Comparison of clinical effects of prilocaine, dexamethasone added to prilocaine and levobupivacaine on brachial plexus block

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Abstract
Objective: To determine whether the addition of 8mg dexamethasone to axillary brachial plexus block would prolong the duration of sensory and motor block in patients undergoing hand and forearm surgery.

Methods: The prospective, randomised, double-blinded study was conducted at the Eskisehir Osmangazi University Medical School, Turkey, from October 2008 to December 2009. It comprised 45 American Society of Anaesthesiologists grade I and II patients under elective surgery of the hand and forearm. The patients were randomly divided into 3 groups: 5 mg/kg of 2% prilocaine was applied to Group 1; 5mg/kg of 2% prilocaine +8mg of dexamethasone (2ml) was applied to Group 2; and 1.5mg/kg 0.5% levobupivacaine was applied to Group 3.

Results: Of the 45 patients, 27 (60%) were men and 18 (40%) were women. There was no significant difference among the groups in terms of demographic data. Based on the duration of motor and sensory block, similar periods of time in Group 1 and Group 2 were noted, whereas this period was statistically different and significantly longer in Group 3 (p < 0.001). There were no complications encountered.

Conclusion: The addition of dexamethasone to prilocaine prolonged the duration of sensory and motor block. It could be used as an effective adjuvant agent. Levobupivacaine could be a more appropriate local anaesthetic in postoperative analgesia and prolonged surgical procedures.

Keywords: Prilocaine, Dexamethasone, Levobupivacaine, Axillary block. (JPMA 64: 433; 2014)
written informed consent of the patients had been obtained. A total of 45 patients aged between 18-60 years undergoing elective hand and forearm surgery and who were in American Society of Anaesthesiologists (ASA) I-II risk group were included in the study. Patients who had severe hepatic, renal, cardiovascular disorders, known allergy and electrolyte imbalance, who were pregnant, unwilling for participation or showing lack of cooperation and patients who were switched to general anaesthesia due to unsuccessful block were excluded.

The patients were randomly divided into three equal groups. Randomisation was done by a computer-generated table of random numbers and the patients were not informed about their groups. Group 1 was administered 5mg/kg of 2% prilocaine; Group 2 was administered 5mg/kg of 2% prilocaine +8mg of dexamethasone (2ml); and Group 3 was administered 1.5mg/kg 0.5% levobupivacaine. Drugs in all groups were completed to 40cc with 0.9% sodium chloride (NaCl) and brachial plexus block was applied with axillary approach. An anaesthesiologist not involved in the performance of axillary block or collection of data prepared all the local anaesthetic mixtures and adjuvant drugs and labelled them using the computer-generated random number.

Patients were not given any pre-medication before the operation. On arrival at the operating room, standard monitoring was established (pulse oximetry, electrocardiography, heart rate and non-invasive arterial blood pressure monitoring) and oxygen was delivered via a Venturi facemask at a rate of 3 L/min. All patients were inserted a 20G canula into a peripheral vein in the contralateral arm and 0.9% NaCl infusion was started. The arm which had to be operated upon was taken to 90 degrees of abduction and the forearm was taken to approximately 90 degrees of flexion, 1 ml of lidocaine injection was given after the operative field had been cleaned and axillary artery was palpated. We used a nerve stimulator (Stimuplex®; Braun, Melsungen, Germany) with 50mm of stimuplex needle (stimuplex®; braun, Germany) for precise localisation of the brachial plexus. The nerve stimulator frequency was set at 2Hz and the intensity of the stimulating current was initially set to deliver 2mA and was then gradually decreased. The position of the needle was considered to be acceptable when an output current ≤0.5mA still elicited a slight distal motor response in each of the nerve distributions (thumb opposition for median, thumb abduction for radial, thumb adduction or ulnar deviation of the hand for ulnar, and flexion of forearm on the arm for musculocutaneous nerves). At this time, the local anaesthetic mixture, 2ml less than the total volume prepared, was injected in increments after negative aspiration for blood and air. In order to avoid intravascular injection, negative aspiration was performed every 3.0-4.0 ml, during injection of the local anaesthetic. The remaining 2ml was diluted to 4ml and used for intercostobrachial nerve block to prevent tourniquet pain. The patients with inadequate block, or block failure in a nerve distribution region were excluded. One anaesthesiologist performed all nerve blocks by the same nerve stimulator technique.

