Clonidine as adjuvant to 0.75% ropivacaine in supraclavicular brachial plexus block for post operative analgesia: A single blind randomized controlled trial

Chinar Patel*, Hetal Parikh, Mrugank M Bhavsar and Rama Upadhyaya

Department of Anesthesia, SBKS MI & RC, Sumandeep Vidyapeeth, Piparia, Vadodara, Gujarat, India

Abstract

Aims & Objective: The present study was aimed to evaluate the effects of clonidine added to 0.75% Ropivacaine on the onset of sensory and motor blockade and duration of analgesia and note the incidence of adverse effects if any.

Material & Method: Patients were randomly allocated into two groups. After written informed consent, in Group I – supraclavicular brachial plexus block was performed with 40 ml of 0.75% Ropivacaine + 1 ml of normal saline and in Group II – patients received the same block with 40 ml of 0.75% Ropivacaine + 2 mcg/kg clonidine. Onset of sensory and motor blockade was recorded. Motor block was evaluated by quantification of muscle force according to a rating scale from 6 (normal muscle force) to 0 (complete paralyses). Sensory block was evaluated by response to pin prick to the innervated areas. Finally duration of analgesia was noted.

Result: There was no intergroup difference in onset of sensory and motor block. The mean duration of analgesia was 554 ± 81.7 min in Group I and 812 ± 109.6 min in Group II.

Conclusion: We conclude that addition of clonidine to 0.75% Ropivacaine in supraclavicular brachial plexus block does not alter the onset of block but prolongs the duration of analgesia.

Keywords: Clonidine, Supraclavicular brachial plexus block, Ropivacaine

1. Introduction

Acute postoperative pain is the result of complex physiological reactions. The dorsal horn is the site of terminations of primary afferents and there is a complex interaction between such fibres, intrinsic spinal neurons, descending modulatory pain fibres and various neurotransmitters such as serotonin, norepinephrine etc.1 The demand for early and efficient rehabilitation in modern day orthopaedic procedures has led to tremendous progress in peripheral nerve blocks. Ropivacaine is a well tolerated regional anesthetic for postoperative analgesia with lower grade of motor block and reduced potential for CNS and cardiotoxicity.2 Clonidine has been used as an adjuvant to local anesthetics in various regional techniques and is known to prolong the duration of peripheral nerve blocks.3,14,16,24,26

The present study was aimed to evaluate the effects of clonidine added to 0.75% ropivacaine on the onset of sensory and motor blockade and duration of analgesia and note the incidence of adverse effects in supraclavicular brachial plexus block.

2. Material and Method

This prospective randomized single blind study was approved by the ethical committee of our institute. After taking informed written consent, 60 patients aged 18 years and above, irrespective of sex, scheduled for orthopaedic surgeries of arm, forearm and hand were selected. A total of 62 patients were selected for the study. Two patients who had partial effect and had to be supplemented with GA were excluded from the study. The patients were randomly divided into two equal groups of 30 each. The dosage of ropivacaine used for supraclavicular block was fixed in both groups.

Group I received 40 ml of 0.75% ropivacaine with 1 ml of saline.

Group II received 40 ml of 0.75% ropivacaine with 2 µg/kg of clonidine.

As premedication, all patients received inj. Midazolam 20 µg/kg and were preloaded with crystalloid at 4ml/kg/hr. They were then placed in supine position with head turned away from the side to be blocked. The arm to be anaesthetized was adducted and hand extended towards the knee. Under complete aseptic precautions, supraclavicular block was performed using paraesthesia technique with 40 ml of 0.75% ropivacaine with or without the adjuvant. An oxygen mask was placed, eyes were covered and vitals were monitored throughout the surgery.

The onset of motor block was evaluated by quantification of muscle force by modified Lovett scale from 6(normal muscle force) to 0 (complete paralyses) while the onset of sensory block was determined by loss of sensation to pin prick over the entire limb and only when adequate block was achieved, were the surgeons allowed to operate.

The drug solution was prepared by the anesthetist who performed the block and patients were evaluated for postoperative analgesia by another anesthetist who was not present in the theatre. Sedation was assessed using the Ramsay sedation score. Subjectively the pain was graded as mild, moderate or severe and objectively assessed by a visual analogue scale (VAS) from 0 (no pain) to 10 (severe pain) which was explained to patient prior to surgery. Patients were observed and treated for side effects.

