Articaine versus lidocaine plus bupivacaine for peribulbar anaesthesia in cataract surgery

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Background. We compared the efficacy and safety of articaine 2% with a mixture of lidocaine 2% and bupivacaine 0.5% without hyaluronidase for peribulbar anaesthesia in cataract surgery.

Method. In this double-blind randomized clinical study, 58 cataract patients were allocated to receive either articaine 2% with epinephrine 1:200 000 or a mixture of equal parts of lidocaine 2% with epinephrine 1:25:100 000 and bupivacaine 0.5%. Ocular and eyelid movement scores, the number of supplementary injections, total volume of solution used and pain and complications during injection and surgery were used as clinical end-points.

Results. Articaine produced greater akinesia after 5 min (P=0.03). Eighteen patients (60%) in the articaine group and 26 (93%) in the lidocaine/bupivacaine group required a second injection (P=0.003). A third injection was needed by two patients (7%) in the articaine group and 12 (43%) in the lidocaine/bupivacaine group (P=0.001). The total mean volume of local anaesthetic required to achieve akinesia was mean 9.4 (SD 1.7) ml in the articaine group and 11.28 (1.86) ml in the lidocaine/bupivacaine group (P<0.001). Median pain score was lower in the articaine group than in lidocaine/bupivacaine group during injection (P=0.004) and surgery (P=0.014). There was no difference between the groups for the incidence of complications.

Conclusion. Articaine 2% without hyaluronidase is more advantageous than a mixture of lidocaine 2% and bupivacaine 0.5% without hyaluronidase for peribulbar anaesthesia in cataract surgery.

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Peribulbar anaesthesia is the technique of choice for the majority of patients undergoing cataract surgery. It is safer than retrobulbar block because the needle is not inserted inside the extraocular muscle cone.¹ Conventionally, a mixture of lidocaine and bupivacaine is used as local anaesthetic solution.² Limited diffusion of local anaesthetic is the main disadvantage of peribulbar anaesthesia, giving rise to the need for repeated injections. This also increases the frequency of complications such as globe perforation and haemorrhage.³⁻⁴ To prevent this and to increase tissue diffusion, hyaluronidase is added in varying concentration to this mixture. However, hyaluronidase is not easily available in most countries.

Articaine, an amide local anaesthetic, was first investigated in 1974.⁵ Currently, it is used for dental surgery in most European countries. Features such as low toxicity, quick diffusion and rapid clearance have led to its widespread use.⁶ Recently, two reports have described the use of articaine in peribulbar anaesthesia.⁷⁻⁸ In this study we compared the safety and efficacy of articaine 2% with a lidocaine 2%/bupivacaine 0.5% mixture, without hyaluronidase.

Patients and methods
Local medical ethics committee approval for the study was obtained and all patients gave informed consent. Fifty-eight patients undergoing cataract surgery under local anaesthesia were included in the study. Communication problems, history of allergy to amide-type local anaesthetic agents,
low plasma cholinesterase activity (possibly leading to reduced metabolism of articaine) were exclusion criteria.

Patients were allocated randomly to receive either articaine 2% with 1:200 000 epinephrine (Ultracaine, Hoechst Marion Roussel, Germany) (n=30) or a mixture of bupivacaine 0.5%, 5 ml (Marcaine flc, Eczacibasi, Turkey) and lidocaine 2%, 5 ml with 1.25:100 000 epinephrine (Jotecaine amp, Adeka, Turkey) (n=28).

Randomization was performed using statistical tables. Allocation was undertaken using sealing envelopes, which were handed over to a resident not involved in the study, who then drew up the local anaesthetic mixture and handed the unlabelled syringe to the investigator. Before surgery, all patients were examined and routine laboratory investigations were performed. Patients were premedicated with oral diazepam at 6 a.m. on the day of surgery.

On arrival in the anaesthetic room, a vein was cannulated and arterial pressure was measured with an automated oscillometer, and monitoring of arterial oxygen saturation and the ECG was commenced. Topical anaesthesia of the conjunctiva and cornea was provided by administering oxibuprocaine 0.4% drops, twice within 2 min. One of two surgeons, who were blinded to the local anaesthetic used, performed local anaesthesia and scored the progression of akinesia. Peribulbar anaesthesia was performed by transpalpebral injection at the third lateral of the inferior eyelid. The needle was introduced along the inferior wall of the orbit to a depth of 20–25 ml with the sharp bevel facing the globe. The direction of injection was almost perpendicular to the frontal plane and parallel to the sagittal plane; the eye was in the neutral position. Injection was performed step by step: into the eyelid (0.5 ml), right after the eyelid (1 ml), at the equator (2 ml) and then behind the equator (2.5 ml). Injections were performed after gentle negative aspiration. Local anaesthetic was injected using a 22 mm, 25 G peribulbar Atkinson needle (Visitec 5027). The maximum injection volume was 8 ml and injection was stopped if proptosis developed. Gentle digital massage of the eyeball between scoring facilitated diffusion of local anaesthetic.

Patients were evaluated for ocular and eyelid movements at 1, 5 and 10 min after injection, at the end of the surgery and after discharge from hospital on the same day, using the scoring system of Brahma and colleagues.3 Ocular movement was 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 eyelid movements is shown in Table 1.

