Combined Subconjunctival Atropine and Intracameral Epinephrine Injection for Pupil Dilation in Phacoemulsification under Peribulbar Anesthesia

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ABSTRACT
Background: The traditional method of pupil dilation in cataract surgery is topical mydriatics. However, this method has some drawbacks, suggesting the need for other alternatives.
Objective: The aim of the current study is to evaluate a new hybrid regimen for pupil dilation in phacoemulsification.
Patients and methods: A prospective randomized controlled contralateral eye study. Under peribulbar anesthesia, bilateral sequential phacoemulsification (with at least a 2-week interval) was performed on conventional cataract cases (40 eyes). The injection group included 20 eyes, in which mydriasis was achieved by a combined subconjunctival 0.6–0.8 mg atropine sulphate and intracameral preserved epinephrine (1:100,000) injection. The topical group included 20 eyes, in which topical tropicamide 1% and phenylephrine 2.5% were used. Dilated pupil diameter (P) was measured using an ophthalmic caliper at four different times: (P1) before corneal incisions, (P2) after corneal incisions (and intracameral epinephrine injection in the injection group), (P3) after ophthalmic viscoelastic device injection, (P4) before intraocular lens implantation, and (P5) at the end of surgery.
Results: (P1) was (4.5 ± 0.61) and (7.7 ± 0.62), (P2) was (7.67 ± 0.64) and (7.54 ± 0.6), (P3) was (7.73 ± 0.64) and (7.68 ± 0.59), (P4) was (7.53 ± 0.6.2) and (7.5 ± 0.59) mm while (P5) was (7.51 ± 0.6) and (7.46± 0.58) mm for the injection and topical groups, respectively. No significant difference existed between both groups except for P1 which was higher in the topical group (p <0.0001).
Conclusion: Combined subconjunctival atropine and intracameral epinephrine is a safe, effective, and practical method for pupil dilation in phacoemulsification when used in conjunction with peribulbar anesthesia.
Keywords: Subconjunctival Atropine, Intracameral Epinephrine, Phacoemulsification.

INTRODUCTION

Topical mydriatics are traditionally used for pupil dilation in cataract surgery. Poor corneal penetration and limited bioavailability of eye drops necessitate repeated instillations, which are not only time consuming but may also result in corneal epithelial toxicity, possible ocular surface contamination, patient discomfort [1], systemic side effects [2,3], and increased dependency on the compliance of nursing staff and patients [1].

Furthermore, the mydriatic effect of eye drops tends to wear off with the subsequent development of intraoperative miosis. Topical non-steroidal anti-inflammatory (NSAIDS) drops may reduce miosis but are also toxic to the epithelium [4].

A small pupil increases surgical difficulty and the potential for consequences including iris trauma, bleeding, capsular damage, and vitreous loss [5].

To overcome the limitations of the standard preoperative topical regimen, other alternatives were tried, such as ocular inserts [2, 6], and intracameral mydriatics such as lidocaine or epinephrine [1, 2, 7–10]. Intracameral epinephrine was used as a single drug to initiate and maintain mydriasis, but its effect was always weaker than eye drops. Therefore, intracameral combinations were suggested to improve the mydriatic effect.

Another option for pupil dilation is the subconjunctival injection of mydricaine, which is a drug mixture containing atropine, epinephrine, and procaine. Mydricaine is used in vitrectomy procedures, but its use may not be popular owing to its cardiovascular complications [11, 12].

In this study, a new hybrid regimen was suggested to achieve maximal and sustained pupil dilation during phacoemulsification without using preoperative mydriatic eye drops.

Subconjunctival atropine was combined with an intracameral, diluted solution of bisulfite containing epinephrine to potentiate its mydriatic effect. The aim of the work was to evaluate the efficacy and safety of this regimen by comparing it to a standard preoperative topical regimen.

PATIENTS AND METHODS
Study design and participants

A prospective randomized controlled contralateral eye study included 20 patients with bilateral cataracts (40 eyes) who underwent bilateral phacoemulsification in a tertiary referral center between September 2018 and September 2020. The eye with a denser cataract was operated on first, and it was randomly allocated to one of the two arms.

The experimental arm, or injection *Group A* (20 eyes), in which the pupil was dilated by a new hybrid injectable mydriatic regimen, and the control arm, or the topical *Group B* (20 eyes), in which the pupil was dilated by a standard topical regimen. The other eye was then operated on using the alternate regimen two weeks later, in order to avoid any potential drug interactions.

