



Full Length Research Paper

Anti-inflammatory Effects of Intracameral Triamcinolone Acetonide Injection versus Topical Dexamethasone after Cataract Surgery: A Prospective Comparative Study

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Article history:

Received: 26-11-2019

Revised: 02-12-2019

Accepted: 19-12-2019

Published: 30-12-2019

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Abstract

Background: Cataract surgery is the commonest among daily ophthalmological practice. However, postoperative inflammation and increased intraocular pressure could represent a significant problem if progressed to macular edema. **Aim of the work:** The current work aimed to compare the intracameral injection of triamcinolone acetonide (TA) versus topical application of dexamethasone after cataract surgery. **Patients and Methods:** This study included 140 patients, who were assigned for elective unilateral phacoemulsification. A detailed preoperative clinical and ophthalmic assessment was performed. At the end of the procedure, patients were randomly categorized into two equal groups: The first group (n = 70 eyes of 70 patients), for intracameral triamcinolone acetonide (TA). The second group (n = 70 eyes of 70 patients) received 0.1% dexamethasone eye drops (every 4 hours for four weeks). The postoperative examination was scheduled for the first postoperative day, first week and first month. The follow up assessment included history of any ocular discomfort, measurement of visual acuity (VA), slit-lamp examination, measurement of intraocular pressure (IOP) and fundus examinations. The anterior chamber cells and flare were the major efficacy criteria examined at the follow up visits. In addition, conjunctival hyperemia was documented. **Results:** Patient age ranged between 40 and 60 years, and there was slight increase of males than females and right than left side in both groups (67.1% and 64.3% vs 70.0% and 62.9% respectively). The operative time ranged between 15 and 26 minutes, with no significant difference between studied groups. There was no significant difference between intracameral TA and topical dexamethasone groups regarding postoperative cells and flare, visual acuity or intraocular pressure. However, postoperative cells, flare and intraocular pressure were significantly decreased over postoperative time from the first to the 30th postoperative day, and visual acuity significantly improved over time.

Conclusion: Both routes (intracameral TA injection and topical dexamethasone) were effective and safe with no significant difference between groups. With advantages and disadvantages of each route of administration and factors related to the drug itself, it is recommended to individualize treatment protocol for each patient.

Keywords: Phacoemulsification; Triamcinolone Acetonide; Dexamethasone; Topical; Intracameral.

Introduction

Cataract surgery is the commonest ophthalmic surgery all over the world. Thus, it has a major public health concern. The newly introduced surgical techniques are associated with significant improvement in treatment outcome and reduced perioperative complications. However, to obtain the best treatment outcome and prevent later complications needs meticulous postoperative care with optimal patient compliance. The adherence to daily multiple use of eye drops for many weeks after surgery is a challenging task especially in elderly patient after cataract surgery⁽¹⁾. The adherence to topical administration of eye drops after phacoemulsification surgery had been reported to vary from 5% to 80.0%⁽²⁾.

Complications after surgery include, but not limited to, inflammation of the anterior segment, increased intraocular pressure (IOP), formation of synechiae, increased the time of recovery, pseudophakic cystoid macular edema (PCME). These complications are explained by physical trauma associated with cataract surgery. In addition, the postoperative infection itself predisposes to the PCME development^(3,4). The inflammatory mediators diffused into the posterior segment of the eye lead to disruption of the blood-retinal barrier with increased permeability of vascular endothelium⁽⁵⁾, and predisposes to development of CME, as cystoids accumulate in the plexiform (outer) and nuclear (inner) retinal layers⁽⁶⁾.

The use of corticosteroids is associated with the reduction in the production of several inflammatory mediators, regardless route of administration. Thus, it extensively used after phacoemulsification cataract surgery. Triamcinolone acetonide (TA) is along-acting corticosteroid of moderate-strength. It was suggested that, subconjunctival, intracameral, and subtenon injection of TA depends

could provide an effective treatment modality for reduction of postoperative complications related to non-adherence use of eye drops⁽⁷⁾. There is a growing interest for alternative “dropless” cataract surgery to guard against non-adherence to topic eye drops⁽⁸⁾. Here we intended to carry out a comparison between the intracameral injection of AT and topical application of dexamethasone to address their efficacy and safety after cataract surgery.

