Comparison of Dexmedetomidine and Dexamethasone as an Adjuvant to Bupivacaine in Onset and Interval of Supraclavicular Nerve Block

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ABSTRACT
Aim: To compare duration and onset of motor and sensory block by using dexmedetomidine and dexamethasone as adjuvant to bupivacaine in supraclavicular brachial plexus block.

Place and duration of study: Department of Anaesthesiology, Surgical Intensive Care & Pain Management, Civil Hospital, Dow University of Health Sciences Karachi from 29th June 2022 to 29th December 2022.

Design: Randomized controlled trial study

Methodology: Sixty patients were enrolled in the study that had an elective upper-limb surgery performed under supraclavicular anaesthesia of hand, wrist, forearm and elbow were allocated through randomization into two groups. Thirty patients in group A treated with bupivacaine 25 ml of 0.5% with dexamethasone 8 mg (2 ML) and 30 in group B treated with bupivacaine 25 ml of 0.5% with dexmedetomidine 1µg/kg (2ml). Patients were observed in post-anesthesiarecoverypost-surgery. Duration of onset of pain was noted by patient’s first request for analgesia.

Results: The mean age of patients was 34.8±9.39 years. Mean onset time of sensory and motor block was significantly low in group A than group B. Mean duration of sensory block and motor block was significantly high in group B than group A [813.87±113.72 vs. 752.63±27.96; p=0.006] and [734.13± 84.44 vs533.07±88.38;p=0.0005]. The time to request for rescue analgesic was significantly increased in group B as compared to group A (p=0.0005).

Practical Implication: Regional anaesthesia in orthopedic procedures is superior to general anaesthesia in terms of better postoperative pain relief, less central nervous system depressant effect of drugs and early discharge from hospital.

Conclusion: The duration of block prolonged in cases where dexmedetomidine was added to the bupivacaine was longer but onset was reduced in comparison to the dexamethasone cases.

Keywords: Brachial plexus block, Supraclavicular block, Dexmedetomidine, Dexamethasone

INTRODUCTION

There have been various novel blocks applied during intraoperative analgesia as well as analgesia for upper extremity operation. Brachial plexus block is one of such very useful block having a long duration efficacy. Continuous technique applying catheterization has economic constrains and risk of infection, therefore making single-shot supraclavicular brachial plexus highly feasible.

Single shot supraclavicular brachial plexus block is more feasible because continuous technique using catheter is costly difficult, and has increased risk of infection1-3. The administration of supraclavicular block is easy and safe currently by using ultrasonography for higher block success rate and very small incidence of pneumothorax in comparison to blind technique. By using of ultrasonography intra neural placement of needle and therefore, injectate can be avoided to retain the nerve morphology. The major benefit of supraclavicular block is that Nerve is tightly packed in that area and it g a very gives a very quick effect of block so giving it Nick name as “spinal of arm”4,5. Numerous agents including dexmedetomidine, a potent alpha -2 agonist, and long acting glucocorticoids have been used as adjuvants to bupivacaine to increase onset and duration of supraclavicular block6,7. The dexmedetomidine acts by stopping the hyper polarization of activated cationic current7. The main action method of dexamethasone is through anti-inflammatory in addition to anti-nociceptive results. This happens through inhibition of inflammatory mediators, through the process of local mediator-vasoconstriction and decrease of the nociceptive-C fiberation. Researchers have compared the aforementioned two drugs and reported contradictory outcomes in context with brachial-plexus blocks when use as adjuvant8-11.

EL-Hamid12 reported that cases where 0.5% levobupivacaine was used with 8mg of dexamethasone there was a significant decrease in the morphine usage post the surgical procedure.

A significant increased extent of motor block was reported in another comparative research where dexmedetomidine was compared against dexamethasone used as an adjuvant (888.62±57.92min vs. 1303.93±233.71 min) in blocking the supraclavicular. There was also an extension in the sensory block in context of dexmedetomidine (1084.14±207.58 vs. 1619.29±235.49) vs. 1084.14±207.58 min) with the dexamethasone adjuvant to bupivacaine group13.