Preoperative evaluation and eligibility criteria:
Intraocular pressure and Best Corrected Visual Acuity (BCVA) were recorded. Preoperative non-dilated pupil diameter was measured, and preoperative maximum pupil dilation was evaluated after topical cyclopentolate (1%), and phenylephrine (10%) instillation. Nuclear cataract density was graded according to the Lens Opacities Classification System III (LOCS III) [13]. Endothelial cell density (ECD) and central corneal thickness (CCT) were measured using non-contact specular microscopy Topcon SP 3000P (Topcon corporation, Tokyo, Japan). Cases of bilateral significant cataract were included, while exclusion criteria.

Exclusion criteria:
- Less than 6 mm in diameter was considered to be poor pupil dilatation such as pseudoexfoliation syndrome.
- Less than 18 years old was considered to be the pediatric age group.
- History of drug allergy to phenylephrine, tropicamide, epinephrine or atropine.
- History of using eye drops like pilocarpine that influence pupil size.
- Prior eye trauma or surgical history.
- Co-existing corneal, retinal, uveitis, optic nerve disorder, or glaucoma.
- Pupil abnormalities. For example, neurological disorders or anisocoria.
- Individuals receiving anti-coagulant treatment as subconjunctival and peribulbar route of injection is utilized.
- Cases with surgical appointments under general anesthesia (to rule out any systemic or ocular effects or interactions of anesthetics).

Perioperative pupil dilation:
The injection group: After peribulbar injection of local anesthesia, 0.6-0.8 mg (0.6-0.8 ml) of 1 mg/ml atropine sulphate (Memphis Pharmaceuticals, Egypt) was injected in the inferior conjunctival fornix, followed 10 minutes later by an intracameral injection of (1:100000) bisulfite containing epinephrine (Misr Co, Egypt) just after performing the corneal incisions. Intracameral epinephrine was freshly prepared during the procedure by adding 0.1 ml of bisulfite-preserved epinephrine (1 mg/ml) to 9.9 ml of ringer lactate. Epinephrine was left in the anterior chamber for one minute before the ophthalmic viscoelastic device (OVD) was injected.

The topical group: For 45 minutes before surgery, cyclopentolate (1%), and phenylephrine (10%) were instilled four times, once every 10 minutes.

Standard surgical technique:
A 0.5% bupivacaine and 2% lidocaine anesthetic combination was injected via peribulbar route. External ocular massage was applied for 10 minutes, followed by sterilization and draping. A clear corneal incision of 2.4 mm width and two side ports were done. A methylcellulose OVD injection and continuous curvilinear capsulorhexis were performed. Infiniti phacoemulsification machine (Alcon Labs, Fort Worth, TX, USA) was used for phacoemulsification (Phaco chop technique). Surgery was completed by irrigation and aspiration of the cortex, foldable intraocular lens implantation, and wound hydration. All operations were performed by the same surgeon (Nossair, A).

Primary outcome measure:
Pupil diameter was measured by a masked observer using video recordings at five different time points: (P1) just before corneal incisions (P2) just before OVD injection (P3) just before capsulorehexis (P4) just before IOL implantation (P5) at the end of surgery. Horizontal pupil diameter in screen captures was measured at these time points in relation to blade width. The pupil diameter in mm was calculated by dividing the measured horizontal diameter over the blade width and multiplying the result by 2.4 mm.

Secondary outcome measures:
Cumulative dissipated energy (CDE) and intraoperative ocular complications were recorded. All patients were monitored for hemodynamic changes of systolic blood pressure (S1, S2, S3, S4), diastolic blood pressure (D1, D2, D3, D4), and heart rate (H1, H2, H3, H4) at four different time points in the operating room using the electrocardio-monitor Mindray MEC-1000 (Mindray Medical International Co., Ltd., Shenzen, China). The first time point was measured in both groups prior to the injection of local anesthetic. The second time point was measured just after local anesthetic injection in both groups, i.e., after subconjunctival atropine injection in the injection group. The third time point was measured just before performing corneal incisions in both groups, while the fourth time point was measured just after OVD injection in both groups, i.e., after intracameral epinephrine injection in the injection group. A heart rate of more than 100 beats per minute (BPM) for more than five minutes was considered to be persistent tachycardia. Persistent hypertension was defined as a blood pressure greater than 140/90 for more than five minutes.
A full postoperative ophthalmic examination, including pupil size measurement, BCVA and intraocular pressure (IOP), was done after one day, one week and one month. Any postoperative complication, such as corneal edema or high intraocular pressure, was recorded. Postoperative CCT and ECD were measured after one month.

