Efficacy of Sub-Tenon’s Block Using Dexmedetomidine Added to Local Anesthetics in Cataract Surgery

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Abstract

BACKGROUND: Sub-Tenon’s block is classified as an episcleral technique (as opposed to retrobulbar and peribulbar approaches). Local anesthetic can be introduced via a needle or blunt probe. Dexmedetomidine is a highly selective α2 receptor agonist and has been used as additive to local anesthetics. Aim of the study: This study aimed to study the efficacy of addition of dexmedetomidine to local anesthetics for the sub-Tenon’s block in cataract surgery. METHODS: 60 patients underwent cataract surgery divided in to two groups. Group I (Local) the patient received 2 ml 2% lidocaine + 2 ml of bupivacaine 0.5% +0.5 ml saline as sub-Tenon’s block. Group II (dexmedetomidine), the patient received 2 ml 2% lidocaine + 2 ml of bupivacaine 0.5% + 25 μg of dexmedetomidine in 0.5 ml saline as sub-Tenon’s block. The onset and duration of the corneal anesthesia and global akinesia, the first time to require analgesia, the number of patient require analgesia, the total consumption of paracetamol, intraocular pressure, 6- point pain score and Ramsey sedation score were compared between the two groups. RESULTS: The onset of corneal anesthesia, global akinesia and total paracetamol consumption were significantly decreased in the dexmedetomidine group. The duration of the corneal anesthesia and global akinesia and the first time to require analgesia were significantly prolonged in the dexmedetomidine group. The number of patient require analgesia was comparable between the 2 groups. The intraocular pressure, 6- point pain score and agitation were significantly decreased in dexmedetomidine group. Conclusion: The addition of dexametomidine to local anesthetics in sub- Tenon’s block decreased the onset for corneal anesthesia and global akinesia and prolonged their durations. Also it decreases the intraocular pressure, the total consumption of paracetamol, pain score and agitation.

Introduction:

There are 3 types of cataract extraction, phacoemulsification is the most common form of cataract removal. It is this most modern method, cataract surgery can usually be performed 30 minutes to 45 minutes and usually requires only minimal sedation. Numbing eye drops or an injection around the eye is used[1].

Another method for cataract extraction is extracapsular cataract surgery: This procedure is used mainly for very advanced cataracts where the lens is too dense to dissolve into fragments (phacoemulsify). This technique requires a larger incision so that the cataract can be removed in one piece without being fragmented inside the eye. Extracapsular cataract extraction usually requires an injection of numbing medication around the eye[2].

Intracapsular cataract surgery is also a surgical technique requires an even larger wound than extracapsular surgery, and the surgeon removes the entire lens and the surrounding capsule together. This method is rarely used today but can still be useful in cases of significant trauma[3].

Tenon’s capsule is a dense, fibrous layer of elastic tissue surrounding the eye and extraocular muscles in the orbit. It originates at the limbus and extends posteriorly to the optic nerve and has sleeves along the extraocular muscles. The penetration of the rectus muscles divides Tenon’s capsule into anterior and posterior portions[4].

An episcleral technique is called Sub-Tenon’s block (as opposed to retrobulbar and peribulbar approaches). Local anesthetic can be introduced via a needle or blunt probe[2].

Dexmedetomidine, a highly selective α2 receptor agonist, produces analgesic, sedative and central sympatholytic effects[5]. It also has been added to local anesthetics in many peripheral nerve block as brachial plexus block[6].

Aim of the study: This study aimed to the efficacy of addition of dexmedetomidine to local anesthetics for the sub-Tenon’s block in cataract surgery.

Patients and methods:

This study was approved by the local Clinical Research Ethics Committee of Menoufiya hospital and written informed consent was obtained from the patients before the surgery. This study was performed in six months period from May 2013 till November 2013. Sixty patients with the American Society of Anesthesiologists (ASA) physical status II-III, aged 40–65 years, undergoing Cataract extraction were enrolled in the study. Exclusion criteria were Patients with history of hypersensitivity to study drugs difficulty in communicating, anxious. uncontrolled arterial hypertension, second or third degree heart block, congestive heart failure, chronic heart failure, expressed recent myocardial infarction, uncontrolled diabetes (blood sugar >250 recorded in last 30 days or HbA1c >7.5%), hepatic impairment (CHILD B classification or higher), renal impairment, ongoing drug or alcohol abuse, coagulopathy, patients who had glaucoma, previously undergone one surgery in the same eye. In the operating room, the peripheral 20 F cannula was inserted and the following monitors were...
established (peripheral pulse oximeter, non-invasive blood pressure and ECG using the three-lead electrode system). No premedication or sedation were given to any patient and then the patients were randomly divided in two groups, 30 patients for each. **Group I** received 2 ml 2% lidocaine + 2 ml of bupivacaine 0.5% +0.5 ml saline and **Group II** received 2 ml 2% lidocaine + 2 ml of bupivacaine 0.5% + 25 µg of dexmedetomidine in 0.5 ml saline. sub-Tenon’s block was done by an ophthalmologist by the following technique: surface anesthesia was achieved by instilling topical agent as benoxinate on the conjunctiva and cornea. 5% povidone iodine eye drops was instilled before embarking on the block, the infero nasal quadrant was the most common site used.