Patients and methods

This prospective comparative study was completed at the Department of Ophthalmology, Damietta Faculty of Medicine, Al-Azhar University, Egypt. It had been completed between January 2017 and June 2019. It finally included 140 patients, who were scheduled for unilateral phacoemulsification with implantation of intraocular lens, signed an informed consent and complete the study. Inclusion criteria were both genders, and age ranged between 40 to 60 years, presence of cataract suitable for phacoemulsification, preoperative visual acuity less than 0.5 (decimal) and preoperative intraocular pressure < 21mmHg. On the other side, exclusion criteria were any ocular pathology, current use of topic corticosteroids, glaucoma, uveitis, intraoperative complication during surgery (e.g., vitreous loss or rupture of posterior capsule), history of previous surgery, and other comorbid conditions. A detailed preoperative clinical and ophthalmic assessment was performed. The ophthalmic examination was completed by slit-lamp examination, measurement of intraocular pressure by Goldman appplanation tonometry, determination of central corneal thickness by ultrasonic pachymetry and dilated fundus examination.

Surgical technique: All surgeries were completed under topical anesthesia. Two hours before surgery, phenylephrine 2.5% and tropicamide 1% eye drops were applied. After anesthesia, a 2.8 mm clear corneal incision was created, followed by injection of sodium chondroitin sulphate 4%-sodium hyaluronate 2% (Viscoat, Alcon, Pharmaceuticals Ltd) and 5.0 mm capsulorhexis was done. The standard phacoemulsification was performed by the phaco-chop maneuver. The bag of the capsule was extended with sodium hyaluronate 1% (Healon, Abbott Medical Optics), and an intraocular lens was inserted in the bag. Then, an irrigation aspiration system was used to remove viscoelastic substance from the bag, the fornix of the capsule, and the anterior chamber of the eye in a standard technique. At the end of the surgery, patients were randomly categorized into two equal groups: The first group ($n = 70$ eyes of 70 patients), TA (Kenacort-A®; Bristol-Myers Squibb) 2 mg/0.05 ml was injected into the anterior chamber through a paracentesis by a 27-gauge cannula. The second group ($n = 70$ eyes of 70 patients) received 0.1% dexamethasone eye drops (every 4 hours for four weeks). All patients received moxifloxacin 0.5% eye drops (Vigamox, Alcon, Pharmaceuticals Ltd), four times a day for 1 week. The postoperative examination was scheduled for the first postoperative day, at the end of the first week and at the end of the first month. The follow up assessment included history of any ocular discomfort, measurement of visual acuity (VA), slit-lamp examination, measurement of intraocular pressure and fundus examinations. The anterior chamber cells and flare were the major efficacy criteria examined at follow up visit. In addition, conjunctival hyperemia was documented. The grading of anterior chamber cells was 0 if cells ≤ 5 , 1 = mild (cells 5-10), 2 = moderate (10-20 cells, 3= marked (21-50 cells), 4 = severe (>50 cells) and 5 = hypopyon. On the other side, aqueous flare scale was graded zero for absent flare, mild [1] for just detectable flare, moderate [2] for clear details of iris, marked [3] for hazy iris details and severe [5] for fibrin deposition and clot formation. Anterior chamber cell and aqueous flare were scored using a 0.5mm (the narrowest slit beam) 8 mm, with maximum magnification and luminance of the slit-lamp.

Statistical analysis was performed by the statistical package for social sciences software (SPSS), version 18.0, (IBM® SPSS® Inc., Chicago, III, USA). Anterior chamber cells and flare were evaluated by Mann–Whitney U-test. Group comparisons of the postoperative intraocular pressure and visual acuity were done using student samples “t” test. Mean values compared overtime by paired samples “t” test or repeated ANOVA. Categorical variables were compared by the Chi-square test. P value < 0.05 was considered significant.