Ethical consent:
The study protocol was approved by the research ethical committee of Dar El Oyoun Hospital. The study was registered at ClinicalTrials.gov under the unique identifier NCT03638726. A written informed

consent was signed by each patient. The Declaration of Helsinki, the World Medical Association's code of ethics for studies involving humans, guided the conduct of this work.

Statistical analysis:

Sample size was calculated utilizing type I error (level of significance) to be 0.05 and type II power to be 0.2. Anticipating the mean increase in pupil size to be 3 mm to reach a target pupil size of 6 mm with a standard deviation of 0.25 and a difference of 0.3 mm between both groups, the estimated sample size was 16 for each group. A sample size of 20 was chosen to enhance the reliability of the results. Snellen's decimal notation of CDVA was translated into logarithmic minimum angle of resolution (Log MAR) units.

Data were collected and then combined into a single database for statistical analysis using the SPSS 16.0 software package (SPSS Inc., Chicago, IL, USA). For independent variables, descriptive data were calculated as means standard deviation (SD), while percentages were used for dichotomous variables. For the examination of the time course, a two-factor analysis of variance (ANOVA) with replication was suggested for the analysis of pupil diameter intra- and inter-groups. Pairwise comparisons were made using the T test. The Pearson coefficient was utilized to evaluate the correlation between several variables. P value ≤ 0.05 was considered significant.

RESULTS

Demographic and preoperative data:

The mean age of patients was 60.25 (SD 12.74), with a range between 34 and 80 years. Eleven (55%) patients were males and 9 (45%) patients were females. Five patients had diabetes (25%), 4 (20%) had hypertension and 2 (10%) had ischemic heart disease. The average number of days between bilateral interventions was 24.85 ± 6.04 days. Preoperative pupil size, cataract grading, BCVA, IOP, CCT, and ECD did not reveal any statistically significant difference among both arms **(Table 1).**

Table (1): Preoperative data including pupil size, cataract grading, IOP, CDVA, CCT and ECD.

Variable	Preoperative pupil size (mm)	Cataract grading (LOCS III)	Preoperative IOP (mmHg)	Preoperative BCVA (Log MAR)	Preoperative CCT (microns)	Preoperative ECD (/mm^2)
Injection group	2.60 ± 0.41	3.7 ± 0.91	16.15 ± 1.9	0.88 ± 0.21	553.7 ± 22.45	2499.75 ± 179.72
Topical group	2.50 ± 0.36	3.35 ± 0.82	15.25 ± 2.3	0.78 ± 0.18	556.2 ± 19.67	2464.85 ± 184.27
P value	0.42	0.34	0.19	0.24	0.71	0.55

Numbers represent means ± standard deviation (SD). ANOVA test is used to calculate P-value.

Intraoperative pupil diameter

The topical group had a statistically higher P1 (p 0.001). (P2), (P3), (P4), and (P5) did not show any statistically significant difference between both groups, although (P2), (P3), (P4), and (P5) were insignificantly slightly higher in the injection group **(Table 2)**.

Table (2): Intraoperative dilated pupil diameter.

Variable	P1	P2	P3	P4	P5
Injection group	4.5 ± 0.61	7.67 ± 0.64	7.73 ± 0.64	7.53 ± 0.62	7.51 ± 0.6
Topical group	7.7 ± 0.62	7.54 ± 0.6	7.68 ± 0.59	7.5 ± 0.59	7.46 ± 0.58
P value	< 0.0001	0.55	0.78	0.89	0.79

P1: Dilated pupil diameter (mm) just before corneal incisions

P2: Dilated pupil diameter (mm) after corneal incisions (and intracameral epinephrine injection in group A).

P3: Dilated pupil diameter (mm) just after ophthalmic viscoelastic device (OVD) injection.

P4: Dilated pupil diameter (mm) before IOL implantation

P5: Dilated pupil diameter (mm) after wound hydration

ANOVA test is used to calculate P-value.