MATERIAL AND METHODS

In a randomized control trial performed at department of Anaesthesiology, Surgical Intensive Care & Pain Management, Civil Hospital, Dow University of Health Sciences Karachi from 29th June 2022 to 29th December 2022. There were 60 patients enrolled with half of the number in each group. The age of the patients were between 18-75 years. Those patients who have consent of participation were registered as participants. Cases with under the American Society of Anesthesiologist physical status (ASA) classification I and II, in addition to their elective surgeries of upper limb through supraclavicular anesthesia were included. The upper limb included hand, wrist, forearm as well as elbow, non-consenting, neuropathy of operative limb, systemic corticosteroid for ≥ 2 weeks in a 6month duration of surgery. Those cases having hypersensitivity to the drugs under consideration or were suffering from coagulation related disorders, or pregnant were excluded. The patients were divided in two groups. Group A were those who received bupivacaine in 25 ml of 0.5% with the dexamethasone in 8mg (2ML). While group B were those who received bupivacaine in 25 ml of 0.5% with the dexmedetomidine 1µg/kg(2ml). All cases received a standardized medicines and their medication was started night prior to their surgical procedure. The complete information regarding patient’s vitals was kept on record.
throughout the procedure. All patients were given I/V midazolam in 0.05mg/kg prior the operation. Ultrasonography was used for identification of the nerves required for block in supraclavicular region. Anesterivmulator was applied through 10cm stimulation needleassistance using 1Hz frequency at 1.0 milli ampere which was then reduced to 0.5mA post twitch received. The complete dose was injected post initial 0.5ml dose in the superioras well as inferior region of nerve (brachial plexus) keeping negative aspiration maintained. Patients were followed in the post- anesthesia care unit (PACU) and pain duration tie was recorded.

Statistical analysis and data entry were done using SPSS- 19. T-test was applied to compare the onset and duration of sensory and motor block as well as duration of post-operative analgesia between two groups. P<0.05 was considered as level of significance.

RESULTS

The ratio of males and females was 1:1. Almost67%ofthe patients were from urban area. There were 55% ASAI cases and 45% ASAII cases (Table 1). The means of age, weight,height,and body mass index of the patients were shown in Table 2. Mean onset time of sensory and motor block was significantly low in group A than group B [18.87±2.67 vs. 24.77±5.90; p=0.00005] and [32.77±2.38 vs. 38.87±3.98; p=0.0005] respectively. Mean duration of sensory block and motor block was significantly high in group A813.87±113.72 vs 752.63±27.96 (p=0.006) than group B 734.13±84.44 vs 533.07±88.38 (p=0.0005). The time to request for first rescue analgesic was significantly (p=0.0005) increased in group B as compare to group A (Table 3).

Table 1: Demographic information of the patients (n=60)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>43.3</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>56.7</td>
</tr>
<tr>
<td>Residential status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>12</td>
<td>40.0</td>
</tr>
<tr>
<td>Urban</td>
<td>18</td>
<td>60.0</td>
</tr>
<tr>
<td>ASA status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>18</td>
<td>60.0</td>
</tr>
<tr>
<td>II</td>
<td>12</td>
<td>40.0</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td>Wrist</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>Forearm</td>
<td>10</td>
<td>33.3</td>
</tr>
<tr>
<td>Elbow</td>
<td>7</td>
<td>23.4</td>
</tr>
</tbody>
</table>

Table 2: Descriptive statistics of the patients according to groups (n=60)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>35.20±8.56</td>
<td>34.57±10.30</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.33±10.03</td>
<td>67.70±11.12</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>161.90±9.13</td>
<td>163.77±7.60</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>24.57±3.54</td>
<td>25.23±3.76</td>
</tr>
</tbody>
</table>

Table 3: Compare the mean commencement and interval of sensory and motor block and analgesia time duration within groups

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group A</th>
<th>Group B</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>One set of sensory block</td>
<td>4.77±2.38</td>
<td>16.87±2.67</td>
<td>0.0005</td>
</tr>
<tr>
<td>Duration of sensory block</td>
<td>813.87±113.72</td>
<td>752.63±27.96</td>
<td>0.006</td>
</tr>
<tr>
<td>Onset of motor block</td>
<td>38.87±3.98</td>
<td>32.77±2.38</td>
<td>0.0005</td>
</tr>
<tr>
<td>Duration of motor block</td>
<td>734.13±84.44</td>
<td>533.07±88.38</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

