Medial Canthus Episcleral (Sub-Tenon’s) Anesthesia Compared With Single Injection Peribulbar Anesthesia For Cataract Surgery

Dowider A.M. and Hoda E. Ezz
Anesthesia Department, Faculty of Medicine, Tanta University

ABSTRACT

Background/aim: Limited diffusion of local anesthetic is the main disadvantage of peribulbar anesthesia, giving rise to the need for repeated injections. Some reports suggested that the use of medial canthus episcleral (sub-Tenon’s) block is becoming more widespread amongst anesthetists and ophthalmologic surgeons. The aim of this work was to compare medial canthus episcleral (sub-Tenon’s) anesthesia with peribulbar anesthesia for cataract surgery.

Patients and methods: Forty adult patients were divided randomly into two equal groups (each of 20 patients). Group I (peribulbar anesthesia), group II (medial canthus episcleral (sub-Tenon’s) anesthesia). In both groups a mixture of 0.7500 ropivacaine and 15 IU hyaluronidase / ml was injected. Akinesia (immobility) of the globe and eyelids was scored at 1, 5, 10 and 15 min after the end of injection and at the end of the surgical procedure. An 18-point scale was used, in which each of the four rectus muscles, levator palpebrae and orbicularis oculi were scored between 0 and 3 (0 no block, 1 = partial akinesia unsuitable for surgery, 2 = partial but sufficient akinesia, 3 = total akinesia). The final score was the total of these six sub scores. Both groups were compared as regard to the injected volume, time of onset, best and post operative akinesia scores and the occurrence of any adverse events.

Results: There was a significant decrease in the injected volume in the episcleral group compared to the peribulbar group. Medial canthus episcleral anesthesia provided a more effective block with rapid onset, better akinesia (total, best and post operative akinesia scores) and longer duration than single injection peribulbar anesthesia. Furthermore large-scale study is recommended for better evaluation of the rate of complications.

Conclusion: Medial canthus episcleral anesthesia is a suitable alternative for peribulbar anesthesia.

INTRODUCTION

Local anesthesia is the technique of choice for surgery on the eye in many instances. The expansion of day case facilities has encouraged its use, and the development of less invasive surgical techniques has rendered general anesthesia largely unnecessary. Retrobulbar and peribulbar blocks are commonly practiced(1).

Peribulbar anesthesia is used for the majority of patients undergoing cataract surgery. It is safer than retrobulbar block because the needle is not inserted inside the extra-ocular muscle cone(2). Limited diffusion of local anesthetic is the main disadvantage of peribulbar anesthesia, giving rise to the need for repeated injections. This also increases the frequency of complications such as globe perforation and hemorrhage(3,4).

Some reports suggested that the use of medial canthus episcleral (sub-tenon’s) block is becoming more widespread amongst anesthetists and ophthalmologic surgeons(1,5). So, the aim of this work was to compare medial canthus episcleral (sub-tenon’s) anesthesia with peribulbar anesthesia for cataract surgery.

PATIENTS AND METHODS

Forty adult patients ASA I&II of both sex with ages ranged between 50-70 years and scheduled for elective open globe lens extraction for cataract surgery in the Ophthalmology Department, Tanta
University Hospital, were included in our randomized prospective study.

Exclusion criteria included; clotting abnormalities and patients on anticoagulant therapy, impaired mental status, patients with communication difficulties, uncontrolled movements or tremors e.g. Parkinsonism, inability to lie flat, one-eyed patients, uncontrolled glaucoma, recent surgical procedure on the same eye, high myopia with axial length > 26mm as detected by ultrasonography and, allergy to hyaluronidase or local anesthetics.

Preoperatively, no premedication was given and an intravenous cannula was inserted. The patients were monitored with pulse oximetry, continuous electrocardiography and non-invasive measurement of systolic, diastolic, and mean arterial blood pressure. Patients were divided randomly into two equal groups (each of 20 patients);

**Group I** (peribulbar anesthesia): technique:

With the eye in the primary gaze position, a 25-gauge short bevel needle was inserted transconjunctivally at the junction between the medial two thirds and lateral third of the inferior orbital rim in a strictly posterior direction\(^6,\) \(^7\). Depth of needle insertion was limited to 25 mm\(^6\). The needle was then shifted slightly medially, displacing the semilunaris fold and caruncle away from the eyeball. The needle was advanced in an anteroposterior direction, with the globe directed slightly medially by the needle, until a click was perceived, at a depth of approximately 15-20 mm. At this point, the globe returned to the primary gaze position. This point represents a reliable depth marker that confirms the episcleral location of the needle tip.

In both groups a mixture of 0.75% ropivacaine and 15 IU hyaluronidase / ml was injected after an aspiration test and the injection was continued until subconjunctival edema (chemosis), proptosis and lid fullness appeared\(^{4,9-12}\). Intermittent digital compression was applied to lower the intraocular pressure until sufficient motor blockade occurred. Patients who needed supplemental injection were excluded from the study.

