Comparison of Articaine and Bupivacaine/Lidocaine for Peribulbar Anesthesia in Cataract Surgery

MONA R. FAHIM, M.D.; HALA M. BAHY EL DEEN, M.D.; RASHAD M. AREF, M.D. and ASHRAF DARWISH, M.D.
The Department of Anesthesiology, Research Institute of Ophthalmology

Abstract

Background: Articaine is an amide local anesthetic with a shorter duration of action than prilocaine. We compared the efficacy and safety of articaine 2% to a mixture of bupivacaine 0.5% and lidocaine 2% for peribulbar anesthesia in cataract surgery.

Method: In this double-blind randomized clinical study, 100 cataract patients were allocated in two groups to receive peribulbar anesthesia with articaine 2% or a mixture of bupivacaine 0.5% and lidocaine 2% or prilocaine 4%. In the two groups, hyaluronidase 1 0IU/ml was added to the anesthetic mixture. Ocular and eyelid movements at 2 minute intervals for 10 minutes, at the end of surgery and at time of discharge from hospital; number of supplementary injections, total volume of solution used and pain and complications during injection and surgery, and time to readiness for surgery were used as clinical end-points.

Results: The articaine group demonstrated a rapid onset of peribulbar block with mean time (SD) to readiness for surgery of 4.0 (4.4) min compared with 6.9 (5.6) min in the bupivacaine/lidocaine group (p=0.0091). The block obtained in the articaine group was dense with eye movement scores at 2,4,6,8 and 10 minutes all significantly reduced (p<0.01 at each interval). There was faster offset of the block in articaine group (p=0.0008). Less supplementary injections and less local anesthetic volume was noted in the articaine group but with no statistical significance in incidence of minor complications between the two groups.

Conclusion: 2% articaine is safe and effective for peribulbar anesthesia and is a good competitor to the traditional mixture of 0.5% bupivacaine/2% Lidocaine.

Key Words: Anesthetic techniques – Peribulbar – Articaine – Bupivacaine/lidocaine.

Introduction

PERIBULBAR anesthesia is the technique of choice for the majority of patients undergoing cataract surgery, owing to the fact that general anesthesia is more hazardous to patients, as most are elderly with serious diseases [1]. Peribulbar is still more popular than retrobulbar anesthesia, where the needle is not inserted inside the extraocular muscle cone [2].

Articaine is an amide local anesthetic that was synthesized in 1960 and then first investigated clinically in 1974 [3]. It is used for dental surgery in most European countries. Articaine is chemically similar to prilocaine, but contains an extra ester group that is hydrolysed by plasma esterases resulting in a short duration of action and low risk of systemic toxicity [4]. It also diffuses rapidly through tissues and has a wide therapeutic index, hence leading to its widespread use [4-6].

In this study, we compared the safety and efficacy of articaine 2%, with a mixture of bupivacaine 0.5%/lidocaine 2%.

Patients and Methods

Local Research Ethics Committee approval was granted and all patients gave informed consent. One hundred patients undergoing cataract surgery under local anesthesia were included in the study. The sample size was determined on the basis of a power calculation. Exclusion criteria included patients unwilling to participate in the study, patients with history of allergy to amide-type local anesthetic agents, and those with low plasma cholinesterase activity (possibly leading to reduced metabolism of articaine).

Patients were randomly allocated in one of two groups, 50 patients in each group (n=50). Group 1 (n=50) received peribulbar anesthesia using 2% articaine group 2 (n=50) received a mixture of equal volumes of 0.5% bupivacaine and 2%
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Hyaluronidase 30IU/ml was added to the two solutions.

Randomization was performed using statistical tables and allocation was undertaken using sealing envelopes which were handed to personnel blinded to the study.

Patients were fasting but not premedicated. On arrival to anesthetic room, a vein was cannulated, monitoring of arterial oxygen saturation, ECG and non-invasive blood pressure was commenced. Topical anesthesia providing analgesia to the conjunctiva and cornea was provided by the topical administration of benoxinate eye drops for three times of five minute intervals. Peribulbar block was then performed by single inferotemporal injection by one of two anesthetic consultants blinded to the local anesthetic mixture.