Heart rate, arterial blood pressure (systolic, diastolic and mean arterial pressures), and oxygen saturation were recorded just before the block and at regular intervals thereafter. All measurements were recorded on the Osmangazi University Anaesthesiology Operation Form and the Working Registration Form.

Demographic data, sensory and motor block onset time, duration of sensory and motor block were also recorded by assessing sensory block by pinprick test using a 3-point scale: 0 = normal sensation; 1 = loss of sensation of pinprick (analgesia); 2 = loss of sensation of touch (anaesthesia), and motor blockade using a Bromage scale (0: no movement; 1: finger movement; 2: wrist flexion; 3: elbow flexion). Sensory and motor blocks were evaluated every 5 minutes until 30 minutes after injection, and then every 30 minutes after surgery, until they had resolved. Sensory and motor block onset time was considered as the time between finishing injection of local anaesthetic and to no response to the pinprick test and full paralysis. Duration until the same sensation was felt on the contralateral arm and the first pain post-operatively was accepted as sensorial block time. Duration until recovery of all movements after motor block had occurred was defined as motor block time. Pain levels at post-operative period were assessed using a 10cm visual analogue scale (VAS) from 0 (no pain) to 10 (severe pain). The patients and the anaesthesiologists who performed the block and who collected patient data were blinded to the mixture used or group allocation.

Patients were followed up for potential side effects (nausea, vomiting, methemoglobinemia, cardiovascular issues). When the patient first complained of pain after operation, intramuscular (IM) injection diclofenac sodium 1mg/kg was given.

Analysis of all data was done using SPSS 15.0 and Stigmastat 3.1 package programmes. Constant quantitative data was defined as frequencies, percentages, mean and standard deviation, while qualitative data was defined as frequencies and ratio. Constant variables composed of independent and repeated measurements and showing normal distribution
were analysed with one-way analysis of variance (ANOVA) and one-way repeated measures ANOVA. Independent and repeated data not showing normal distribution was analysed with Kruskal-Wallis and Friedman tests. Tukey and Fisher least significant difference (LSD) methods were used in multi-comparison of these tests. Chi-square test was done for categorical data sets. A p level of <0.05 was accepted as statistically significant.

**Results**

In terms of demographic data, there was no significant difference among the three groups (p>0.05) (Table-1). Likewise, no significant difference was found among the groups in terms of systolic, diastolic and mean arterial pressures on control and during operation (p>0.05).

Motor block and sensorial block onset times were found as 5 (5-15), 5 (5-15), 15 (15-25) in the three groups, respectively. While similar times were found between Group 1 and Group 2, the time period was longer in Group 3. The difference was statistically significant in terms of both sensorial and motor block onset times (p<0.001) (Table-2).

Motor and sensorial block times were evaluated in

**Table-1: Demographics.**

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n:15)</th>
<th>Group 2 (n:15)</th>
<th>Group 3 (n:15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>40.8 ± 9.1</td>
<td>40.4 ± 9.3</td>
<td>39.6 ± 6.8</td>
</tr>
<tr>
<td>Gender (f/m)</td>
<td>6/9</td>
<td>7/8</td>
<td>5/10</td>
</tr>
</tbody>
</table>

**Table-2: Motor and sensorial block onset times (min).**

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor block onset time (min)</td>
<td>5 (5-10)</td>
<td>5 (5-10)</td>
<td>15 (15-20)*</td>
</tr>
<tr>
<td>Sensorial block onset time (min)</td>
<td>5 (5-10)</td>
<td>5 (5-10)</td>
<td>15 (10-15)*</td>
</tr>
</tbody>
</table>

Data are given as median, 25%-75%. Kruskal-Wallis one way variance analysis (p<0.001*).