**Evaluation:** Comparability between groups included; age, gender, weight and height of each patient, axial length of the globe as measured preoperatively using echography and duration of surgery. The volume of injected anesthetic solution was also noted.

Akinsia (immobility) of the globe and eyelids was scored at 1, 5, 10 and 15 mm after the end of injection and at the end of the surgical procedure. An 18-point scale was used, in which each of the four rectus muscles, levator palpebrae and orbicularis oculi were scored between 0 and 3 (0 = no block, 1 = partial akinesia unsuitable for surgery, 2 = partial but sufficient akinesia, 3 = total akinesia). The final score was the total of these six sub scores\(^{13}\).

**Best akinesia score** was defined as the highest akinesia score obtained for each block without or before supplemental injection if necessary.

Time of onset was defined as the time that elapsed from the end of injection to best akinesia score.

**Duration of blockade** and the occurrence of any adverse events or complications were also noted.

Data were collected, tabulated and statistically analyzed. Results were expressed as mean ±SD. Chi-square analysis was used for comparison of qualitative values between groups. For comparison of quantitative values we used; Paired-t test for comparison within the same group and unpaired-t test for comparison between groups. P ~ 0.05 was considered significant.
RESULTS
The two groups were comparable in terms of age, sex, weight, height, axial length and duration of surgery (table I).

There was a significant decrease in the injected volume of local anesthetic in group II (7.90 ± 1.55 ml) compared to group I (8.85 ± 1.18 ml). The time of onset was decreased in group II (14.45 ± 2.80 minutes) compared to group I (18.60 ± 3.71 minutes). On the other hand, there was a significant increase in the duration of blockade in group II (61.9 ± 7.31 minutes) compared to group I (52.65 ± 11.35 minutes). There was a significant increase in the total akinesia score at 1, 5, 10, and 15 minutes, best and post operative akinesia scores in group II compared to group I, table (II and III), figure (I).

As regard the adverse events and complications, there were no cases of globe perforation, post operative squint or central spread in either group. In group I; no cases showed incomplete superior rectus block, 20% showed incomplete orbicularis block but sufficient for surgery, 10% showed chemosis, 5% had pain during injection of local anesthetic. In group II; 20% showed incomplete block of superior rectus muscle, 10% showed incomplete orbicularis block but both were sufficient for surgery, 5% showed chemosis and no cases experienced pain during injection, table (IV). Patients who needed supplemental injection were excluded from our study.

Table I: Patient characteristics in both groups

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>56.75±5.46</td>
<td>58.15±6.5</td>
</tr>
<tr>
<td>Sex (male: female)</td>
<td>8:12</td>
<td>9:11</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>68.6±6.17</td>
<td>70.15±7.06</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>164.5±6.14</td>
<td>167.3±5.91</td>
</tr>
<tr>
<td>Axial length (mm)</td>
<td>22.44±1.14</td>
<td>23.14±1.21</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>38.85±7.67</td>
<td>35.60±7.31</td>
</tr>
</tbody>
</table>

Table II: Quality of blockade in both groups

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injected volume (ml)</td>
<td>8.85±1.18</td>
<td>7.90±1.55*</td>
</tr>
<tr>
<td>Onset of blockade (min)</td>
<td>18.60±3.71</td>
<td>14.45±2.80*</td>
</tr>
<tr>
<td>Duration of blockade (min)</td>
<td>52.65±11.35</td>
<td>61.90±7.57*</td>
</tr>
<tr>
<td>Best akinesia score</td>
<td>14.90±2.83</td>
<td>16.65±1.90*</td>
</tr>
<tr>
<td>Postoperative akinesia score</td>
<td>10.60±1.96</td>
<td>12.85±1.81*</td>
</tr>
</tbody>
</table>

Table III: Total akinesia score in both groups

<table>
<thead>
<tr>
<th></th>
<th>1 min</th>
<th>5 min</th>
<th>10 min</th>
<th>15 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>2.3±0.9</td>
<td>8±4.12*</td>
<td>10.9±3.92*</td>
<td>13±4.1*</td>
</tr>
<tr>
<td>Group II</td>
<td>2.9±1.3</td>
<td>12±3.91*+</td>
<td>14.75±3.09*</td>
<td>16.6±2.04*</td>
</tr>
</tbody>
</table>

Table IV: Complications of blockade in both groups

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete block of superior rectus muscle</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Incomplete orbicularis block</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>Chemosis</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Pain during injection</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Post-operative squint</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Globe penetration and perforation</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Central spread</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

+ Significant difference between groups (p ≤ 0.05)
* Significant difference within the same group (p ≤ 0.05)
DISCUSSION

Peribulbar anesthesia is the technique of choice for most patients undergoing cataract surgery. Nevertheless, all complications associated with retrobulbar anesthesia have also occurred with the peribulbar technique\(^\text{14}\). Techniques that involve only 1 peribulbar injection have been designed with the hope that single injection will reduce morbidity\(^\text{12}\). Single injection high volume medial canthus episcleral (sub-Tenon’s) anesthesia is becoming more widespread amongst anesthetists and ophthalmologic surgeons\(^\text{1,5}\). So, we aimed to compare medial canthus episcleral anesthesia with single injection peribulbar anesthesia for cataract surgery.