Cumulative dissipated energy (CDE)

The mean CDE was 7.98 (SD 1.92) and 8.25 (SD 2.05) for the injection and topical groups, respectively, with insignificant variations among both arms (P =0.75).

We found a significant positive correlation between CDE and cataract grading in the injection group (r =0.85, P =0.001) and in the topical group (r =0.74, P =0.001).

No significant correlation between CDE and pupil size measured at the end of surgery (D5) was noted in the injection arm (r =0.29, P =0.61) while the correlation was negatively significant in the topical group (r =0.485, P =0.03).

No intraocular complication occurred in both groups.

Intraoperative cardiovascular changes

Between the two groups, there were no statistically significant variations in systolic blood pressure at 4 different intraoperative time points (S1, S2, S3, S4) (P =0.67). No correlation was found between the method of pupil dilation and systolic blood pressure (P =0.45). Insignificant differences between groups regarding diastolic blood pressure at the 4 time points (D1, D2, D3, and D4) (P =0.77) were observed. The pupil dilation method did not affect diastolic blood pressure (P =0.86). The heart rate was also not significantly different in both arms regarding the four time points (H1, H2, H3, and H4) (P =0.61), and it was not correlated to the pupil dilation method (P =0.76). **Table 3** shows the comparison between hemodynamic changes in both arms at each time point.

Table (3): Intraoperative cardiovascular changes (systolic blood pressure, diastolic blood pressure and heart rate).

	Injection group	Topical group	P value
Systolic blood pressure			
S1	125.35 ± 4.49	126.15 ± 5.93	0.63
S2	127.1 ± 4.69	128.5 ± 6.22	0.43
S3	129.5 ± 7.6	128.25 ± 6.9	0.59
S4	131.85 ± 7.25	129.2 ± 6.4	0.23
Diastolic blood pressure			
D1	80.25 ± 4.34	81.05 ± 5.31	0.61
D2	81.55 ± 5.01	81.4 ± 5.48	0.92
D3	80.6 ± 4.78	81.55 ± 5.02	0.54
D4	81.6 ± 3.76	80.9 ± 5.27	0.63
Heart rate			
H1	79.4 ± 5.3	78.45 ± 9.83	0.7
H2	79.5 ± 5.34	78.6± 9.89	0.72
H3	80.55 ± 5.06	81.95 ± 6.96	o.47
H4	82.35 ± 5.67	80.55 ± 5.67	0.32

Mild systolic hypertension (140–150 mmHg) was detected in one patient in each group (5%).

These two patients were known to be hypertensive and were well controlled with medical treatment preoperatively. No intraoperative antihypertensive medication was administered, and no serious effect was encountered.

Postoperative data

Mild corneal edema was detected in two patients in each group (10%) on the first postoperative day, which completely resolved within one week. One patient in the injection group suffered a limited subconjunctival hemorrhage at the inferior fornix that was absorbed within one week. Transient mild IOP elevation (26 mmHg) was detected on the first postoperative day in one patient (5%) and two patients (10%) in the injection and topical groups, respectively. No anti-glaucoma medication was required.

On the first postoperative day, the postoperative pupil size was noticeably greater in the injection arm, with a mean of 3.80 (SD 0.52) mm compared to a mean of 2.72 (SD 0.47) mm in the topical group (P =0.001). However, after one week and one month, no significant differences were noticed among the two arms (P =0.13) or among different time points (P =0.46).

Statistically significant diminution of postoperative ECD was observed in the injection arm (P =0.001) and the topical arm (P =0.001) after one month (P =0.0001). However, an insignificant postoperative increase in CCT was detected in the injection arm (P =0.56) and the topical group (P =0.23) as well.

Postoperative BCVA and IOP were comparable among both groups after 1 day, 1 week, and 1 month following surgery. Postoperative CCT and ECD measured after one month did not show significant differences between both groups **(Table 4).**

Table (4): Postoperative data including BCVA, IOP, CCT and ECD.