Results

In the current work, patient age ranged between 40 and 60 years, and there was slight increase of males in both groups than females and right than left side (67.1% and 64.3% vs 70.0% and 62.9% respectively). Smoking reported in 11.4% in intracameral TA group, compared to 10.0% of the topical dexamethasone group. There was no significant difference between both groups regarding patient age, sex, operated side or smoking (Table 1). The operative time ranged between 15 and 26 minutes, with no significant difference between studied groups. In addition, there was no significant difference between intracameral TA and topical dexamethasone groups regarding postoperative cells and flare, visual acuity or intraocular pressure. However, postoperative cells, flare and intraocular pressure were significantly decreased over postoperative time from the first to the 30th day. Visual acuity however, significantly improved over time (Table 2).

Table (1): Comparison between intracameral TA and topical dexamethasone groups regarding patient demographics, operated side and smoking

		Intracameral TA	Topical dexamethasone	test	P
Age	Mean±SD	51.18±5.0	50.62±4.36	0.70	0.48
	Min. - Max.	40-60	42-59		
Sex (n, %)	Male	47(67.1%)	49(70.0%)	0.13	0.71
	Female	23(32.9%)	21(30.0%)		
Operated side	Right	45(64.3%)	44(62.9%)	0.03	0.86
	Left	25(35.7%)	26(37.1%)		
Smoking		8(11.4%)	7(10.0%)	0.08	0.78

Table (2): Comparison between intracameral TA and topical dexamethasone groups regarding operative time and postoperative data.

		Intracameral TA	Topical dexamethasone	test	P
Operative time (min)	Mean±SD	18.21±1.91	17.90±2.02	0.94	0.34
	Min. – Max.	15-26	15-24		
Postoperative Cells	First day	2.13±0.82	2.00±0.83	0.92	0.36
	7 days	0.61±0.49	0.54±0.56	0.80	0.42
	30 days	0.34±0.47	0.40±0.490	0.69	0.49
Postoperative Flare	First day	0.21±0.41	0.23±0.42	0.20	0.84
	7 days	0.09±0.28	0.13±0.33	0.82	0.42
	30 days	0.04±0.20	0.06±0.23	0.39	0.70
Intraocular Pressure	Preoperative	18.60±1.12	18.60±1.10	0.23	0.82
	First day	19.55±1.03	19.40±0.71	1.05	0.29
	7 days	16.85±1.38	16.67±1.09	0.88	0.38
	30 days	12.67±1.20	12.43±0.75	1.43	0.15
Visual acuity (decimal)	Preoperative	0.21±0.10	0.23±0.09	0.96	0.34
	First day	0.69±0.09	0.70±0.08	0.87	0.38
	7 days	0.80±0.09	0.78±0.06	1.82	0.07
	30 days	0.86±0.13	0.84±0.16	0.99	0.32

Discussion

Surgical trauma initiated a cascade of inflammatory reactions in eyes after cataract surgery. Uncontrolled inflammation may lead to complications like CME, increased IOP, formation of synechiae, and opacity of the posterior capsule⁽⁹⁾. There are several routes of corticosteroid applications at the end of phacoemulsification surgery. Some surgeons apply these injections to suppress or prevent the inflammatory reactions during the first postoperative 24 hours. Others apply nothing at all other than topical steroids^(10,11).

Subconjunctival steroid injections remain one of the most prevalent modalities to guard against inflammation after cataract. However, it is a painful process especially in cases with topical anesthesia and can lead to subconjunctival hemorrhage and chemosis⁽¹²⁻¹⁴⁾. Intracameral injection of TA during or at the end of surgery had been associated with a reduction of inflammation of the anterior chamber and corneal edema on the first postoperative day. However, it is not devoid of unwanted effects, as it had a predilection to increase IOP in some patients due to its particulate structure^(15,16). Thus, shift to other drugs or routes of administration had been tried in a trial to find the optimal drug and route to deal with postoperative inflammation.