In the present study, there was a significant decrease in the injected volume in the episcleral group compared to the peribulbar group. Our results are in agreement with those of Ripart et al\(^\text{13}\).

As regard the degree of akinesia our results revealed a significant increase in the total akinesia score at 1, 5, 10 and 15 minutes, best and post operative akinesia scores in the episcleral group compared to the peribulbar group. The results of Ripart et al\(^\text{13}\) and Truc et al\(^\text{15}\) are in agreement with our results. Moreover, Nouvellon et al\(^\text{16}\) evaluated 2031 single-injection medial canthus high volume episcleral anesthesia patients, and found that; total akinesia was obtained in most of the patients (86.5\%) after the puncture and in more than 90\% after a supplemental injection.

The relatively large volume injected in our study is very important to provide akinesia in both groups. This can be explained by the tissue compartment principle in which a needle is inserted into a compartment and the local anesthetic injected spreads by virtue of its pressure and volume through the compartment\(^\text{17}\).

In peribulbar technique, local anesthetic must spread from the extraconal space to the intraconal space. Because the corpus adiposum of the orbit is separated into multiple compartments by a small network of septa, this spread of local anesthetic is sometimes heterogeneous and incomplete\(^\text{18}\). This irregular spreading accounts for imperfect blockade in up to 50\% of patients in some series or for the need for multiple injections or very high volume\(^\text{19}\).

As regards medial canthus episcleral technique, Ripart et al\(^\text{9}\) confirmed by computed tomography study in eight human cadaver eyes that single injection medial canthus periocular anesthesia is in fact, an episcleral anesthesia, which explains the
good sensory block of the globe. Episcleral space is limited by the sclera and the fascial sheath of the orbit (Tenon's capsule). It has been hypothesized that, episcleral anesthesia acts by spreading the local anesthetic through the fascial sheath of the eyeball from the episcleral space to the intraconal (retrobulbar) space\(^{20,21}\). The ciliary nerves, responsible for the sensory innervation of the globe, pass through the episcleral space and are bathed by any anesthetic solution injected into this space, resulting in a good sensory blockade of the eyeball. It has been confirmed that, spread of the local anesthetic is guided by the facial sheath of the orbit into the episcleral space all around the eyeball\(^{9,10}\). So, a small volume of local anesthetic injected in this space is guided to surround the eyeball and produce analgesia\(^{22,23}\). Also as the fascial sheath of the eyeball extends to the rectus muscle sheaths, this explains why a large volume of local anesthetic is preferentially guided to those muscle sheaths to produce good akinesia\(^9\). Also, the fascial sheath of the eyeball guides the injected solution to the lids, especially to the orbicularis muscle. This explains why we can prevent blinking during surgery without performing any facial nerve block\(^{8,10,24}\). Chemosis is caused by spreading guided from the episcleral to the subconjunctival space, which is caused by the common insertion of the conjunctiva and fascial sheath of the eyeball near the corneal ring\(^9\).

As regard the onset of adequate akinesia, our results revealed a significant rapid onset in the episcleral anesthesia group compared to the peribulbar anesthesia group. This is in agreement with the results of Briggs et al\(^{25}\) and Ripart et al\(^{13}\).

As regard the duration of block, our results revealed a significantly longer duration in the episcleral group than the peribulbar group. However, the duration of block was sufficient for surgery in both groups. As regard the adverse events and complications, only few minor complications were reported, while, no major complication was reported such as; globe perforation or central spread in either group. This may be due to small number of patients and should be re-evaluated on a large scale. These results are in agreement with those of Ripart et al\(^{13}\) who proved that; episcleral anesthesia has a less complication rate than the peribulbar anesthesia. The caruncular injection seems to be safe. Indeed in this region, the extraconal space is large and avascular, which reduces the nsk of hematoma or intravascular injection\(^{26}\) Also, Gillart et al\(^{27}\) reported a significantly lower percentage of hemorrhage after injection at the caruncle. Moreover, Vohra and Good\(^{28}\) reported no staphylomas in the nasal equatorial region in the eyes they studied. Thus, the medial canthus approach, at least theoretically, may be less hazardous in axial myopic patients.

So, medial canthus episcleral anesthesia provided a more effective block with rapid onset, better akinesia and longer duration than single injection peribulbar anesthesia. Furthermore, large-scale study is recommended for better evaluation of the rate of complications.

REFERENCES

5. Dark A: Local anaesthesia for routine


