analgesia.

Using Ultrasound guidance for regional blocks, enhances the safety profile of the block since it isn't a blind procedure then and chances of hitting vascular structures and puncturing it are greatly reduced.

Local anaesthetics reversible block conduction of impulses in peripheral nerves by inhibiting passage of sodium ions through ion selective sodium channels and thus preventing propagation of action potential (2). They may be combined or adjuvants may be added to potentiate their action.

Bupivacaine has been used in all types of nerve blocks, lumbar and caudal epidurals, paracervical blocks and intravenous regional analgesia.

Bupivacaine is available for clinical use as racemic mixtures (50:50 mixtures) of enantiomers.

Ropivacaine is new, long-acting local anaesthetics, pure (S-isomer) enantiomer. Ropivacaine is chemically similar to bupivacaine, the butyl group being replaced by a propyl group. Though it has similar structure, pharmacology and pharmacokinetics to that of bupivacaine, ropivacaine has lower potential for the toxic effect. Ropivacaine shows lower systemic toxicity as compared to bupivacaine.
When clinically effective doses and concentrations are used, there are no clinically relevant differences in the comparative efficacy of ropivacaine and bupivacaine.(4,5).

Both bupivacaine and ropivacaine can be used for all types of nerve blocks, epidural, Spinal anaesthesia, infiltration of field block, acute pain management. They can cause minimal side effects which are depending on plasma concentration of drug,(8) such as numbness of tongue and circumoral tissues, restlessness, tinnitus, vertigo, slurred speech, seizures, hypotension, cardiac arrhythmias(9), cardiac arrest(10), hepatotoxicity(11).

The aim of the present study is to compare the efficacy of 0.5% bupivacaine and 0.75% ropivacaine - the onset, duration and quality of the brachial plexus block through interscalene approach.

**Materials And Methods**

The study was conducted in the department of Anaesthesiology at MGM Hospital, Navi Mumbai.

**Inclusion Criteria**

A total of 50 patients belonging to ASA Grades 1 and 2 between 20 and 60 years age of either sex were included in the study, scheduled for various surgical procedures of upper limb.

**Exclusion Criteria**

Patients with local infection, pneumothorax, peripheral neuropathy, severe liver or kidney disease, history of previous adverse reactions to local anaesthetic drugs and coagulopathy were excluded from the study.

After explaining the details of the procedure, written consent was taken from each patient. Pre-operative assessment was carried out in every patient 1 day before surgery.

The patients were randomly allocated into two groups according to the drug received:

- **Group A**: Patients were given 15 ml of 0.5% bupivacaine with 40 mcg of dexmedetomidine.
- **Group B**: Patients were given 15 ml of 0.75% ropivacaine with 40 mcg of dexmedetomidine.

Care was taken in proper positioning of the patient and proper visualisation of the needle via USG. Before injecting the local anaesthetics, the patient was explained about the accidental paraesthesia that may occur during the introduction of needle. By following aseptic precautions either bupivacaine or ropivacaine was injected into interscalene brachial plexus.

**Statistical Analysis**

The patient data were analysed using the unpaired t-test, P < 0.05 is considered as statistically significant.

**Results**

A total of 50 patients were studied in the age group of 20-60 years of either sex. Most number of surgeries were performed in the age group of 20-30 years about 53.3%. A more number of males underwent surgeries when compared to females about 80% and 20%, respectively.

The onset of sensory blockade was measured from the commencement of injection of anaesthetic solution until the loss of pinprick sensation. The onset of motor blockade was measured from commencement of injection of anaesthetic solution until the loss of finger movements.

The actual difference between mean duration of onset of sensory blockade and motor blockade in Group A and in Group B was 1.6 min and 2.7 min, respectively (Table 1).

Duration of sensory blockade was measured from the time of sensory loss of pinprick sensation to the time of return of pinprick sensation. Duration of motor blockade was measured from the time of loss of finger movements to time of return of finger movements. The actual difference between mean duration of sensory and motor blockade in Groups A and B was 36.36 and 14.51 min, respectively (Table 2).

The duration of analgesia of Groups A and B were 678.75 ± 187 and 648.17 ± 180.91, respectively. The difference in duration between two groups is 30.58 min.

Grading of sensory and motor blockade was assessed in both groups and results were tabulated in Table 3. Most number of cases attained Grade IV which means complete block of sensory and motor functions among both Groups A and B. Sensory blockade in Grade IV was observed in more number of patients about 72.8% when compared to Motor blockade about 62.7%.
Quality of blockade was assessed which is expressed in terms of complete blockade, incomplete blockade and failure. Complete blockade was more in Group B when compared to Group A about 66.67% and 58.62%, respectively. Incomplete block observed in 41.37% of Group A and 26.67% of Group B patients. Failures were not observed in Group A, but in Group B failures were 2 patients (6.66%).

No complications like haematoma, horner syndrome, bradycardia, hypertension, brachial neuritis, pneumothorax, haemothorax not occurred in the present study.