The patient was asked to look upwards and outswards, under sterile conditions, the conjunctiva and tenon capsule were gripped with non-toothed forceps, 5 mm away from the limbus. A small incision was made through these layers with scissors to expose the whitish sclera. A small blunt, curved toothed forceps, 5 mm away from the limbus curved 19G, 25 mm sub-Tenon’s cannula is passed into the tunneled and advanced slowly keeping the tip hugging the sclera until the syringe is vertical to a depth of 15–20 mm in the inferonasal quadrant. This delivers anesthetic posterior to the equator of the globe.

The mean arterial blood pressure (MAP), heart rate and oxygen saturation were recorded every 5 min intraoperative and 15 minutes postoperative till first two hours. A decrease in (MAP) by 20% was treated by ephedrine bolus in a dose (5 mg) IV. A decrease in the heart rate below (50 beat/min) was treated by atropine (0.25-0.5 mg) IV.

Demographic data (age, gender, weight, height and duration of surgery) were assessed. Corneal sensation was evaluated using cotton wick at every 30 seconds till the onset of anesthesia and every 20 minutes till recovery. Ocular movement was evaluated at 2-minute interval movement in the superior, inferior, medial and lateral directions was scored as 0 (no movement), 1 (up to 2 mm movement) or 2 (>2 mm movement); this gave a range from 0 (complete akinesia) to 8 for each assessment. Time for adequate conditions to start the surgery was defined as presence of corneal anesthesia together with the total ocular movement score ≤4 and eyelid squeezing score of 0.

The intraocular pressure was assessed before sub-Tenon injection, one minute, 5 minutes, 10 minutes and 15 minutes after injection via schioitz tonometer. The Ramsay sedation score was at every 10 minutes during 1st 30 minutes and every 15 minutes till one hour and every 3 minutes in the 2nd hour on a numerical scale; 1 = anxiety and completely awake, 2 = completely awake, 3 = awake but drowsy, 4 = asleep but responsive to verbal commands, 5 = asleep but responsive to tactile stimulus, and 6 = asleep and not responsive to any stimulus. 6-point verbal rating score was used to assess the severity of the pain and patients were asked to rate their pain intensity choosing from the following descriptors: none, very mild, mild, moderate, severe, very severe (0-5); zero means no pain and 5 means very severe. The pain was assessed at the end of surgery and every 60 minutes up to 2 h and then at 4 h, 6 hours and 12 h. Paracetamol oral tablets (500 mg) was given if a verbal rating scale score was ≥2. The time of first request for analgesic and total analgesic requirement in 12 hrs were also recorded.

Statistical analysis of data was carried out as for all comparisons $P < 0.05$ was considered significant. Numerical variables were presented as mean and standard deviation (SD) and categorical variables were presented. Paired - Samples T test was used for analysis of used for between-group comparisons of numerical variables. Chi – sequer test for gender and number of patients required analgesia. The Mann-Whitney test was used for pain score and sedation score.

**Results:**

**Table (1):** Demographic data

<table>
<thead>
<tr>
<th></th>
<th><strong>Group I (Local)</strong></th>
<th><strong>Group II (Dexmedetomidine)</strong></th>
<th><strong>Statistical Test</strong></th>
<th><strong>P value</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (Year)</strong></td>
<td>59.9 ± 2.17</td>
<td>61 ± 2.47</td>
<td>t = 1.8</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Gender (M : F)</strong></td>
<td>17 : 13</td>
<td>19 : 11</td>
<td>chi = 0.28</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Weight (Kg)</strong></td>
<td>73.75 ± 3.9</td>
<td>74.7 ± 3.02</td>
<td>t = 1.89</td>
<td>0.064</td>
</tr>
<tr>
<td><strong>Height (Cm)</strong></td>
<td>165.8 ± 4.88</td>
<td>164.7 ± 4.4</td>
<td>t = 0.92</td>
<td>0.363</td>
</tr>
<tr>
<td><strong>Duration of surgery (min)</strong></td>
<td>41.6 ± 4.9</td>
<td>40.7 ± 8.6</td>
<td>t = 0.49</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Data expressed as mean and standard deviation (Mean± SD). Paired sample T test. denotes statistical significance ($P < 0.05$). Chi-square test for gender

