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Cataract surgery combined with intravitreal injection of triamcinolone acetonide

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PURPOSE. To evaluate whether the addition of cataract surgery to an intravitreal injection of triamcinolone acetonide markedly increases frequency and spectrum of complications.
METHODS. The comparative nonrandomized clinical interventional investigation included a study group of 60 eyes (56 patients) undergoing cataract surgery and additionally receiving an intravitreal injection of about 20 mg of triamcinolone acetonide and a triamcinolone control group of 290 eyes (262 patients) that consecutively received an intravitreal injection of about 20 mg triamcinolone acetonide without cataract surgery. Reasons for intravitreal injection of triamcinolone acetonide were exudative age-related macular degeneration (n=228; 65%), diffuse diabetic macular edema (n=94; 27%), central retinal vein occlusion (n=17; 5%), and branch retinal vein occlusion (n=11; 3%). Mean follow-up was 8.6±6.8 months. A second control group included 1068 patients (1068 eyes) who consecutively underwent routine cataract surgery without intravitreal injection.
RESULTS. Study group and triamcinolone control group did not vary significantly in best visual acuity during follow-up (p=0.08), final visual acuity at the end of follow-up (p=0.30), maximal intraocular pressure during follow-up (p=0.99), frequency of an intraocular pressure higher than 21 mmHg (p=0.66), and intraocular pressure at the end of follow-up (p=0.06). Postoperative infectious endophthalmitis, wound leakage or other corneal wound healing problems, persisting corneal endothelial decompensation, rhegmatogenous retinal detachment, marked postoperative pain, or a clinically significant decentration of the intraocular lens were not observed. Study group and the non-triamcinolone control group did not vary significantly in the rate of posterior lens capsule rupture (p=0.11), postoperative infectious endophthalmitis, and persisting postoperative corneal endothelial decompensation.
CONCLUSIONS. The addition of cataract surgery to an intravitreal injection of triamcinolone acetonide may not markedly increase amount and frequency of side effects and complications of intravitreal triamcinolone acetonide. No safe conclusions can be reached regarding differences in frequency of postoperative infectious endophthalmitis. (Eur J Ophthalmol 2005; 15: 329-35)

KEY WORDS. Age-related macular degeneration, Cataract surgery, Diabetic macular edema, Phacoemulsification, Triamcinolone acetonide, Intraocular pressure

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INTRODUCTION

Since the basic studies by Machemer, Peyman, and other researchers more than 20 years ago, the intravitreal injection of triamcinolone acetonide has increasingly been performed as treatment of intraocular neovascular, inflammatory, proliferative, or edematous diseases, such as diffuse diabetic macular edema, exudative age-related macular degeneration, neovascular glaucoma, proliferative diabetic retinopathy, proliferative vitreoretinopathy, central

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and branch retinal vein occlusion, chronic uveitis, sympathetic ophthalmia, foveal telangiectasia, and pre-phthisical chronic ocular hypotony (1-34). Pilot studies, prospective randomized clinical trials, as well as experimental investigations have suggested that intraocular triamcinolone acetonide reduces intraretinal edema and inhibits intraocular angiogenesis (37-43). Since patients presenting with intraocular neovascular and edematous diseases often additionally show cataract, it was the purpose of the present study to examine whether cataract surgery in addition to the intravitreal injection of triamcinolone acetonide increases the frequency of side effects and complications of the therapy.

METHODS

The comparative nonrandomized investigation included a study group consisting of 60 eyes (56 patients) that consecutively underwent cataract surgery and additionally received an intravitreal injection of about 20 mg triamcinolone acetonide at the end of surgery as treatment of exudative age-related macular degeneration (n=39; 65%), diffuse diabetic macular edema (n=16; 27%), central retinal vein occlusion (n=3; 5%), or branch retinal vein occlusion (n=2; 3%). For all eyes of the study group, the opacity of the lens was sufficiently high to decrease the ophthalmoscopic visibility of the fundus. The degree of cataract was not systematically graded using a lens opacity grading system.

