DEXMETHETOMIDINE AS AN ADJUVANT WITH 0.25% BUPIVACAINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK
Prakash R. Dhumal¹, Padmanabha D. V², Priyanka Rathi³, Bhagyad. V⁴, Nilesh Jawe⁵

¹Assistant Professor, Department of Anaesthesia, GMC, Miraj.
²Assistant Professor, Department of Anaesthesia, GMC, Miraj.
³Assistant Professor, Department of Anaesthesia, GMC, Miraj.
⁴Assistant Professor, Department of Anaesthesia, IGICH, Bangalore.
⁵Assistant Professor, Department of Anaesthesia, RCSM GMC, Kolhapur.

ABSTRACT
The aim of this study is to evaluate the effect of addition of dexmedetomidine to 0.25% bupivacaine in brachial plexus block.

MATERIALS AND METHODS
80 consenting patients fulfilling the inclusion criteria were divided randomly into two groups using "slips in a box technique" of 40 each. Group D (study group)- 30 mL of 0.25% bupivacaine with 0.5 mL (50 µg) dexmedetomidine. Group B (control group)- 30 mL of 0.25% bupivacaine with 0.5 mL, 0.9% saline. Neural localisation was achieved using a nerve stimulator. All the patients received brachial plexus block through the supraclavicular approach by an experienced anaesthesiologist different from the one assessing the patient intra and postoperatively. Both were blinded to the treatment groups. Sensory block was assessed by pinprick test using 3-point scale. Motor blockade was assessed using Bromage 3-point score. Onset of sensory and motor block, duration of sensory and motor block, duration of analgesia and quality of block was noted.

RESULTS
There were no significant differences in demographic and haemodynamic data. Onset of sensory block was faster in Group D (12.33±1.64 mins.) compared to Group B (21.78±2.22 mins.). Onset of motor block was faster in Group D (9.38±1.55 mins.) compared to Group B (15.68±2.09 mins.). Duration of sensory block in Group D showed 508.50±33.25 mins. and Group B 219.38±24.42 mins. Duration of motor block in Group D showed 434.25±33.96 mins. and Group B 165.75±19.20 mins. Duration of analgesia in group D was 538.50±33.25 mins. compared to group B with 264.38±24.42 mins. Quality of block was better in Group D as compared to Group B.

CONCLUSION
Dexmedetomidine at the dose of 50 µg added to 0.25% bupivacaine in supraclavicular brachial plexus block in upper limb surgeries is highly effective in prolongation of motor and sensory analgesia and provides better postoperative analgesia without any potential side effects.

KEYWORDS
Adjuvant, Dexmedetomidine, Supraclavicular Brachial Plexus Block, Bupivacaine.

HOW TO CITE THIS ARTICLE: Dhumal PR, Padmanabha DV, Rathi P, et al. Dexmedetomidine as an adjuvant with 0.25% bupivacaine for supraclavicular brachial plexus block. J. Evid. Based Med. Healthc. 2016; 3(99), 5467-5472. DOI: 10.18410/jebmh/2016/1132

BACKGROUND
Peripheral nerve block provides an effective alternative to general anaesthesia and central nerve blocks for surgery. Peripheral nerve blocks can be customised for use in anaesthesia, postoperative analgesia, diagnosis and treatment of chronic pain disorders. Skillful application of peripheral nerve blockade broadens the anaesthesia provider’s range of options in providing optimal anaesthetic care. With appropriate selection and sedation, these techniques can be used in all age groups.¹

Peripheral nerve blocks are safer than general and spinal anaesthesia with distinct advantage. They not only provide intraoperative anaesthesia, but also extend analgesia in the postoperative period without any systemic side effects.² Peripheral nerve blocks reduce complications and side effects of general anaesthesia like post-anaesthetic nausea, vomiting, atelectasis, hypotension, ileus, dehydration and deep vein thrombosis. It avoids the stress of laryngoscopy and tracheal intubation.