Duration of analgesia was measured from the time of onset of sensory block to the first complaint of pain. Rescue analgesia (intramuscular Diclofenac) was administered as soon as the patient complained of pain (VAS ≤ 3). Thus the onset of both motor and sensory block and the duration of postoperative analgesia were studied. The software used in the statistical analysis of this study was PASS and SPSS 11.5 and the power of the study was ≥0.8 (80%).
3. Results

There was no statistically significant difference (P=0.41) among the two groups in terms of demographic data [Table1].

Table 1: Demographic data of groups (mean ± SD)

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of patients</th>
<th>ASA Gr. 1/II/III</th>
<th>Age (years)</th>
<th>Weight (kg)</th>
<th>MF</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>30</td>
<td>14/12/4</td>
<td>53.3 ± 5.29</td>
<td>54 ± 5.63</td>
<td>18.11</td>
</tr>
<tr>
<td>II</td>
<td>30</td>
<td>15/12/3</td>
<td>50.7 ± 5.54</td>
<td>51.6 ± 6.95</td>
<td>14.16</td>
</tr>
</tbody>
</table>

The onset time of sensory block, as measured by pinprick, was 8.3 ± 1.45 minutes (mean ± s.d) in Group I and 8.0 ± 0.93 minutes in Group II which was similar and statistically insignificant (P=0.271) in both groups [Table 2]. The onset time of motor block as measured by a rating scale in Group II which was also statistically insignificant and clinically similar (P=0.251) [Table 2].

The mean duration of analgesia in the control group I was 562±78.05 minutes while in group II was 809 ± 101.6 minutes. A statistically significant longer duration of analgesia in group II was observed when compared to Group I (P<0.0001) [Table 2]. The average VAS pain score at the time of giving rescue analgesic was similar in both groups. There was no significant change in the hemodynamic parameters in both groups [Table 3].

Mild short lived intraoperative sedation (Ramsay score 4) was noted in group II in two patients within upto 15 minutes of the block which did not necessitate any treatment and both patients were closely monitored postoperatively and recovered well. No other side effects were noted [Table 4].

4. Discussion

In the recent years, Ropivacaine has been increasingly replacing bupivacaine for regional techniques because of its similar analgesic properties, lesser motor blockade and decreased propensity for cardiotoxicity. The concurrent injection of clonidine has been suggested to improve the nerve block characteristics through either local vasoconstriction or C-fibre blockade. Though, when injected as a sole analgesic into the brachial sheath, it did not provide clinically relevant analgesia. Clonidine has been demonstrated to inhibit the action potential of Aα and C- fibres. It possibly enhances or amplifies the sodium channel blockade of local anesthetics by opening up the potassium channels resulting in membrane hyper polarization, a state in which the cell is unresponsive to excitation output. The α2-adrenergic receptors activated by clonidine are located on primary efferent terminals, neurons in the superficial laminae of the spinal cord, and in the brain stem nuclei implicated in analgesia. Inhibition of noradrenaline release, mediated by an interaction with α2- adrenergic presynaptic receptors, has been an alternative explanation for the enhancing effect of peripheral administration of clonidine. It has also been observed that parental administration of the same dose of clonidine, as a sole analgesic was not effective in providing sufficient analgesia in brachial plexus blocks but did prolong the duration when given with a local anesthetic by its direct action on the nerve fibres.

It is interesting to note that clonidine is widely recommended to prolong duration of brachial plexus block, even relatively low dose Clonidine, as adjuvant to 0.5% bupivacaine for supraclavicular block has been demonstrated to prolong the duration of analgesia as well as the motor block. In a dose finding study, Singelyn et al suggested that a dose of 0.05 µg/kg was the minimum effective dose of clonidine required for prolongation of analgesia without undue side effects. Bernard and Marie, evaluated a dose range 30- 300 µg of clonidine added to lignocaine for brachial plexus blocks, and demonstrated a reduction in block onset time as well as improvement in the efficacy of surgical anaesthesia. We however observed no difference in block onset with or without clonidine but a notably extended pain relief was observed.