The triamcinolone control group included 290 eyes (262 patients) that consecutively received an intravitreal injection of about 20 mg triamcinolone acetonide as treatment of exudative age-related macular degeneration (n=189; 65%), diffuse diabetic macular edema (n=78; 27%), central retinal vein occlusion (n=14; 5%), or branch retinal vein occlusion (n=9; 3%), and that did not undergo cataract surgery at the time of the intravitreal injection or during the follow-up. Follow-up had to be at least 1 month. Age was significantly higher, visual acuity (VA) was significantly lower, and there were proportionally significantly more women in the study group compared with the control group (Tab. I). The study group and control group did not vary significantly in right or left eye, refractive error, and intraocular pressure (IOP) at baseline of the study (Tab. I). Applying Bonferroni's method to correct for performing multiple statistical comparisons, study group and control group no longer differed significantly ($p>0.05$) in any of the parameters at baseline of the study. All patients were fully informed about the experimental character of the intravitreal injection of triamcinolone acetonide. All patients signed an informed consent. The ethics committee of the university (Ethikkommission II der Fakultät für Klinische Medizin Mannheim der Ruprecht-Karls-Universität Heidelberg, Germany) had approved the study, following the tenets of the Declaration of Helsinki.

A second control group (non-triamcinolone control group) included 1068 patients (1068 eyes) who consecutively underwent routine cataract surgery due to nuclear cataract (n=53), corticonuclear cataract (n=709), subcapsular posterior cataract (n=263), or advanced to premature cataract (n=43). Mean age of the patients was 73.22±10.29 years and mean axial length was 23.42±1.58 mm (median, 23.20 mm; range, 20.01–33.98 mm). Preoperative refractive error ranged between –30.50 diopters and +9.25 diopters (mean: –0.70±3.79 diopters; median, 0 diopters).

In the study group and in the non-triamcinolone control group, cataract surgery was performed in a standardized manner with topical anesthesia. Surgery included 1 mm wide paralimbal incisions at the 9 o'clock position and 3 o'clock position, a limbal clear cornea incision at the 12 o'clock position, injection of a viscoelastic substance into the anterior chamber, capsulorrhexis, hydrolineation and hydrodissection, phacoemulsification of the lens nucleus and aspiration of the lens cortex, re-filling of the anterior chamber and the lens capsular bag with the viscoelastic substance, widening of the limbal incision to about 3.5 mm, implantation of a foldable intraocular lens (Acrysoft, Alcon Laboratories, Forth Worth, TX; diameter of the optical part: 6.5 mm) into the lens capsular bag, aspiration of the viscoelastic substance out of the anterior chamber, and injection of Ringer's solution through a paracentesis into the anterior chamber to normalize the IOP and to test the water tightness of the paralimbal incisions. Cataract surgery was uneventful in 59 (98.3%) eyes. In 1 (1.7%) eye, the posterior lens capsule ruptured, and a transpupillary vitrectomy was performed prior to insertion of the intraocular foldable lens. In a second step, fluid from the anterior chamber was partially released through a paracentesis, and 0.2 mL of Ringer's solution containing about 20 mg of triamcinolone acetonide was injected in the temporal inferior quadrant at a distance of 3 mm to the limbus transconjunctivally into the vitreous cavity. Duration of the whole surgery including the intravitreal injection ranged between 8 and 15 minutes.

In the triamcinolone control group, the only procedure performed was the intravitreal injection of about 20 mg of triamcinolone acetonide under topical anesthesia. A lid speculum was inserted, a paracentesis was carried out to decrease the volume of the eye, and injection of about 20 mg of triamcinolone acetonide (0.2 mL) was performed through a sharp 27-gauge needle through the inferior pars plana, at 3 mm to 3.5 mm from the limbus. Postoperative treatment consisted of gentamicin eyedrops administered three times a day for 1 week after surgery. The technique has been described in detail (24).

Postoperatively, all patients were re-examined during the first week after surgery, and roughly in monthly intervals after that. The postoperative examination included VA measurement, tonometry, slit lamp biomicroscopy including assessment of the degree of intraocular inflammation, and fundus examination. The mean follow-up duration was 9.51±7.46 months (median, 7.4 months; range, 1 to 27.4 months) in the study group and 8.36±6.68 months (median, 6.7 months; range, 1 to 35.2 months) in the control group (Tab. I).