Ambulatory surgery is becoming increasingly desirable as it offers economic advantage, much comfortable and convenient for the patient. Peripheral nerve blocks play a major role in daycare surgeries where top priorities of
success are alertness, ambulation, analgesia and almentation.

Brachial plexus blocks are among the most commonly studied peripheral nerve blocks owing to their high success rate and their ability to provide prolonged postoperative analgesia. In addition, the sympathetic block produced is of value for arm or hand reimplantation surgery or to establish a vascular shunt for dialysis.³

Successful blockade of the brachial plexus relies on the fact that these branches are enveloped in a tubular sheath of fascia. Thus, if one branch is identified by eliciting paraesthesia or by using a nerve stimulator and a reasonably large volume of anaesthetic injected, blockade of the entire plexus maybe predicted.³

Of the common approaches to brachial plexus block, at the level of the supraclavicular approach the brachial plexus is arranged in a very compact space as the plexus crosses the first rib and thus inclusion of all three trunks in the block maybe predicted. An additional advantage is that the block can be performed with the patient’s arm in any position.¹

Limiting factors of brachial plexus block is the time required for onset of action and duration of analgesia. Increasing the dose or volume of local anaesthetics increases the risk of systemic toxicity and continuous catheter block techniques requires additional time, cost and skill. Hence, there has always been a search for adjuvants to the regional block with drugs that prolongs the duration of analgesia with lesser adverse effects.² Many drugs have been tried like opioids, clonidine, dexamethasone and midazolam.⁴

Alpha 2 adrenergic receptor agonists have been tried either alone or in combination with another drug to prolong anaesthesia in various methods of anaesthetic administration like epidural, intrathecal and regional nerve blocks.² Dexmedetomidine is an alpha-2 receptor agonist and its α2/α1 selectivity is 8 times more than clonidine.⁵ Several studies have found dexmedetomidine to be safe and effective in various neuraxial and regional anaesthesia in humans with lesser side effects.⁴,⁵

This study was done to evaluate the effect of addition of dexmedetomidine to 0.25% bupivacaine in brachial plexus block.

MATERIALS AND METHODS

After obtaining the approval of the Institutional Ethics Committee and written informed consent from the patients, 80 patients were included.

Inclusion Criteria

Patients for elective surgeries on upper limbs-
1. ASA (American Society of Anaesthesiologists) grade I and II.
2. Patients between the ages of 18-60 years of either sex.
3. Undergoing surgeries on upper limb.
4. Patients of weight 35-80 kg.
5. Who gives written informed consent.

Exclusion Criteria

1. Patients on adrenergic receptor agonist and antagonist therapy.
2. Known hypersensitivity to local anaesthetics.
3. Uncontrolled diabetes mellitus.
4. Pregnant woman.
5. Preexisting peripheral neuropathy.
6. Patients with bleeding disorder.
7. ASA III and above.

A preanaesthetic checkup was done for all patients, which included a detailed history, general physical and systemic examination. Basic investigations were done (Hb%, complete blood counts, bleeding time, clotting time, random blood sugar, serum urea, serum creatinine, if age above 45 yrs., then ECG). Patients were kept nil per oral overnight. Selected patients were divided randomly into two groups using "slips in a box technique" of 40 each.

Group D (Study Group)- 30 mL of 0.25% bupivacaine with 0.5 mL (50 µg) dexmedetomidine.

Group B (Control Group)- 30 mL of 0.25% bupivacaine with 0.5 mL 0.9% saline. On arrival in the operating room, baseline heart rate, blood pressure and oxygen saturation were recorded. An intravenous line was secured in the unaffected limb and ringer lactate started. All the patients received brachial plexus block through the supraclavicular approach by an experienced anaesthesiologist different from the one assessing the patient intra and postoperatively. Both were blinded to the treatment groups.

Neural localisation was achieved using a nerve stimulator following negative aspiration. The solution containing local anaesthetic combined with dexmedetomidine or normal saline as mentioned above were injected.