Variable	Injection group	Topical group	P value
Postoperative BCVA (Log MAR)			
One day	0.25 ± 0.06	0.285 ± 0.06	0.56
One week	0.06 ± 0.07	0.09 ± 0.02	0.312
One month	0.55 ± 0.12	0.65 ± 0.15	0.64
Postoperative IOP (mmHg)			
One day	15.65 ± 2.83	15.35 ± 3.03	0.45
One week	15.8 ± 2.07	14.95 ± 1.9	0.18
One month	15.85 ± 1.75	15.15± 2.01	0.25
Postoperative CCT (microns) one month	557.85 ± 22.61	564.05 ±20.85	0.37
Postoperative ECD (/mm^2) one month	2271.2 ± 163.1	2260.95 ±189.07	0.85

DISCUSSION

Although recent trends in modern ophthalmology are moving towards topical anesthesia, needle block still has its place in cataract surgery because topical anesthesia may not be suitable for every surgeon, every patient, or every procedure [14]. As a result, surgeon preferences for anesthesia methods vary greatly. For example, in several underdeveloped nations, such as Nigeria, peribulbar injection is the most often employed technique [15], and even in the developed world, like the UK, it remains in use [16]. In fact, several surgeons are still more satisfied with peribulbar anesthesia [17], which was preferred in this study as it reduces the need for additional anesthesia during the procedure [18] and decreases postoperative pain [17, 18]. Furthermore, intracameral lidocaine injection and intravenous sedation are frequently used in conjunction with topical anesthesia to improve analgesia. That was not applicable in our study as intracameral lidocaine is a known mydriatic and intravenous sedation can induce hemodynamic changes.

Our new hybrid mydriatic regimen ingredients included atropine and epinephrine, so it can be compared to subconjunctival mydricaine, which is a mixture of 1.3 mg atropine, 0.12 mg epinephrine, and 8.4 mg of procaine hydrochloride [11]. The previous formula is called mydricaine No. 2, while the dosage of atropine and procaine in mydricaine No. 1 is cut in half. Each single ingredient in this mixture is capable of inducing cardiovascular complications on its own [12]. Thus, it was believed that the adverse effects of mydricaine, which had been frequently reported [11, 12], were the results of the additive effects of three different drugs rather than the side effects of one of them solely.

In the current investigation, the intracameral epinephrine concentration was 1:100,000, which was far less than the epinephrine dose in mydricaine. The route of epinephrine administration was another difference because the intraocular route is known to limit systemic absorption of drugs [2], hence no adverse cardiovascular effects were previously observed with intracameral epinephrine use [2,8,9,19]. On the other hand, subconjunctival atropine was injected at a dose of 0.6 mg, which was almost equivalent to the atropine dose in mydricaine No.1 and nearly half of that in mydricaine No.2. Although a periocular route such as subconjunctival injection may result in systemic absorption, it seems that absorption is much less than true systemic administration. Based on this concept, periocular steroids, for example, are commonly used in uveitis to limit their systemic complications [20]. The absence of pupil dilation in the other eye at the end of surgery in the current study demonstrated that subconjunctival atropine caused mydriasis primarily through a direct effect on the eye rather than systemic spread. This could explain why the combination of

subconjunctival atropine and intracameral epinephrine was found to be systemically safe, as the cardiovascular parameters remained unchanged.

The new hybrid regimen was also found to be locally safe without negative effects on the cornea, visual acuity, or IOP. Diluted bisulfite containing epinephrine was used as it had been previously suggested to be a safe alternative to preservative-free epinephrine in case of its shortage [21]. Fresh preparation and maximum dilution were considered to minimize bisulfite toxicity or instability. Epinephrine was used at a concentration of 1:100,000, which did not increase the risks of corneal endothelial cell loss or corneal edema compared to the topical arm. Our results agree with the findings of other investigators [9,22]. Excellent postoperative BCVA also indicated the safety of intracameral epinephrine on the retina, as visual acuity is a marker of retinal toxicity [9]. Previous reports also supported this observation [8,9,23]. Similarly, postoperative intraocular pressure can serve as an indicator of trabecular meshwork toxicity [7].

As mydricaine may be viewed as a straw man, a better choice to compare would be the recently introduced intracameral mydriatic drug mixtures such as mydrane (0.12 mg of tropicamide, 1.86 mg of phenylephrine hydrochloride, and 6 mg of lidocaine hydrochloride are all present in one ampoule of a 0.6 ml solution.) [10]. Mydrane is available only in Europe and the USA for now. It has a much higher cost than eye drops, which may be compensated by the savings in nursing time [24]. However, its cost-effectiveness remains debated, at least for routine use. Interestingly, the new hybrid mydriatic regimen has a lower cost than eye drops and can still save nursing time as well. Other possible mydriatic mixtures may include combined intracameral lidocaine and epinephrine, but in our country, at the time of study conduction, preservative-free lidocaine was not only difficult to obtain but also much more expensive than atropine. Unfortunately, mydricaine was all that was available in that class.