**Table-3: Duration of sensorial block (min).**

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of sensorial block</td>
<td>216.7±35.8</td>
<td>380±50.9*</td>
<td>502.3±64.2*</td>
</tr>
</tbody>
</table>

Data are given as mean ± SD (p<0.001*).

**Table-4: Duration of motor block (min).**

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of motor block</td>
<td>135 (120-180)</td>
<td>300 (265-350)*</td>
<td>380 (311-400)*</td>
</tr>
</tbody>
</table>

Data are given as median, 25%-75%. Kruskal-Wallis one way variance analysis (p<0.001*).

minutes. A statistically significant difference was found between group in terms of block times (p<0.001). Motor and sensorial block times were longer in Group 3 compared to Group 1 and Group 2; while motor and sensorial block times were longer in Group 2 compared to Group 1 (p<0.001) (Tables 3, 4).

No side effects were seen in patients.

**Discussion**

Properties of an ideal drug used for peripheral nerve block are rapid sensorial block onset time, earlier recovery of motor block than sensorial block, and the patient’s ability to move the extemity during analgesia. Various adjuvants are added to local anaesthetics in order to ensure these properties.

A study reported that 8mg of dexamethasone added to lidocaine in intravenous regional anaesthesia in 75 patients did not change sensorial and motor block onset time. However, it significantly prolonged durations of sensorial and motor block.

Another study concluded that 8mg of dexamethasone added to mepivacaine prolonged duraton of analgesia. However, it did not reduce sensorial and motor block onset times in 45 patients undergoing hand and forearm operations.

One study showed that dexamethasone added to bupivacaine prolonged the duration of sensorial and motor block in interscalene brachial plexus block. It also showed that VAS scores on 24 hour was lower in dexamethasone group, but were similar on 48 hour. It reported that dexamethasone reduced opioid use by prolonging the sensorial block time.

Another study concluded that dexamethasone added to levobupivacaine improved post-operative analgesia in brachial plexus block. Although analgesic mechanism of corticosteroids is not fully understood, but corticosteroids are known to have functional and structural effects on normal peripheral nerve fibres. However, steroids were reported to stimulate vasoconstriction and thereby reduced absorption of local anaesthetic. One study reported that steroids inhibited synthesis and secretion of some inflammatory mediators and thereby the duration of analgesia stood prolonged.

A study investigated the influences of dexamethasone added to lidocaine in 60 patients undergoing elective hand and forearm surgery. It reported that 8mg dexamethasone was seen to prolong the duration of sensorial and motor block, but did not affect block onset time. It was suggested that steroid addition is not
indicated in all patients and also care must be taken in patients with diabetes, hyperglycaemia and infection. The current study concluded that 8mg dexamethasone prolonged duration of blockade, but did not change block onset time. And any diseases or symptoms which affect steroid use as diabetes mellitus, hyperglycaemia or infection were not seen.

In our study, we saw that rapid block onset time was an advantage, but short duration of action was a disadvantage of prilocaine. Dexamethasone added to prilocaine may be a good option in axillary brachial plexus blockade as it significantly prolonged the duration of motor and sensory block and reduces block onset time and also no side effects were seen in patients. Block onset time of levobupivacaine was longer than that of prilocaine and it may reduce additional analgesic use in axillary brachial plexus blockade due to long sensorial blockade effect.

Conclusion
The addition of dexamethasone (8mg) to prilocaine in axillary brachial plexus block prolonged the duration of sensory and motor blockade. Dexamethasone may be used as an effective adjuvant agent. Besides, levobupivacaine is a very effective and safe local anaesthetic in long surgical interventions due to its post-operative analgesic effect and satisfactory sensorial and motor block.

Acknowledgements
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References