Sensory block was assessed by pinprick test using 3-point scale.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal sensation</td>
</tr>
<tr>
<td>1</td>
<td>Decreased loss of sensation</td>
</tr>
<tr>
<td>2</td>
<td>Complete loss of sensation</td>
</tr>
</tbody>
</table>

Motor blockade was assessed using Bromage 3-point score.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal sensation</td>
</tr>
<tr>
<td>2</td>
<td>Decreased motor strength with ability to move fingers only.</td>
</tr>
<tr>
<td>3</td>
<td>Complete motor block with inability to move fingers.</td>
</tr>
</tbody>
</table>

After the brachial block injection, sensory and motor blockade were assessed every 3 minutes up to 30 minutes. The time interval from the end of total local anaesthetic administration up to complete sensory block was defined as onset time of sensory block. Duration of sensory block was defined as the time interval between end of local anaesthetic administration and complete resolution of anaesthesia on all nerves.
The time interval from the end of local anaesthetic administration up to complete motor block was defined as onset of motor block. Duration of motor block was defined as time interval between end of local anaesthetic administration and complete resolution of motor block.

Duration of analgesia defined as the time interval between complete sensory blockade till patient’s first request of rescue analgesia was also noted. Rescue analgesia diclofenac sodium 75 mg IM was given when patient visual analogue score >4.

0- No pain.
10- Worst possible pain.

Intraoperative haemodynamic variables assessed were Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Saturation of Oxygen (SpO2). They were assessed at 0 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 45 minutes, 60 minutes, 90 minutes and 120 minutes. Adverse events like hypotension (20% decrease in relation to baseline) and bradycardia (heart rate <50 beats per minute) were also documented and corrected with appropriate measures. Post-surgery, the total duration of motor and sensory blockade were also recorded.

Quality of block was assessed by the following numeric scale.

Grade 4 (Excellent) - No complaints from the patient.
Grade 3 (Good)- Minor complaints with no need for supplemental analgesia.
Grade 2 (Moderate)- Complaint that required supplemental analgesia.
Grade 1 (Unsuccessful)- Patient given general anaesthesia.

Statistical Analysis
Statistical analysis was done using SPSS 22 version software entering data in Microsoft excel data sheet. Frequencies and proportions formed the categorical data. Chi-square was used as test of significance. Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two groups. Paired t test is the test of significance for paired data such as before and after drug. p value of <0.05 was taken as statistically significant for our study.

RESULTS

<table>
<thead>
<tr>
<th>Group</th>
<th>Group B</th>
<th>Group D</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>33.25</td>
<td>9.44</td>
<td>33.60</td>
</tr>
<tr>
<td>Weight (Kgs)</td>
<td>60.50</td>
<td>5.81</td>
<td>61.32</td>
</tr>
</tbody>
</table>

| Table 1. Profile of Subjects in the Study |

There was no significant difference in age and weight between two groups. Both groups were comparable in terms of age and weight (P value- 0.87 and 0.54).

<table>
<thead>
<tr>
<th>Group</th>
<th>Group B</th>
<th>Group D</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>%</td>
<td>Count</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>35</td>
<td>15</td>
</tr>
<tr>
<td>Male</td>
<td>26</td>
<td>65</td>
<td>25</td>
</tr>
</tbody>
</table>

| Table 2. Gender Distribution of Subjects Between Two Groups |

χ²=0.054, df=1, p=0.816. In the study, there was no significant difference in gender between two groups. Both groups were comparable in term of gender distribution (P value - 0.81).

<table>
<thead>
<tr>
<th>Group</th>
<th>Group B</th>
<th>Group D</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Onset of motor block (mins.)</td>
<td>15.68</td>
<td>2.09</td>
<td>9.38</td>
</tr>
<tr>
<td>Onset of sensory block (mins.)</td>
<td>21.78</td>
<td>2.22</td>
<td>12.33</td>
</tr>
</tbody>
</table>

| Table 3. Comparison of Onset of Motor and Sensory Block Between Both Groups |

* P value - 0.001, highly significant.