If the block was sufficient 5 min after the injection, s.c. injection was performed into the superior eyelid for eyelid akinesia. If the total ocular movement score was 6 or higher or if there was full movement in any direction, supplementary injection was performed via the superomedial transpalpebral route using 3–5 ml of the same solution. An inferomedial transpalpebral injection (a third injection) was given if the block was still not sufficient after 10 min. The need for supplementary local anaesthesia and the total volume of local anaesthetic 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. Patients were asked after surgery if they experienced any pain during injection and surgery and were asked to mark the degree of pain on a horizontal line numbered 0–10. Duration of surgery and time from injection to discharge from hospital were recorded for each patient.

Statistical analysis of data was performed using Epi Info 2002 (CDC) software. The Mann–Whitney U-test was used to compare ocular and eyelid movement scores, and pain score. The two-tailed Student’s t-test was used for age, total volume of local anaesthetic, duration of surgery and time from initial injection to the end of surgery. The χ²-test or Fisher’s exact test, as appropriate, was used for sex, number of supplementary injections required and complications.

### Results

The mean age was 66 (range 52–74) yr in the articaine group and 69 (53–80) yr in the lidocaine/bupivacaine group. There were 14 men (n=30) in the articaine group and 15 men (n=28) in the lidocaine/bupivacaine group. There were no differences between the groups with respect to age or sex.

The ocular movement score was significantly lower in the articaine group at all evaluation points (Table 2). Eighteen patients (60%) in the articaine group and 26 (93%) in the lidocaine/bupivacaine group required second injections (P=0.003) (Fig. 1). Two patients (7%) in the articaine group and 12 (43%) in the lidocaine/bupivacaine group required a third injection (P=0.001).

There was no difference between the groups in median eyelid movements at 1, 5 and 10 min and at the end of the surgery. However, the median eyelid movement score was statistically greater in the articaine group at discharge (P=0.013) (Table 3).

The median pain score was significantly lower in the articaine group during the injection (P=0.004) and surgery (P=0.014) (Table 4).

The mean time from initial injection to the end of surgery was 45 (SD 11) min in the articaine group and 47 (14) min in the lidocaine/bupivacaine group (95% confidence interval [CI] 4.2 to 2.5 min, P=0.25) and from initial injection to discharge was 248 (60) min and 260 (52) min, respectively (CI –39.0 to 6.4 min, P=0.420).

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**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>No movement</td>
<td>1</td>
<td>No movement</td>
<td>0</td>
</tr>
</tbody>
</table>

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For more details, refer to the full text of the article.
The total volume of local anaesthetic solution used was 9.47 (1.7) ml and 11.8 (1.9) ml in the articaine group and lidocaine/bupivacaine group, respectively (CI ±2.7 to ±0.9 ml, \( P < 0.001 \)).

Local anaesthesia complications were the same in both groups (\( P > 0.05 \)). Chemosis during injection developed in three patients in the articaine group and five in the lidocaine/bupivacaine group. A small periorbital haematoma occurred in one patient in the lidocaine/bupivacaine group; no other local anaesthesia complications such as retro-orbital haematoma or globe perforation was observed.

Discussion

Peribulbar anaesthetic solutions are usually combined with hyaluronidase in order to increase tissue diffusion,\(^9\)\(^10\) although hyaluronidase is not readily available in most countries. In this study, because of non-availability of hyaluronidase, we compared articaine and a conventional mixture of lidocaine/bupivacaine with regard to akinesia, analgesia, additional injection requirement and complications.

A single injection for peribulbar anaesthesia has several advantages over multiple injections. Single injection decreases the pain, risk of globe perforation, haemorrhage and intravascular injection. Additional injections increase the complication risk.

In our study, the articaine group had fewer requirements for a second injection (60%); the need for a third injection rate was also less in this group. This superior action of articaine may be related to better tissue diffusion. Almann and colleagues\(^7\) reported a second injection rate of 24% for articaine 2% with hyaluronidase and 51% for bupivacaine/lidocaine with hyaluronidase. There was no need for a third injection in the articaine group and one patient needed a third injection in the lidocaine/bupivacaine group. Requirements for additional injections were less in Allman’s studies\(^7\)\(^8\) than in our study. This is probably related to the use of hyaluronidase.

In the present study, the complication rate was similar in both groups. Allman and colleagues\(^7\) found a higher frequency of complications in the lidocaine/bupivacaine group compared with the articaine group. However, in a second study on articaine,\(^8\) they did not demonstrate any significant differences between articaine and lidocaine/bupivacaine.

In our study, there was no reduction in anaesthetic effect during surgery. However, at discharge from hospital, both globe movement score and eyelid movement score were significantly higher in the articaine group.

One of the most unpleasant aspects of local anaesthesia is pain during surgery. Many patients delay surgery because of fear of pain and the injection. In our study, patients in the articaine group had lower pain scores during injection and surgery.

In conclusion, this study suggests that articaine 2% (with epinephrine 1:200 000) without hyaluronidase has several advantages over lidocaine 2% with 1.25:100 000 epinephrine and bupivacaine 0.5% without hyaluronidase for peribulbar anaesthesia in cataract surgery.

References