### Table 1: Onset of sensory and motor blockade in minutes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Time in minutes</th>
<th>t value</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of pinprick sensation (mean±SD)</td>
<td>14.06±4.13</td>
<td>12.46±2.28</td>
<td>1.7998</td>
<td>&gt;0.05 NS</td>
</tr>
<tr>
<td>Loss of finger movements (mean±SD)</td>
<td>19.48±6.0</td>
<td>16.78±4.63</td>
<td>1.8921</td>
<td>&gt;0.05 NS</td>
</tr>
</tbody>
</table>

SD: Standard deviation, NS: Not significance

### Table 2: Duration of sensory and motor blockade in minutes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Time in minutes</th>
<th>t value</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery of pinprick sensation (mean±SD)</td>
<td>612.82±150.3</td>
<td>576.46±179.3</td>
<td>0.899</td>
<td>&gt;0.05 NS</td>
</tr>
<tr>
<td>Recovery of motor paralysis (mean±SD)</td>
<td>478.79±143.4</td>
<td>464.28±187.6</td>
<td>0.328</td>
<td>&gt;0.05 NS</td>
</tr>
</tbody>
</table>

SD: Standard deviation, NS: Not significance

### Table 3: Grade of sensory and motor blockade in both groups

<table>
<thead>
<tr>
<th>Grade</th>
<th>Sensory</th>
<th>Motor</th>
<th>Sensory</th>
<th>Motor</th>
<th>Sensory</th>
<th>Motor</th>
<th>Sensory</th>
<th>Motor</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>6.67</td>
<td>6.67</td>
</tr>
<tr>
<td>II</td>
<td>8</td>
<td>1</td>
<td>27.59</td>
<td>3.44</td>
<td>6</td>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>37.93</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>26.66</td>
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<tr>
<td>IV</td>
<td>21</td>
<td>17</td>
<td>72.41</td>
<td>58.63</td>
<td>22</td>
<td>20</td>
<td>73.33</td>
<td>66.67</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>29</td>
<td>100</td>
<td>100</td>
<td>30</td>
<td>30</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

SD: Standard deviation, NS: Not significance

### Discussion

The selection of optimal long-acting local anaesthetic and concentration for brachial plexus block must take into consideration the available anaesthetics, the time to onset, duration of blockade and side effects of each drug and dose. In the present study, the onset of sensory and motor blockade was faster with 0.75% of ropivacaine when compared to 0.5% of bupivacaine. Duration of sensory and motor blockade is lesser with 0.75% ropivacaine when compared with 0.5% of bupivacaine. However, there is no much clinical difference in onset, duration of sensory and motor blockade and duration of analgesia. The adjunct dexmedetomidine used with both the drugs, helped in mildly sedating the patient without causing any haemodynamic disturbance.

In accordance with this study Misolek et al. (14), Vainionpää et al. (15), Hickey et al. (16), also concluded that there was no prominent clinical difference between 0.75% ropivacaine and 0.5% bupivacaine in terms of onset, duration and quality of analgesia.
Few studies such as Raeder et al.(18), McCrae et al.(12), documented that the onset time of both sensory and motor blockade between 11 and 20 min, whereas in a few studies like Bertini et al.(19) prolonged time about 23-48 min were observed and Klein et al.(20) observed less time about <6 min than our study. These differences may be attribute to the anatomic location of the different nerve blocks (supravclavicular, interscalene, and infraclavicular) and the technical procedure used.

Scott(6) documented that ropivacaine caused less CNS symptoms and was at least 25% less toxic than bupivacaine. The majority of symptoms occur early and a maximum effect with bupivacaine (P < 0.05). Chazalon et al.(10), Huet et al.(22) reported that cardiopulmonary resuscitation following ropivacaine injection was successful. In contrast to this Long et al.(23) documented that cardiac arrest is difficult to treat and may require cardiopulmonary bypass. However, in this study, there was no incidence of ropivacaine or bupivacaine toxicity.

Although there appears to be a considerable difference, when these results were subjected to statistical analysis by using Chi-square test, they were statistically insignificant.

**Conclusion**

About 15 ml of 0.5% bupivacaine or 15 ml of 0.75% ropivacaine for interscalene brachial plexus block produced satisfactory and comparable sensory, motor block related to onset, duration, quality and duration of analgesia. The addition of dexmedetomidine helped to potentiate and its absorption mildly sedated the patients. The lower CNS and cardiotoxicity of ropivacaine may help in reducing risk to the patient. There were no much clinical differences in onset, duration and analgesia among 0.5% bupivacaine and 0.75% ropivacaine when injected in equal volumes for brachial plexus block by interscalene approach via ultrasound guided technique. Hence, choice of local anaesthetic should not be only based on the onset and duration. Ropivacaine has improved safety profile when compared to bupivacaine, it may be advantageous.

**References**


15. Vainionpää VA, Haavisto ET, Huha TM, Korpi KJ, Nuutinen LS.


