

Pupil dilation with intracameral lidocaine during phacoemulsification: Benefits for the patient and surgeon

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Topical and/or intracameral administration of anticholinergic and/or sympathomimetic mydriatic agents which are usually used for pupillary dilation during cataract surgery, have some disadvantages such as slow onset of dilation and adverse ocular and systemic effects. We evaluated intracameral injection of preservative-free 1% lidocaine without using any preoperative or intraoperative mydriatics to induce pupil dilation in 31 consecutive eyes scheduled for phacoemulsification cataract extraction and intraocular lens implantation. Pupil diameter was measured before and 90 sec after intracameral lidocaine injection. After intracameral lidocaine injection, the mean pupil diameter was significantly greater than the baseline measurement ($P < 0.001$). No additional mydriatics were needed up to the end of the operations. Intracameral preservative-free lidocaine 1% has a rapid and effective mydriasis that could be a safe alternative to topical and intracameral mydriatics in phacoemulsification.

Key words: Intracameral lidocaine, phacoemulsification, pupil dilation

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Cataract surgery requires adequate mydriasis, which is usually achieved by topical and/or intracameral administration of anticholinergic and/or sympathomimetic mydriatic agents, commonly cyclopentolate, tropicamide and phenylephrine.^{1,2}

These regimens, however, have some disadvantages such as slow onset of dilation, which increases the waiting time before operation,^{2,3} adverse ocular and systemic effects, which are specially important in high-risk groups such as hypertensive patients and children²⁻⁵ and their tendencies to wear off during surgery.²

Intracameral injection of preservative-free lidocaine was attempted as an alternative to reduce the potential disadvantages of common mydriatics.^{6,7} We evaluated using intracameral injection of preservative-free lidocaine to induce pupil dilation, without using any preoperative dilating eye drops or intraoperative mydriatics.

Materials and Methods

This prospective interventional case series included patients

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with senile cataracts scheduled for phacoemulsification and intraocular lens (IOL) implantation. For cataract grading, we matched the color and opalescence of the patient's lens on the slit-lamp examination with the standard photographs of Lens Opacities Classification System III.⁸ The patients with any visible iris abnormality due to any cause were excluded from the study. The Institutional Review Board of the Iran University of Medical Sciences approved the study and all patients signed an informed consent.

All patients were given three drops of tetracaine 1% five min before surgery. All procedures and measurements were performed by one surgeon (AN). After creation of a paracentesis, 0.2 to 0.3 ml of preservative-free lidocaine 1% was injected into the anterior chamber. A quick chop method⁹ was performed using Millennium phacoemulsifier (Bausch and Lomb, NY, USA), hydroxypropyl methylcellulose 2% (Bausch and Lomb, Waterford, Ireland) as a viscoelastic agent, balanced salt solution (BSS[®]) as irrigation solution and one-piece foldable IOL (Acrysof[®], Alcon laboratories inc, Fort Worth, TX, USA) in the bag implantation. There was no epinephrine added to the irrigating solution.

Before lidocaine injection, the horizontal diameter of the pupil was measured with a caliper under the operating microscope light. The light intensity of the microscope was the same during measurements and throughout all procedures. Pupil diameter was measured again within 90 sec after intracameral lidocaine injection, when the surgeon was able to proceed for needle capsulorrhexis. All measurements were taken on the surface of the cornea and no magnification correction was made to know the actual size of the pupil. Total surgical time was measured from the time of first stab incision to the end of operation when the blepharostat was removed.

Data were analyzed using SPSS for Windows Version 11 (SPSS, Chicago, Illinois, USA).

Results

Sixteen males and 15 females with a mean age of 67.3±9.9 years were included in the study. There were four diabetic and four pseudoexfoliative eyes. All the patients had brown irides. Included eyes had nuclear opalescence and nuclear color ≥ Grade 4 (range 4 to 6) with variable amounts of cortical and posterior subcapsular cataracts. None of the patients had mature cataract.

The mean pupil diameter after intracameral lidocaine was significantly greater than the baseline pupil size [Table 1]. The mean increase in pupil size was 4.39±0.53 mm. There was no

Table 1: Mean pupil diameters (in mm) in patients who underwent phacoemulsification with intracameral injection of lidocaine for pupillary dilation

	Pre injection	Post injection	P value (t test)
All patients	2.63 ± 0.33	7.03 ± 0.61	<0.01
Male	2.61 ± 0.37	6.84 ± 0.74	<0.01
Female	2.66 ± 0.30	7.20 ± 0.40	<0.01
Pseudoexfoliatives	2.47 ± 0.34	6.00 ± 0.40	<0.01
Diabetics	2.55 ± 0.17	7.00 ± 0.70	<0.01

significant difference between the average male and female pupil diameters and between the average pupil size of diabetic and non-diabetic patients, both at baseline and after intracameral lidocaine injection measurements (independent t test). At baseline there was no significant difference between average pupil diameter in patients with pseudoexfoliation (2.66 mm) and those without (2.47 mm). However, after intracameral lidocaine injection, the average pupil diameter was significantly greater for patients without pseudoexfoliation (7.1 mm vs. 6.00 mm, Independent t test and Mann-Whitney test, $P < 0.01$). The mean surgical time was 11.67 ± 3.05 min.

The pupil dilation was satisfactory, persistent and stable up to the end of the surgery. One patient developed posterior capsular tear with vitreous loss at the time of cortical material removal that was managed properly with an IOL in the ciliary sulcus, without the need for additional mydriatics.

Discussion

Lidocaine is an antiarrhythmic drug as well as an effective local anesthetic. Intracameral injection of preservative-free lidocaine is used widely for local anesthesia and discomfort relief in cataract surgery.^{1,10} Lidocaine causes no additional inflammation and endothelial cell loss and its safety has been confirmed in previous studies.¹¹⁻¹⁴

Lincoff *et al.* reported the effect of lidocaine on iris paralysis and mydriasis.¹⁵ They noted pupil dilation after accidental intraocular injection of lidocaine without administration of any mydriatic drug. Lee *et al.* reported immediate pupil dilation after intracameral injection of preservative-free lidocaine 1% in previously undilated phakic eyes during trabeculectomy surgery.⁶ Cionni *et al.* used intracameral lidocaine injection to induce mydriasis in phacoemulsification surgery, avoiding all preoperative dilating eye drops.⁷ However, in their report, epinephrine has been added to the infusion during routine procedure to maintain pupil dilation.⁷

This study shows that injection of 0.2 to 0.3 ml of 1% preservative-free lidocaine in anterior chamber can have a persistent, stable and satisfactory pupil dilation for a safe phacoemulsification and IOL implantation in different patients including diabetic and non-diabetic and eyes with pseudoexfoliation. In the present study, despite the fact that no additional mydriatic drug has been used in infusion fluid, the pupil was adequately maintained dilated during the procedure.

Intracameral lidocaine has some advantages over topical mydriatics. It doesn't need time-consuming preoperative program for pupillary dilation, doesn't have systemic side-effects of topical mydriatics and provides satisfactory pupillary dilation as well as simultaneous anesthetic effect in phacoemulsification cataract surgery.

This study has some limitations. We measured the pupillary diameters on the surface of the cornea and did not consider the

magnification factor of cornea to calculate the actual pupillary diameters. In this study, the usual operating time was 8 to 15 min. However, it is not clear how long the pupillary dilation will last after an intracameral lidocaine injection. Although in the sole complicated case of this study, the pupil maintained its dilation up to the end of 25 min of the operation this could not be generalized. Future studies are recommended to study the permanence of pupillary dilation after intracameral lidocaine injection as compared to the topical and intracameral mydriatics. We conclude that intracameral lidocaine is a safe and efficient alternative to traditional topical and intracameral mydriatics during phacoemulsification surgery.

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