Statistical analysis was performed by using a commercially available statistical software package (SPSS for Windows, version 11.5, SPSS, Chicago, IL). In the text and Table, means and standard deviations are given. The statistical significance of differences was examined applying the chi-square-test, or the Mann-Whitney test or Student t-test for independent samples if study group and control group were compared with each other. Comparing values within each of the groups, Wilcoxon text or Student t-test for paired samples were performed.

RESULTS

Postoperative infectious endophthalmitis, postoperative sterile endophthalmitis, postoperative wound leakage, an unusually high corneal astigmatism higher than 1.5 diopters, or other unusual corneal wound healing problems were not observed. None of the patients reported marked postoperative pain, and none of the patients asked for an analgetic therapy for more than the first postoperative night. Change in the color of the iris or a persisting corneal endothelial decompensation with subsequent corneal edema and pseudophakic bullous keratopathy were not biomicroscopically detected in any subject. Postoperative intraocular inflammation as assessed by slit lamp biomicroscopy was low (less than Tyndall ++ in all eyes). Decentration of the intraocular lens necessitating additional surgery to re-locate the intraocular lens did not occur during the follow-up period. Rhegmatogenous retinal detachment was not observed in any eye included in the study.

In the study group, IOP increased significantly ($p<0.001$; Wilcoxon test) from 15.8±4.4 mmHg (median, 16 mmHg) prior to surgery to a mean maximum of 22.2±8.1 mmHg (median, 20 mmHg) about 4 to 8 weeks after surgery, and decreased again significantly ($p<0.001$) to 16.2±7.4 mmHg (median, 16 mmHg) at the last examination. The mean IOP at the last follow-up examination and the preoperative IOP value did not vary significantly ($p=0.68$). Twenty-one eyes (35%) developed maximal IOP measurements higher than 21 mmHg. One patient showed an IOP value of 60 mmHg at the first postoperative day. For the

TABLE I - COMPOSITION OF THE STUDY GROUP AND CONTROL GROUP

	Study group	**Triamcinolone control group**	**p value**
No.	60	290	
Age, yr	77.8±7.7	74.3±10.2	0.01
Female/male	44/16	168/122	0.03
Right/left eyes	24/36	137/153	0.39 (NS)
Refractive error, D	1.06±0.50	0.67±2.00	0.18 (NS)
Follow-up, mo	9.51±7.46	8.36±6.68	0.33 (NS)
Median	7.4	6.7	
Range	1.0–27.4	1.0–35.2	
Baseline visual acuity	0.14±0.12	0.17±0.13	0.03
Intraocular pressure, mmHg	15.8±4.4	15.1±3.2	0.45 (NS)

Means and standard deviations are given

latter patient, cataract surgery was complicated by a rupture of the posterior lens capsule, and subsequently transpupillary anterior vitrectomy was performed, prior to the intravitreal injection of triamcinolone acetonide at the end of surgery. Probably due to hyaluronic acid partially left in the anterior chamber, IOP was markedly increased at the first postoperative day. The IOP could be controlled and reduced to normal values by topical medication within 1 week. In that patient as well as in all other patients showing IOP measurements higher than 21 mmHg during the whole follow-up period after surgery, IOP could be normalized by topical antiglaucomatous treatment.

In the triamcinolone control group, IOP increased significantly ($p<0.001$; Wilcoxon test) from 15.1±3.2 mmHg (median, 16 mmHg) prior to surgery to a mean maximum of 21.3±6.3 mmHg (median, 20 mmHg) and decreased again significantly ($p<0.001$) to 16.8±4.6 mmHg (median, 16 mmHg) at the last examination. The mean IOP at the last follow-up examination and the preoperative IOP value did not vary significantly ($p=0.68$). A maximal IOP measurement higher than 21 mmHg was found in 112 (39%) eyes. In all but 3 (1.0%) eyes, IOP could be regulated by antiglaucomatous medication. Filtering surgery became necessary for 3 (1.0%) eyes that showed an elevation of IOP to values up to 65 mmHg (n=2) or up to 35 mmHg (n=1) despite maximal topical and systemic antiglaucomatous therapy.