Onset of sensory blockade was faster in Group D (12.33±1.64 mins.) compared to Group B (21.78±2.22 mins.). Onset of motor block was faster in Group D (9.38±1.55 mins.) compared to Group B (15.68±2.09 mins.). Both the differences were statistically significant (P<0.001).
There was no significant difference between mean duration of surgery (mins.) in Group D and Group B (P>0.05). Mean duration of surgery in Group D is 57.50 mins. and in Group B is 58.38 mins. Both groups were comparable in terms of duration of surgery.

Duration of sensory block in Group D showed 508.50±33.25 mins. and group B 219.38±24.42 mins. Duration of motor block in group D showed 434.25±33.96 mins. and group B 165.75±19.20 mins. Both were statistically significant with p value <0.001.

Duration of analgesia also showed a p value of <0.001, which was highly significant. Duration of analgesia in Group D was 538.50±33.25 minutes compared to Group B with 264.38±24.42 minutes.

In the study, there was no significant difference in heart rates, SBP, DBP, RR and SpO2 between two groups at all the intervals at baseline, intraoperative and postoperative period.

<table>
<thead>
<tr>
<th>Group</th>
<th>Group D</th>
<th>Group B</th>
<th>Total</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>QOB (Grade)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>3 (7.5%)</td>
<td>30 (75%)</td>
<td>33 (41.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>IV</td>
<td>37 (92.5%)</td>
<td>10 (25%)</td>
<td>47 (58.75%)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>40</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Comparison of Quality of Block (QOB) in Group D and Group B

Grade III- 7.5% of patients in Group D achieved grade 3 (good) quality of block, whereas only 30% of patients in Group B achieved the same.

Grade IV- 92.5% of patients in Group D achieved grade 4 (excellent) quality of block, whereas 25% in Group B achieved grade 4 quality of block.

Quality of block was better in Group D as compared to Group B. There was no complete failure of block in either of groups. This difference was statistically highly significant (P<0.001).

DISCUSSION

Onset of Sensory and Motor Block- In our study (Table 3), onset of sensory blockade was faster in Group D (12.33±1.64 mins.) compared to Group B (21.78±2.22 mins.). Onset of motor block was faster in Group D (9.38±1.55 mins.) compared to Group B (15.68±2.09 mins.). Both the differences were statistically significant (P<0.001). These results were similar to the results obtained in studies conducted by Harshavardhana H S (2014). Keshav et al (2014) and Sarita SS et al (2013).

Sarita SS et al in their study found onset of sensory block in dexmedetomidine group (1.77±1.28 mins.) was faster as compared to clonidine group (2.33±1.21 mins.). In another study, Keshav et al compared the effect of adding dexmedetomidine (1 μg/kg) and clonidine (1 μg/kg) to 38 mL 0.25% bupivacaine in supraclavicular block also found that onset of sensory block was faster in earlier in dexmedetomidine group (1.70±1.28 mins.) as compared to clonidine group (2.33±1.21 mins.). Dose of dexmedetomidine (1 μg/kg) and concentration (0.25%) of bupivacaine in these studies were almost the same as used in our study.
In a study by Harshavardhana H S et al also onset of sensory and motor block was faster in dexmedetomidine group (2.59±2.2 mins. and 4.12±1.6 mins., respectively) as compared to clonidine group (3.26±1.4 mins. 5.36±3.2 mins., respectively).

**Duration of Sensory and Motor Block**

In our study (graph 1), duration of sensory block in Group D showed 508.50±33.25 mins. and Group B 219.38±24.42 mins. Duration of motor block in Group D showed 434.25±33.96 mins. and group B 165.75±19.20 mins. Both were statistically significant with p value <0.001.


Gandhi R et al in their study compared the effect of adding dexmedetomidine (30 µg) to 38 mL 0.25% bupivacaine in supraclavicular block. They found that duration of sensory and motor block were longer in dexmedetomidine group (732.4±48.9 mins. and 660.2±60.4 mins., respectively) as compared to the duration of sensory and motor block in control group (146.5±36.4 mins. and 100.7±48.3 mins., respectively).