A 25 gauge 25mm sharp disposable needle (Atkinson) was inserted inferolaterally and transconjunctivally past the equator then redirected upwards and inwards (10-20°). Injections were performed after gentle negative aspiration with a maximum volume of 10ml and injection was stopped if proptosis developed. Digital massage was undertaken for 2 minutes.

Patients were evaluated for ocular and eyelid movements using the scoring system described by Brahma and colleagues [7] at 2, 4, 6, 8 and 10 minutes after injection, at the end of the surgery and before discharge from hospital on the same day. Ocular movements were scored for each direction of gaze in the superior, inferior, medial and lateral directions with a maximum score for each direction of 3 points and a possible total maximum of 12 points. The scoring system for ocular & eyelid movements are shown in Table (1).

Table (1): Scoring system for the degree of ocular and eyelid akinesia.

<table>
<thead>
<tr>
<th>Ocular movement</th>
<th>Score</th>
<th>Eyelid movement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full movement</td>
<td>3</td>
<td>Full movement</td>
<td>2</td>
</tr>
<tr>
<td>Moderate movement</td>
<td>2</td>
<td>Flicker</td>
<td>1</td>
</tr>
<tr>
<td>Flicker</td>
<td>1</td>
<td>No movement</td>
<td>0</td>
</tr>
<tr>
<td>No movement</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If the block was sufficient 6 minutes after the injection, s.c. injection was performed into the superior eyelid for eyelid akinesia. The block was considered inadequate for surgery if eyeball movement score was 2 or more in any direction at 10 minutes. If this occurred, a second injection was performed via the superomedial transpalpebral route using 3-5ml of the same solution. The need for supplementary local anesthesia and the total volume of local anesthetic required was recorded.

The surgeon assessed the degree of proptosis and chemosis during injection and surgery. Pain and complications during injection and surgery were noted. Time to readiness for surgery was noted when the ocular movement score was 4 or less. Patients were asked postoperatively if they experienced any pain during insertion of the block and during surgery, and were asked to mark the degree of pain on a horizontal line number 0-10. Prior to discharge, visual acuity was assessed and eyeball movement scored.

Statistical analysis of data:

The volume of local anesthetic injected was expressed as mean±SD. Groups were compared using parametric tests for continuous variables and non-parametric tests for ordinal or nominal variables.

Results

There were 50 patients in the articaine group and 50 patients in the bupivacaine/lidocaine group. All patient data were included in the statistical analysis. No patients were excluded. Patient characteristics in the three groups were similar and no significant differences were detected (Table 2).

The ocular movement score was significantly lower in the articaine group at 2, 4, 6, 8 and 10 minutes and at the end of surgery and increased prior to discharge (Table 3).

The mean (SD) time from block insertion to readiness of surgery was 4.0 (4.4) min in the articaine group and 6.9 (5.6) min in the bupivacaine/lidocaine group (p=0.0091). This finding was statistically significant.

There was no difference between the groups in median eyelid movements at 2, 4, 6, 8 and 10 minutes and at the end of surgery and increased prior to discharge (Table 3). The mean (SD) time from block insertion to readiness of surgery was 4.0 (4.4) min in the articaine group and 6.9 (5.6) min in the bupivacaine/lidocaine group (p=0.0091). This finding was statistically significant.

There was no difference in surgical duration between the three groups (Table 2). Three patients (15%) required a supplemental injection in group 1 (articaine) compared to 4 patients (20%) in group 2 (bupivacaine/lidocaine) (p>0.01). Mean total volume of local anesthetic used was 9.3 ± 1.7ml in group 1 and 10.1 ± 2.1ml in group 2 and 9.9 (1.8) ml in group 3 (p>0.01).
There was no difference in visual acuity at the beginning and end of the procedure in the two groups. No significant differences in complications during the procedure (pain, proptosis, chemosis) were noted in the two groups. 2 patients complained of some discomfort during surgery in group 2 (bupivacaine/lidocaine) and received few drops of benoxinate eye drops. No serious complications were noted (Table 5).