**Table (2):** Onset and duration of anesthesia and akinesia, number of patients require analgesia and paracetamol consumption
<table>
<thead>
<tr>
<th></th>
<th>Group I (Local)</th>
<th>Group (Dexmedetomidine)</th>
<th>II</th>
<th>Statistical Test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onset of anesthesia (mins)</strong></td>
<td>2± .35</td>
<td>1.35 ± .37</td>
<td>t =6.9</td>
<td>&lt;.001*</td>
<td></td>
</tr>
<tr>
<td><strong>Onset of akinesia (mins)</strong></td>
<td>9±.76</td>
<td>7.4±.5</td>
<td>t =4.8</td>
<td>&lt;.001*</td>
<td></td>
</tr>
<tr>
<td><strong>Duration of anesthesia (mins)</strong></td>
<td>82.7± 6</td>
<td>107.8± 6.6</td>
<td>t =15.4</td>
<td>&lt;.001*</td>
<td></td>
</tr>
<tr>
<td><strong>Duration of akinesia (mins)</strong></td>
<td>148 ± 14.4 8</td>
<td>182.4 ± 44.9</td>
<td>t = 3.9</td>
<td>=.002*</td>
<td></td>
</tr>
<tr>
<td><strong>No require analgesia (Yes : No)</strong></td>
<td>29 : 1</td>
<td>26 :4</td>
<td>chi = 1.96</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td><strong>Paracetamol consumption (gm)</strong></td>
<td>.93± .31</td>
<td>.47± .29</td>
<td>t = 5.9</td>
<td>&lt;.001*</td>
<td></td>
</tr>
</tbody>
</table>

Data expressed as mean and standard deviation (Mean± SD), Paired sample T test. * denotes statistical significance (P< 0.05). Chi-square test for number require analgesia

**Figure (1):** First time to require analgesia
Figure (2): Intraocular pressure

Table (3): Pain score at first 12 hours

<table>
<thead>
<tr>
<th></th>
<th>Group (Local) Median [Range]</th>
<th>Group (Dexmedetomidine) Median [Range]</th>
<th>Mann-Whitney Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At end of operation</td>
<td>2 [2-2]</td>
<td>1 [0-1]</td>
<td>1272.0</td>
<td>0.700</td>
</tr>
<tr>
<td>60 min after</td>
<td>2 [2-3]</td>
<td>1 [0-1]</td>
<td>1354.5</td>
<td>0.000*</td>
</tr>
<tr>
<td>2 hr after</td>
<td>3 [2-3]</td>
<td>1 [1-2]</td>
<td>1311.0</td>
<td>0.000*</td>
</tr>
<tr>
<td>4 hr after</td>
<td>2 [2-3]</td>
<td>1 [1-2]</td>
<td>1277.0</td>
<td>0.000*</td>
</tr>
<tr>
<td>6 hr after</td>
<td>2 [2-2]</td>
<td>1 [1-2]</td>
<td>1269.0</td>
<td>0.000*</td>
</tr>
<tr>
<td>12 hr after</td>
<td>2 [2-2]</td>
<td>2 [1-2]</td>
<td>1113.0</td>
<td>0.002*</td>
</tr>
</tbody>
</table>

Data expressed as median and range, Mann-Whitney Test. * denotes statistical significance (P< 0.05).

Table (4): Sedation score at first 2 hours

<table>
<thead>
<tr>
<th></th>
<th>Group (Local) Median [Range]</th>
<th>Group (Dexmedetomidine) Median [Range]</th>
<th>Mann-Whitney Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min</td>
<td>1 [1-1]</td>
<td>2 [2-2]</td>
<td>590</td>
<td>0.000*</td>
</tr>
<tr>
<td>20 min</td>
<td>1 [1-1]</td>
<td>2 [2-3]</td>
<td>520</td>
<td>0.000*</td>
</tr>
</tbody>
</table>
Data expressed as median and range, Mann-Whitney Test. * denotes statistical significance (P< 0.05).