Even, Sarita SS et al found duration of sensory and motor block were longer in dexmedetomidine group (413.97±87.31 mins. and 472.24±90.06 mins., respectively) as compared to clonidine group (227±48 mins. and 292.67±59.13 mins., respectively).

Sandhya A et al in their study compared the effect of adding dexmedetomidine (100 µg) to 30 mL 0.325% bupivacaine in supraclavicular block. They also found that duration of sensory and motor blockade were longer in dexmedetomidine group (755.6±126.8 mins. and 702±111.6 mins., respectively) as compared to duration of sensory and motor blockade in control group (234.8±47.9 mins. and 208±22.7 mins., respectively).

Keshav et al (2014) compared the effect of adding dexmedetomidine (1 µg/kg) and clonidine (1 µg/kg) to 38 mL, 0.25% bupivacaine in supraclavicular block. They found that duration of sensory and motor block was longer in dexmedetomidine group (400.15±85.13 mins. and 470±86.6 mins., respectively) as compared to clonidine group (227±48.36 mins. and 292.67±59.13 mins., respectively).

**Duration of Analgesia**

In our study (Graph 1), mean duration of analgesia showed a p value of <0.001, which was highly significant. Duration of analgesia in group D was 538.50±33.25 mins. compared to group B with 264.38±24.42 mins. Our result was similar to the studies conducted by Gandhi R et al (2012), Sarita SS et al (2013), Sandhya A et al (2014) and Keshav et al (2014).

Gandhi R et al in their study showed that duration of analgesia in dexmedetomidine group (732.4±95.1 mins.) was longer than control group (194.8±60.4 mins.). Sarita SS et al in their study showed that duration of analgesia in dexmedetomidine group (456.21±9.7 mins.) was longer than clonidine group (289.67±62.5 mins.). Sandhya A et al in their showed that duration of analgesia in dexmedetomidine group (776.4±130.8 mins.) was longer than control group (241.4±51.2 mins.).

Keshav et al too in their study showed that duration of analgesia in dexmedetomidine group (732.4±95.1) was longer than control group (289.67±60.01 mins.).

**Haemodynamic Stability and Quality of Block**

In our study, there was no significant difference in heart rate, systolic and diastolic blood pressure, respiratory rate, SpO2 between two groups at all the intervals at baseline, intraoperative and postoperative period.

Though group D showed statistically significant fall in HR, SBP, DBP intraoperatively, all these parameters recovered in the postoperative period. Also, even Group B showed slight fall in HR, SBP, DBP intraoperatively, which recovered as well postoperatively.

Quality of block (Table 4) was more superior in terms of patient comfort and side effects with Group D than Group B.

Sarita SS et al also reported the better quality of block in dexmedetomidine group (grade 4 quality in 80% patients) compared to clonidine group (grade 4 quality in 40% patients). This improved quality of block might be the result of various mechanisms of nerve conduction block such as hyperpolarisation, decreased compound action, potential and inhibition of voltage gate of sodium pump.

**Side Effects and Complication**

In our study, no side effects/complications were seen in either of the groups during the first 24 hrs. in postoperative period.

Esmaoglu et al (2010) reported bradycardia in 7 patients out of 30 patients in dexmedetomidine group and Sandhya A et al (2014) also reported bradycardia in one patient in dexmedetomidine group. This may be due to higher dosage (100 µg) of dexmedetomidine used in their study.

**CONCLUSION**

Dexmedetomidine at the dose of 50 µg added to 0.25% bupivacaine in supraclavicular brachial plexus block in upper limb surgeries is highly effective in prolongation of motor and sensory analgesia and provides better postoperative analgesia. So, the patient remains comfortable in the postoperative period with considerable therapeutic benefit and without any potential side effects.

**REFERENCES**