DISCUSSION

Regional anesthesia in orthopedic procedures is superior to general anesthesia in terms of better postoperative pain relief, less central nervous system depressant effect of drugs and early discharge from hospital15. For surgeries on the upper limb, the brachial plexus block is a practical and often employed regional anesthetic method. Although there are many various techniques, we chose the supraclavicular route because it is a straightforward and secure method for administering anesthetic and pain relief during procedures below the shoulder joint, hence several anaesthetic like ketamine, propofol, alfentanil and dexamethasone have been applied as anadjuvantstowards the locally available anesthetic drugs for accelerating the onset, prolong the duration and improve the quality of block. In this study we aimed to compare the effect of dexametomidine, and dexamethasone added to bupivacaine on duration and onset of motor as well as sensory block as well as duration of postoperative analgesia. In this study the average age was 35.20±8.5 years in group A and 34.57±10.31 years in group B. This was almost similarly with study by Hamada MH et al19. In some studies, average age of the patients was 30 to 40 years20-22. In our study there were male to female ratio was equal (Ratio=1:1). In most of the studies male and female ratio was almost equal and some have difference21-22.

Our study showed that mean duration of sensory [813.87±113.72 min vs. 752.63±27.96 min; p=0.006] and motor block [734.13±84.44 min vs. 533.07±88.38 min; p=0.0005] was significantly high in the dexametomidine to bupivacaine (Group B) as compare to dexamethasone to bupivacaine (Group A). However mean onset of sensory and motor block was shorter in dexamethasone group than dexametomidine group [18.87±2.67 vs. 32.77±2.38; p=0.0005] respectively. Mean duration of sensory and motor block was significantly low in group A than group B respectively. Similar mean time to request of rescue analgesia was also significantly high in dexametomidine to bupivacaine (Group B; 1320.73±150.59 min) as compare to dexamethasone to bupivacaine (Group A; 805.77±84.83 min). This finding is similar with thestudybyHamadaetal19 revealed that mean duration of sensory and motor as well as of duration of analgesia was significantly prolonged in dexametomidine group as compared to dexamethasone. But onset of motor and sensory block was shorter in dexamet has one group than dexamethasone group. In another study conducted by Gunaseelan et al23 after axillary block with dexametomidine and dexamethasone as adjuvants to bupivacaine, they compared the duration of sensory and motor blockade and postoperative analgesia. The authors identified higher duration interval in dexametomidine group. Khaleeq et al20 and Gautam et al21 detailed the adjuvant qualities of dexametomidine as block of supraclavicular-brachial-plexus with prolonged analgesia duration also reported similar results.

The properties of adjuvant dexametomidine in supraclavicular-brachial plexus-block has also been reported by Kathuria et al30 as reducing the motor as well as sensory block-onset time while extends the duration. This block was reported not only to delay the primary dead of analgesia post operation but also reduced its overall consumption within 24 hours. Ray et al34 compared the dexametomidine binary doses and reported that the mean duration of sensory analgesia onset as well as that of motor blockage had a significant comparison. However there was no significant finding related with motor and sensory blockage as well as the time when the patient primarily demanded the pain analgesic. Contrary to this Ali32 stated both of the doses to be good adjuvants in peripheral blockage of nerve vein comparison with dexametomidine as itself.

Many studies had used dexametomidine as an adjuvant to LA in different regional and peripheral nerve blocks and found that it is an excellent choice in potentiating the local anesthetic effects25-28. The effects of adding dexametomidine to local anesthetics such as ropivacaine and bupivacaine in the supraclavicular, interscalene, cervical plexus, and ulnar nerve blocks have been explored by Swain et al25. Dexametomidine has been demonstrated to improve the quality and duration of analgesia.

Liu et al27 and Vieira et al26 established the fact that perineural dexamethasone has a prolonged analgesic effect and provides long-term motor block duration with 0.25% bupivacaine in supraclavicular-brachial plexus nerve-block. Biradar et al26 supported the dexamethasone as adjuvant to bupivacaine as a
relatively quick onset of motor block and well-assessed sensory block. Weietal also reported dexmedetomidine as insignificant in bringing hemodynamic variations regarding BSSS dosage applied.

There were few studies reporting insignificant onset of sensory and motor block in the dexmedetomidine injected patients than in controls. Local anesthesia and block techniques can be the reason for causing insignificant variance. The current study has some limitation only including ASA I and ASA II patients and unintentional miss of delayed complications due to non-follow of cases above 24 hours post-operation.

CONCLUSION

Dexmedetomidine addition to bupivacaine can not only prolongs the motor/immobility block but also facilitate in the longer extent of analgesia compared to the dexmedetomahas, however the block onset was reduced than in patients who were given dexamethasone with bupivacaine.

Conflict of interest: Nil

Ethical consideration: Permission was granted by Institutional Review Board.

REFERENCES