Neither subconjunctival atropine alone nor intracameral epinephrine by its own would have been capable of inducing powerful mydriasis at such low doses. Actually, pupil dilation with subconjunctival atropine alone was significantly less than the topical group but pupil diameter values increased to become higher than the standard topical regimen, after intracameral epinephrine injection, starting from the time of capsulorhexis untill the end of the surgery. Epinephrine dose was low compared for example to epinephrine-Shugarcaine (1/100000 v 1/4000) so might have been expected to have less effect. However, an augmented mydriatic effect was observed due to synergism. Intracameral epinephrine rapidly dilates the pupil within 30 seconds [1] mainly by alpha receptor and to a lesser extent by beta receptor sympathomimetic actions [25]. The anticholinergic atropine sulfate abolishes sphincter pupillae muscle action preventing intraoperative miosis which may be considered the main reason for the previously reported weaker effect of single intracameral epinephrine use [8]. This pharmacological combination (atropine and epinephrine) can be also potentially helpful in (IFIS)[26].

As a pupil diameter of approximately 6 mm can be considered a cutoff for adequacy and safe phacoemulsification, more pupil dilation than drops may show limited relevance once the pupil is over 6 mm. That assumption holds true for an average capsulorhesis size of 4-5 mm to perform routine endocapsular phacoemulsification. Nevertheless, a greater pupil dilation than 6 mm maybe beneficial in other situations, such as supracapsular nucleofractis techniques, dealing with hard cataracts, or manual small incision cataract extraction. Although this study was conducted on conventional cataract cases, the encouraging outcomes of the new hybrid regimen may gather further interest to investigate its role in more challenging cases such as those with small pupils or other procedures like combined phaco-vitrectomy surgery.

However, the current regimen has some limitations. Indeed, subconjunctival haemorrhage may develop, hampering a fine postoperative appearance. Therefore, this regimen is not suitable for patients taking anti-coagulant medications or suffering from a bleeding tendency. Furthermore, the relatively prolonged period between subconjunctival injection and creating corneal incisions may delay the flow of surgery. On the other hand, avoiding preoperative mydriatic eye drops can eliminate the preoperative nursing time, which is usually three to four times longer than the procedure itself, subsequently leading to fewer burdens on staff, less cost, more patient satisfaction, and a speedier workflow. While the effect may seem counterproductive, this is only true if topical anesthesia is used. So it is better to reserve this regimen for cases done under peribulbar anesthesia, as external pressure for a few minutes before surgery is already needed. In that case, adding subconjunctival injection to peribulbar injection is unlikely to result in any significant extra risk or delay.

On the first postoperative day, there was a larger pupil in the injection group (less than 4 mm), but it did not affect vision or cause any patient discomfort. After one week, no significant difference in pupil size existed between both groups. Postoperative pupil dilation did not last long in the injection group, despite the fact that it involved atropine use. This can be attributed to the blood-aqueous barrier breakdown and surgically induced miosis that are known to develop following cataract surgery [4].

Based on our knowledge, injection of atropine as a subconjunctival mydriatic agent combined with intracameral epinephrine in phacoemulsification has never studied before. Subconjunctival atropine injection increased the mydriatic effect of intracameral epinephrine without compromising systemic or ocular safety. It also prevented intraoperative miosis, which may occur with topical mydriatics or a single intracameral epinephrine injection. When it was used in

conjunction with peribulbar anesthesia, no additional risk or delay was observed. Maximal and maintained pupil dilation was achieved during surgery without using preoperative topical mydriatics or NSAIDS, reducing their burden on the corneal epithelium. This new combination is not only easy to prepare but also available in any operating theatre. Another important advantage is its low cost, which is less than half that of topical mydriatics.

In conclusion, combined subconjunctival atropine and intracameral epinephrine injection can be used safely as a non- inferior alternative regimen for pupil dilation in phacoemulsification with peribulbar anesthesia. Further studies may confirm our results.

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