Table (2): Patient and surgical characteristics. Values are mean (SD).

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% articaine (n = 50)</td>
<td>0.5% bupivacaine +2% Lidocaine (n = 50)</td>
</tr>
<tr>
<td>Age (range)</td>
<td>74.0 (63-88)</td>
</tr>
<tr>
<td>Male: Female</td>
<td>12: 8</td>
</tr>
<tr>
<td>Axial length (mm)</td>
<td>22.5 (1.1)</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>34.0 (9.5)</td>
</tr>
<tr>
<td>Time from block to discharge (min)</td>
<td>109.4 (20.9)</td>
</tr>
</tbody>
</table>

Table (3): Median (range) ocular movement scores.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>articaine (n = 50)</td>
<td>bupivacaine/lidocaine (n = 50)</td>
</tr>
<tr>
<td>2 min</td>
<td>6 (2-7)</td>
</tr>
<tr>
<td>4 min</td>
<td>3 (0-8)</td>
</tr>
<tr>
<td>6 min</td>
<td>2 (1-4)</td>
</tr>
<tr>
<td>8 min</td>
<td>0 (0-2)</td>
</tr>
<tr>
<td>10 min</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>End of surgery</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>Discharge</td>
<td>6 (4-8)</td>
</tr>
</tbody>
</table>

*p<0.01

Table (4): Median (range) eyelid movement scores.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>articaine (n = 50)</td>
<td>bupivacaine/lidocaine (n = 50)</td>
</tr>
<tr>
<td>2 min</td>
<td>1 (0-1)</td>
</tr>
<tr>
<td>4 min</td>
<td>1 (0-1)</td>
</tr>
<tr>
<td>6 min</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>8 min</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>10 min</td>
<td>0 (0-1)</td>
</tr>
<tr>
<td>End of surgery</td>
<td>1 (0-1)</td>
</tr>
<tr>
<td>Discharge</td>
<td>2 (1-2)</td>
</tr>
</tbody>
</table>

*p<0.01

Table (5): Complications during injections and surgery.

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2% articaine (n = 50)</td>
<td>0.5 bupivacaine/2% lidocaine (n = 50)</td>
</tr>
<tr>
<td>Supplementary injection required</td>
<td>3 (15%)</td>
<td>4 (20%)</td>
</tr>
<tr>
<td>Intraoperative discomfort/pain</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Significant proptosis present</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Significant chemosis present</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Discussion

In this study, peribulbar anesthesia using a single inferotemporal injection with 2% articaine compared to 0.5% bupivacaine/2% Lidocaine and 10IU/ml hyaluronidase were added to all local mixtures was performed. The advantage of the single technique included; decreased pain sensation and risk of globe perforation, hemorrhage and intravascular injection; as additional injections increase the complication risk [8,9].

In our study, ocular movement scores were significantly lower in the articaine group compared to the other group during surgery. Moreover at discharge from hospital, both globe and eyelid movement scores were significantly higher in the articaine group. This is advantageous as prolonged ocular anesthesia makes the eye vulnerable to trauma and dryness [9].

In our study, the articaine had fewer requirements for a second injection (15%) compared to the bupivacaine/lidocaine group (20%). Allman and colleagues [10] reported a second injection rate of 24% for articaine 2% with hyaluronidase and 51% for bupivacaine/lidocaine with hyaluronidase, which correlated to our study regarding the two groups.

Total volume used was less in the articaine group compared to the other group, hence avoiding increased intraocular pressure during surgery.

In the present study, patients in articaine group did not experience pain or discomfort during injection or surgery and also did not have any significant complication (chemosis, proptosis) compared to
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The comparison of articaine and bupivacaine/lidocaine group (pain). Still yet, there was no statistical significant difference.

In conclusion, this study suggests that articaine 2% hyaluronidase 10IU/ml) has several advantages regarding akinesia, anesthesia, incidence of pain and complications and block duration over the usage of 0.5% bupivacaine/2% lidocaine with the same additives.

References