Table 2: Onset and Duration of analgesia (Mean ± SD)

<table>
<thead>
<tr>
<th>Group</th>
<th>Onset in minutes (mean ± s.d)</th>
<th>Duration of analgesia (mean ± S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensory</td>
<td>Motor</td>
</tr>
<tr>
<td>I</td>
<td>8.3 ± 0.45</td>
<td>13.1 ± 1.46</td>
</tr>
<tr>
<td>II</td>
<td>8.0 ± 0.93</td>
<td>14.3 ± 1.31</td>
</tr>
</tbody>
</table>

Table 3: Hemodynamic Parameters (mean ± S.D)

<table>
<thead>
<tr>
<th>Group</th>
<th>MAP (mean ± S.D)</th>
<th>PR (mean ± S.D)</th>
<th>MAP (mean ± S.D)</th>
<th>PR (mean ± S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>80.03±6.69</td>
<td>80.03±6.69</td>
<td>77.53±7.44</td>
<td>77.53±7.44</td>
</tr>
<tr>
<td>II</td>
<td>78.45±8.10</td>
<td>89.13±4.54</td>
<td>76.83±9.60</td>
<td>86.85±8.63</td>
</tr>
</tbody>
</table>

Figure 1: Hemodynamic Parameters

MAP: Mean arterial pressure, PR: pulse rate

Table 4: Side effects and complications

<table>
<thead>
<tr>
<th>Group</th>
<th>Sedation</th>
<th>Hypotension</th>
<th>Bradycardia</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

IIBR (2014) 05 (05)  www.ssjournals.com
Totally paralleling our findings, El Saied et al., showed an increase in duration of analgesia from 587 minutes in control group to 828 minutes in clonidine group with a mean diff of 241 min. with 150 µg of clonidine added to 40 ml of ropivacaine 0.75%, in brachial plexus block. They also noted no difference in onset time of both sensory and motor blocks of both groups and no major side effects.

However, there is also evidence to dispute this recommendation. Dumas et al. observed no difference in duration of analgesia with or without clonidine, but also noticed marked variability in the duration in groups containing clonidine, added to levobupivacaine, in axillary brachial plexus blocks. This was explained on the basis of inter-patient variation in anatomy of the plexus sheath and the difference in the spread of local anesthetics with different techniques. Other authors have also demonstrated that neither the onset nor the efficacy of nerve blockade was influenced by adding clonidine. These variations in the reported effects of small dose clonidine on onset time and efficacy of nerve block have been explained by differences in the type of nerve block, mixture injected, and the technique used to perform the block (single injections versus multiple injections). A multiple injection technique was shown to improve both onset time and quality of nerve block as compared to single shot method. Though one study demonstrated that clonidine prolongs the duration of analgesia in brachial plexus blocks regardless of the approach and technique.

It has been studied that the doses and routes of administration of clonidine are mainly responsible for its side effects namely sedation, hypotension and bradycardia etc. These effects have shown to vary with different types of peripheral nerve blocks, probably influencing the rate of absorption of the injected anesthetic solution.

Singelyn et al. safely used 0.05µg/kg of clonidine in axillary block. Larger doses of 1µg/kg have been used with 0.75% ropivacaine in femoral nerve blocks, but only mild short lasting increases in degree of sedation 10 min after block placement with no cardiovascular side effects were reported. However, doses like 150 µg of clonidine, when used intrathecal have notably caused hypotension, sedation and dry mouth. The interaction of clonidine with central α-2 receptors is known to cause sedation while augmentation of parasympathetic system and inhibition of sympathetic system are suggested to be mainly responsible for its hemodynamic side effects. These effects were claimed to be more pronounced with larger doses of clonidine. A recent study even reported that the risks of using clonidine as an adjuvant in brachial blocks outweigh the benefits owing to high incidences of side effects like bradycardia, sedation and orthostatic hypotension. We however noticed that with a dose of 2 µg/kg of clonidine which has not been used widely experimented for brachial plexus blocks, we achieved significant prolongation of analgesia without any detrimental effects of the systemic manifestations of clonidine.

5. Conclusion

Our results show that clonidine does not alter the onset of block but prolongs the duration postoperative analgesia when added ropivacaine 0.75% in supraclavicular brachial plexus blocks and can be used safely for extended postoperative pain relief.

References

13. Sia S, Lepri A. Clonidine administered as an axillary block does not affect postoperative pain when given as the sole analgesic. Anaes Analg 1999; 88:1109-12.
33. Bernard JM, Macarie P. Dose-range effects of clonidine added to lidocaine for brachial plexus block. Anesthesiology 1997; 87:277-84.

IJB (2014) 05 (05) www.ssjournals.com