<table>
<thead>
<tr>
<th>Time</th>
<th>Median IOP (mm Hg)</th>
<th>Range IOP (mm Hg)</th>
<th>30 min</th>
<th>45 min</th>
<th>60 min</th>
<th>90 min</th>
<th>120 min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 [1-1]</td>
<td>3 [2-3]</td>
<td>497.5</td>
<td>497.5</td>
<td>497.5</td>
<td>520.0</td>
<td>502.5</td>
</tr>
</tbody>
</table>

Discussion:
Local anesthesia in Sub-tenon infiltration has become increasingly popular for cataract and posterior segment surgery (vitreo-retinal surgery) which presumed advantages are speed of onset, its safety, and patient compliance [13].

Dexmedetomidine, an α2 adrenoreceptor agonist and it have shown that perineural dexmedetomidine reduces the onset time and prolongs the duration of sensory and motor block [15].

There was a leak in the studies which used dexmedetomidine in the sub-tenon block. In the present study, we compare the sub-Totenon block by using lidocaine 2% plus bupivacaine 0.5 alone or with their combination with dexmedetomidine in cataract extraction.

In the present study the results of demographic data were comparable between the studied groups. The onset of global anesthesia and akinesia were shortened significantly in the dexmedetomidine group and also the duration of the global anesthesia and akinesia were prolonged significantly in the dexmedetomidine group.

These results were concomitant with the study done by Channabasappa et al who compared the addition of dexmedetomidine as an additive to local anesthetics in peribulbar block for cataract surgery and concluded that dexmedetomidine significantly decreased the onset of anesthesia and akinesia and prolonged their duration [14].

Also in the study done by Gandhi et al, who demonstrated the addition of dexmedetomidine as an additive to local anesthetics for brachial plexus block and found that it shorten the onset and prolong the duration of sensory and motor block [15].

In the study done by Cabral et al who studied the effect of clonidine added to lidocaine for sub-Tenon’s anesthesia in cataract surgery, and found that the duration of sensory anesthesia and duration of motor akinesia were prolonged in the lidocaine group [16]. Clonidine is also α2 adrenoreceptor agonist as dexmedetomidine but dexmedetomidine is more potent than clonidine 8 to 10-fold [17].

The intraocular pressure was significantly decreased in the dexmedetomidine group. This result may be due to reduction of aqueous humor production due to the direct vasoconstrictor effect on the afferent blood vessels of the ciliary body [18]. Also it facilitates the drainage of aqueous humor by reducing sympathetically mediated vasomotor tone of the ocular drainage system [19]. And the hypotensive effect of dexmedetomidine can be responsible for reduction of IOP [20].

This result comes with the agreement of the study done by Madan et al who studied the effect of peribulbar clonidine on the intraocular pressure (IOP) during cataract surgery and concluded that (IOP) was significantly decreased [21].

Channabasappa et al who compared the addition of dexmedetomidine as an additive to local anesthetics in peribulbar block for cataract surgery and concluded that dexmedetomidine significantly decreased (IOP) [22].

In the view of the first time to require analgesia, it was significantly increased in the dexmedetomidine group. The pain score and the analgesic requirement were significantly decreased in the dexmedetomidine group. The total number need analgesia in the first 12 hours was comparable between the two groups. These results were supported by many studies as mentioned above Channabasappa et al [22] and Cabral et al [23] studies.

And also in the study done by Guo et al who studied the the antinociceptive effect of dexmedetomidine on rats and concluded that part of the mechanism by which dexmedetomidine produces an antinociceptive effect is by an action directly on the locus ceruleus (LC), and this effect is blocked by specific alpha(2) antagonists injected into the LC [24].

As regards the sedation score was increased significantly in dexmedetomidine group. This results was supported by the study done by Ayoglu et al who compared the bolus dose of intravenous dexmedetomidine with retrobulbar block in patients underwent cataract extraction, and concluded that the Ramsey sedation score was higher on the dexmedetomidine group without respiratory depression [25].

In the study done by Channabasappa et al who compared the addition of dexmedetomidine in a two doses (25 μg -50 μg) as an additive to local anesthetics in peribulbar block for cataract surgery and concluded that dexmedetomidine significantly elevates the modified Ramsay score in the two doses when compared with local anesthetics alone [26]. α2 -adrenergic receptor agonist produces analgesia and sedation due to multiple factors. Peripherally, α2 -agonist produces analgesia by reducing the release of norepinephrine and causing α2 –receptor-independent inhibitor effect on nerve fiber action potential. Centrally, α2 –receptor produces analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of α2 -adrenoceptor in the locus coeruleus [27,28].

Conclusions:
The addition of dexmedetomidine to local anesthetics in sub-Tenon’s block decreased the onset for corneal anesthesia and global akinesia and prolonged their durations. Also it decreases the intraocular pressure, the total consumption of paracetamol, pain score and agitation.

References: