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Pupil Dilation by Intracameral Injection of Preservative Free 1% Lidocaine and Topical Mydriatics in Phacoemulsification Cases: A Comparative Study

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Abstract **Original Research Article**

Purpose*:** To compare the results of pupil dilation by an intracameral injection of preservative free 1% lidocaine with conventional topical mydriatics during phacoemulsification cataract surgery. Comparison was also done for simultaneous anaesthetic effect between intracameral lidocaine and topical mydriatics. ***Methods: A randomized, comparative interventional study was conducted. The study included 50 patients who underwent phacoemulsification and intraocular lens implantation surgery and were divided in two groups. One group was given topical mydriatics (25 eyes) preoperatively and other intracameral lidocaine (25 eyes) at commencement of surgery to dilate the pupil. The topical group received 3 drops of tropicamide 0.8% and phenylephrine 5% eye drops 15 minutes apart starting 45 minutes before surgery. The intracameral group received preservative-free lidocaine 1% (0.2 to 0.3 mL) injected just before the procedure began. In both groups, the horizontal pupil diameter was measured before and after pupil dilation using the same caliper. Total surgical time, need for a supplement mydriatic agent during the surgery and subjective surgical performance were recorded. Any adverse ocular and systemic effects between two groups were also compared. ***Results:*** The mean age, sex, cataract grading, baseline horizontal pupil diameter and mean surgerical time were similar between the topical and intracameral group. The mean pupil dilation was 4.62 ± 0.96 mm in the intracameral group and 4.76 ± 0.75 mm in the topical group. There was no statistically significant difference between the two groups (P value =0.57).There was no significant difference between groups in the overall subjective surgical performance (P=0.72). No patient in any group required supplementary intracameral mydriatic injection. ***Conclusion:*** Intracameral lidocaine is a safe, effective and reliable alternative to topical mydriatic for pupil dilation with added advantages of fast postoperative recovery and is also devoid of the side effects caused by the systemic absorption of topical mydriatics.It has an additive anaesthetic effect too.

Keywords: Pupil dilation, phacoemulsification, topical mydriatic, intracameral lidocaine.

INTRODUCTION

Adequate mydriasis of pupil is a prerequisite for good visualization of opacified lens in cataract surgery. This is usually achieved by topical and/or intracameral administration of anti- cholinergic agents, sympathomimetic mydriatic agents, or both; the most commonly being used are tropicamide, phenylephrine and cyclopentolate [1,2]. These agents,on the other hand, have cetain disadvantages like slow onset of dilation, which increases the waiting time before surgery [3-5], adverse ocular and systemic effects, which are especially important in high-risk groups like cardiac and hypertensive patients and children [6-8]. In addition, the effect of these agents may wear off during surgery. Intracameral injection of lidocaine has been used as an alternative to reduce the potential disadvantages of commonly used mydriatics. This study assessed pupil dilation by an intracameral injection of 1% lidocaine (preservative free) and compared the results with those of conventional topical mydriatics. Simultaneously, we also assessed the effect of intracameral lidocaine as an anesthetic agent.

MATERIALS AND METHODS

This was a hospital based,prospective, randomized, comparative interventional study. For study purpose 25 cases for each group were taken. Exclusion criteria were patients having intumescent cataract, complicated cataract, traumatic cataract, congenital cataract, previous ocular surgery, laser procedures, iris abnormalities, pseudoexfoliation, uncontrolled diabetics, patients with benign prostatic hypertrophy and use of topical ocular medications (except artificial tears). After explaining the study, surgical procedures and possible complications, an informed consent was obtained and hospital ethics committee approval was obtained. Patients were assigned into two groups. Group A: Patient selected for pupil dilation with Intracameral preservative free 1% lidociane who underwent phacoemulsification with IOL implantation.

Group B: Patient selected for pupil dilation with topical mydriatics who underwent phacoemulsification with IOL implantation.

All surgeries were performed by the same surgeon using proparacaine 0.5% eye drops after pupillary dilation in topical mydriatic group (Group B) and without dilation in Intracameral lidocaine group (Group A). Pupillary dilation was done with tropicamide 0.8% and phenylephrine 5% eye drops in topical mydriatic group with 3 drops at 15 minutes interval 45 minutes prior to surgery. Intracameral preservative free 1% lidocaine 0.1-0.2 ml was injected in anterior chamber in intracameral mydriatic group and pupil diameter was noted after 90 seconds with calipers. Surgery time was recorded from the moment of creating the side port incision.

Hydroxypropylmethylcellulose 2% was used as an ophthalmic viscosurgical device and balanced salt solution (BSS) as the irrigating solution. In all eyes, a single-piece foldable IOL was implanted in the bag. No epinephrine was added to the irrigating solution.

Total surgical time, need for supplementary mydriatics during the procedure, patient's orbital pain perception index analysis were noted. Subjective surgical performance was graded during capsulorhexis, phacoemulsification, cortex aspiration, and IOL implantation on a scale of 0 to 2 (0 = uncomplicated; I = slightly complicated; 2 = complicated). Lens opacity was graded using the Lens Opacities Classification System Ill (LOCS Ill).

Data were analyzed using the Statistical Package of Social Sciences (SPSS) version 23.0. Descriptive statistics were expressed as mean (standard deviation (SD)) and frequency (percentage) as appropriate. The independent sample t-test was used to compare the groups and to ascertain significance of difference. The level of significance was set at p value <0.05.

RESULTS

The topical group(Group B) comprised of 12 men and 13 women with a mean age of 60.16 ± 7.5 years (SD) and the intracameral group (Group A) comprised of 10 men and 15 women with a mean age of 63.60 ± 9.5 years. Table 1 shows the patient characteristics. Age, sex, baseline pupil size, and duration of surgery were not statistically different between the 2 groups. All patients had brown irises and nuclear opalescence and nuclear cataract of LOCS III grade 2-4 with variable amounts of cortical and posterior sub capsular cataract.

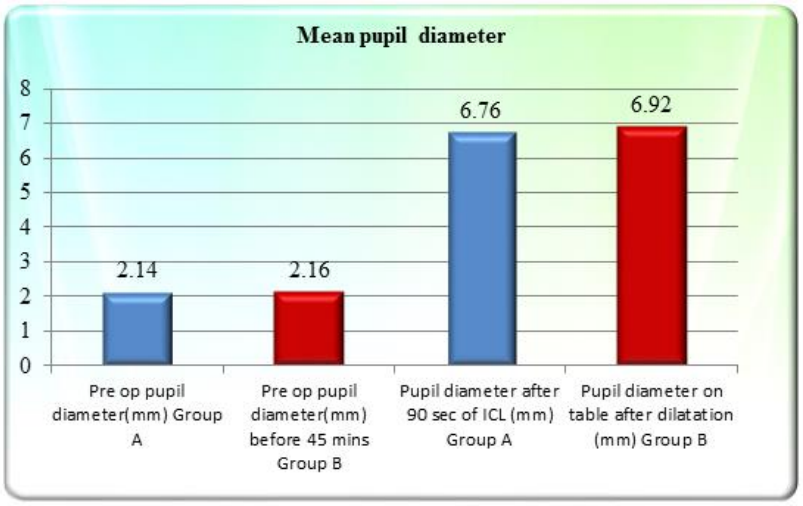
Table-1: Patient demographics

		Group		P Value
		Intracameral lidocaine	**Topical mydriatics**	
Sex	Male	13	12	
	Female	10	15	
Mean Age (years)		63.60 ± 9.5	60.16 ± 7.5	0.16
Mean baseline pupil diameter (mm)		2.14 ± 0.36	2.16 ± 0.34	0.84
Mean pupil diameter after drug use (mm)		6.76 ± 0.79	6.92 ± 0.74	0.46
Mean increased in pupil dilation (mm)		4.62 ± 0.92	4.76 ± 0.75	0.57
Mean surgical time (min)		16:06 ± 2:20	15:53 ± 2:08	0.72

There was no statistically significant difference between the two groups in pupil size both preoperative (perop) (P value= 0.84) and after dilatation (P value= 0.46). In Group A mean preop pupil diameter ± SD was 2.14 ± 0.36 mm(fig.1a) and pupil diameter after 90 sec of intracameral lidocaine (ICL) was 6.76 ± 0.79 mm(fig.1b and c) , whereas in Group B mean preop pupil diameter ± SD before 45 min of taking patient on table was 2.16 ± 0.34 mm and pupil diameter on table before starting phacoemulsification was 6.92 ± 0.74 mm. In Group A mean increase in pupil diameter ± SD after 90 sec of injecting ICL was 4.62 ± 0.96 mm whereas in Group B mean increase in pupil diameter ± SD after 3 drops of topical mydriatics at 15 min interval was 4.76 ± 0.75 mm.

The mean pupil diameter in male and female before dilation was not significant (P value=0.81),

moreover, pupil diameter in male and female after dilation (P value=0.19) and change in pupil diameter after dilation in male and female after dilation (P value=0.20) was also not significant. There was no statistically significant difference between change in mean pupil diameter between the two groups (P value= 0.57).



Mean total surgical time in Group A was 16:06 ± 2:20 min and in Group B was 15:53 ± 2:08 min. There was no statistically significant difference between the two groups. (P value= 0.72). Complication rates were slightly more in Group B as compared to Group A but the difference was statistically not significant (P=0.83).

Surgical performance ranking for capsulorhexis, phacoemulsification, cortex removal, lens implantation was done in both groups with 0 for uncomplicated, 1 for slightly complicated, 2 for complicated as per surgeons ranking . The difference was statistically not significant for capsulorhexis (P value =1.0), Phacoemulsification (P value =0.6),Cortex removal (P value =1.0),Lens implantation (P value= 0.83).

Table-2: Surgical performance ranking in both groups

	Ranking						**P value**
	Group A			**Group B**			
	0	**1**	**2**	**0**	**1**	**2**	
Capsulorhexis	23	2	0	23	2	0	1.0
Phacoemulsification	23	2	0	22	2	1	0.60
Cortex removal	23	2	0	23	2	0	1.0
Lens implantation	23	1	1	22	2	1	0.83

0-uncomplicated; 1-slightly complicated; 2-complicated

Pain perception index of patients in both groups with Group A having 24 patients with no pain and 1 with mild pain whereas in Group B having 21 patient with no pain,3 patient with mild pain and 1 with moderate pain.

The difference was not statistically significant (P value =0.33). Patient was asked to grade pain by using Visual analogue scale (VAS Scoring) intraoperatively, pain intensity was assessed with a 10 cm visual analogue scale in which we draw a 10 cm line & divided it in 10 equal parts. On that line ,zero means no pain & ten means worst imaginable pain.

Pictures showing pupil before dilatation and after dilatation with preservative free lidocaine 1%

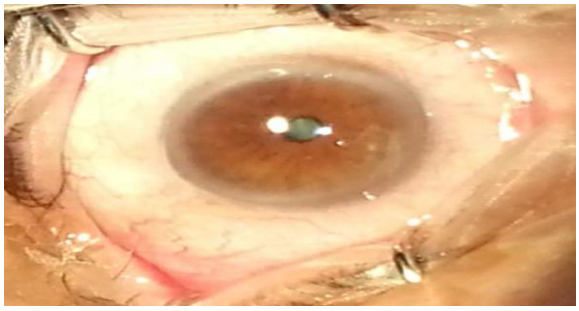


Fig-1(a):Before dilatation pupil diameter 2.0mm (GroupA)

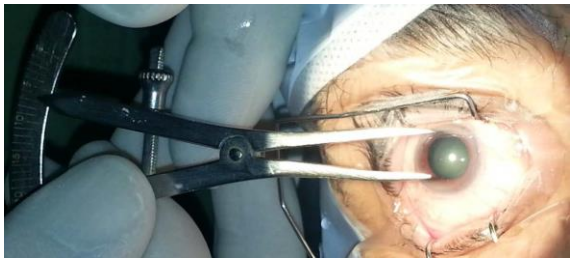


Fig-1(b):90 seconds after dilatation with intracameral preservative free 1% lidocaine pupil diameter 7.0mm(Group A)

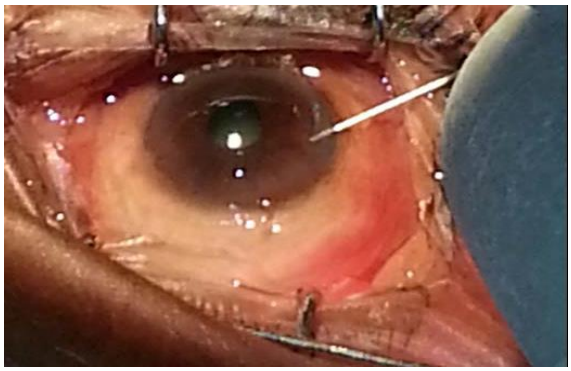


Fig-1(c): Intracameral injection of preservative free lidocaine 1%(GroupA)

DISCUSSION

Topical mydriatic agents are in common practice for dilation of the pupil for cataract sugery for many years. Disadvantages of these agents however, prompted for search of safer alternatives. Lidociane is an anti - arrhythmic drug and effective local anesthetic agent. It acts by blocking sodium channels leading to inhibition of membrane potential. Intracameral injection of preservative-free lidocaine is used widely for local anesthesia and discomfort relief in cataract surgery [9] Lidocaine causes no additional inflammation and endothelial cell loss and its safety has been confirmed in previous studies [10,11-13].

Lincoff *et al*. [14] reported the effect of lidocaine on iris paralysis and pupil dilation. They found the pupil dilated after accidental intraocular injection of lidocaine without administration of a mydriatic drug. Lee *et al*. [15] reported immediate pupil dilation after intracameral injection of no preserved lidocaine 1% in previously undilated phakic eyes during trabeculectomy. Cionni *et al.* [10] used intracameral lidocaine injection to induce mydriatics in phacoemulsification without the administration of preoperative dilating eye drops. However, they added epinephrine to the infusion solution during routine procedures to maintain pupil dilation. Nikeghbali A *et al.* [16] reported statistically significant (P=.001) difference in pupil dilatation between intracameral preservative free 1% lidocaine group and topical mydriatics group. Sanjiv K Gupta *et al*. [17] reported that intracameral irrigating solution (0.5% lignocaine + 0.001% epinephrine) provided rapid mydriasis adequate for safe phacoemulsification which was unaffected by duration of surgery, grade of nucleus and ultrasound time.

This study shows that injection of 0.2 to 0.3 mL of preservative-free lidocaine 1% in the anterior chamber provides persistent, stable, satisfactory pupil dilation for safe phacoemulsification and IOL implantation. The mean increase in pupil diameter was not statistically significant in both groups, also the overall surgical performance and duration of surgery were not significantly different between the 2 groups. In the present study, no additional mydriatic drug was used in the infusion fluid in either group.

The injection of intracameral lidocaine has advantages over topical mydriatics. It shortens the time taken for the pupil to dilate preoperatively, does not have systemic topical mydriatic side effects, and provides better pupil dilation as well as a simultaneous anesthetic effect for phacoemulsification with good patient compliance. In this study, the amount of pupil dilation was not significantly different during the surgeries and pupils remained dilated well till the end of surgeries. However, it is not clear how long the pupil dilation lasts after an intracameral lidocaine injection. Therefore, we recommend future studies of the duration of pupil dilation after intracameral lidocaine injection.

Thus our study conclude that pupil dilation can be successfully managed with intracameral mydriatics like preservative free lidocaine 1% in phacoemulsification with intraocular lens implantation with good visual outcome with as good results as with topical mydriatics and avoiding many adverse side effects of topical mydriatics and save time of both patients and surgeon too.

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