Here, we addressed the efficacy and safety of intracameral TA versus topical dexamethasone after cataract surgery. Our results demonstrated that, intracameral TA is comparable to topical dexamethasone for all postoperative variables (cells, flare and visual acuity). No complications were reported in either group till the end of the follow up period (30 days after operation).

Chen et al.⁽¹⁷⁾ reported that, steroids had been used to guard against postoperative inflammation for a long time. The mechanism of anti-inflammatory actions of steroids is due to multiple intercellular mediators. Steroids control the leakage of inflammatory cells and inhibit granulation tissue formation and fibroblast propagation.

In line with the outcome of the current study, an experimental study carried out by **Oh JY et al.**⁽¹⁸⁾. They injected TA into the rabbit's eyes anterior chamber with assessment of its effects on the corneal epithelium. They reported no significant reduction in thickness of the cornea or count of the endothelial cells. **Ellis**⁽¹⁹⁾ conducted a study on 60 eyes, 30 received intracameral TA and other 30 received topical dexamethasone after surgery till healing was achieved. The results showed no significant changes were found between the two groups regarding cell count in the anterior chamber at the 7th postoperative day. However, the cellular count was significantly reduced in the intracameral TA group than topic group at the end of the first month.

The efficacy of intravitreal and intracameral TA injection has also been reported when used alone or when combined with topical steroids to manage inflammatory reactions after cataract surgery in uveitic eyes^(20,21).

Although it is simple method of drug delivery, the topical use of steroids had certain drawbacks, like higher cost, poor patient compliance, corneal irritation, and disruption of tear film. Thus, other routes of administration are considered to avoid these drawbacks⁽²²⁾.

In the line with the current work, **Karalezli et al.**⁽¹⁵⁾ reported that, intracameral TA injection is very effective in reduction of inflammatory reactions after phacoemulsification. Aqueous flare is a standard indicator of ocular inflammation, and usually peaks at the first postoperative day (as in the current work) and gradually reduced thereafter. The current work revealed that, aqueous flare is comparable between intracameral TA and topical dexamethasone group till the end of follow up duration (30 days). **Merkoudis et al.**⁽²³⁾ reported that, this anti-inflammatory effect depends on the type of the steroid, route of administration and frequency of instillation in cases of topical use. Increased IOP is a particular problem with intracameral or topic use of corticosteroids. However, both groups did not show abnormal elevation of IOP or significant difference between both groups at any point of postoperative follow up times. IOP significantly decreased after surgery with progressive decrease with time when

compared to preoperative values. A dropless post-cataract surgery is of utmost importance among patients with multiple eye' drops and helps the compliance of the patient and this represents the main advantage of intracameral injection of TA. However, caution and regular monitoring of IOP is crucial. The PREMEDI study reported a significant rise of IOP above 25 mmHg in about 7.1% of diabetic patients during 12 weeks after TA subconjunctival injection and one participant required TA depot surgical resection⁽²⁴⁾. Unfortunately, the follow up duration of the current work is shorter than that reported in previous report. In addition, the inclusion of diabetic patients could explain their results.

Finally, **Ozge et al. (25)** reported that, the advancement of surgical techniques and instruments to deal with cataract made inflammatory control after cataract surgery of uncomplicated cases, an easily manageable with topical steroids. Thus, intracameral injection of TA or other steroids in uncomplicated cataract surgery seems questionable.

Considering results of the current work and previous literature, we could suggest the use of intracameral TA or other steroids in patients with history of low compliance with topical steroids, or in cases with multiple eye' drops use which could affect patient compliance after surgery. Otherwise, the topical corticosteroids are preferable. Finally, each case should be thoroughly assessed before cataract surgery and individualized regarding anti-inflammatory drugs.

Conflict of interest: none

Financial disclosure: none to disclose

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