The study group and triamcinolone control group did not vary significantly in the increase in IOP during the follow-up ($p=0.38$), the maximal IOP during follow-up ($p=0.99$), the frequency of an IOP measurement higher than 21 mmHg ($p=0.66$), and IOP at the end of follow-up ($p=0.06$).

In the study group, VA increased significantly ($p<0.001$) from 0.14±0.12 (1.08±0.50 logMar units) to 0.21±0.16 (0.83±0.37 logMar units), and decreased significantly ($p<0.001$) towards the end of the follow-up to 0.14±0.13 (1.08±0.50 logMar units). Comparing the best postoperative VA with the preoperative VA measurements, an increase in VA was found in 43 eyes (72%), and a decrease in VA defined as a loss of at least one line was observed in 4 eyes (7%). Thirteen eyes (22%) did not show a change in VA. The postoperative increase in VA was on an average 1.98±2.27 Snellen lines (-0.21±0.28 logMar units).

In the triamcinolone control group, VA increased significantly ($p<0.001$) from 0.17±0.13 (0.90±0.39 logMar units) to 0.24±0.18 (0.75±0.39 logMar units), and significantly ($p<0.001$) decreased towards the end of the follow-up to 0.15±0.14 (1.02±0.45 logMar units). Comparing the best postoperative VA with the preoperative VA measurements, an increase in VA was found in 198 eyes (68%), and a decrease in VA defined as a loss of at least one line was observed in 41 eyes (14%). Forty-six eyes (16%) did not show a change in VA. The postoperative increase in VA was on an average 1.98±2.27 Snellen lines (-0.21±0.28 logMar units). Study group and control group did not vary significantly in the amount of maximal gain in VA during the follow-up ($p=0.48$), the best VA during follow-up ($p=0.08$), and final VA at the end of follow-up ($p=0.30$).

With respect to intraoperative and postoperative surgical complications, the study group and the non-triamcinolone control group did not vary significantly in the rate of a rupture of the posterior lens capsule or zonula fibers (3/60 [5%] versus 42/1068 [3.9%]; $p=0.11$), postoperative infectious endophthalmitis (0 versus 0), and persisting postoperative corneal endothelial decompensation (0 versus 0).

DISCUSSION

Cataract is one of the most common ophthalmologic diseases in the elderly population. It is, therefore, not rare that cataract is present in eyes showing additional age-related disorders, such as diabetic retinopathy and retinal vein occlusions. Since the latter diseases may be treatable by intraocular injections of triamcinolone acetonide, and because intraocular triamcinolone acetonide can further increase a pre-existing lens opacification, it may be useful to combine an intravitreal injection of triamcinolone acetonide with cataract surgery in some patients. Taking into account that researchers have only recently started to evaluate intravitreal injections of triamcinolone acetonide clinically, and in view of the already known complications and side effects of intraocular triamcinolone acetonide, such as secondary ocular hypertension, secondary open-angle glaucoma, postoperative infectious endophthalmitis, and postoperative sterile endophthalmitis, any additional procedure may further increase the frequency and enlarge the spectrum of complications of the therapy (44-55). Therefore, the purpose of the present investigation was to examine the clinical outcome of patients undergoing cataract surgery in combination with an intravitreal injection of triamcinolone acetonide compared with patients who receive the intraocular injection as a single proce-

dure, and compared with patients undergoing routine cataract surgery.

Due to the properties as a steroid, expected complications of triamcinolone acetonide when added to cataract surgery may be infectious endophthalmitis and postoperative secondary ocular hypertension. Additionally, a dislocation of the lens may be discussed as possible complication of intraocular triamcinolone acetonide, as steroids in high concentrations may, at least theoretically, lead to an alteration of the lens zonules.

The results of the present study may show that the rate of infectious endophthalmitis may not be markedly elevated for eyes undergoing cataract surgery combined with intravitreal triamcinolone acetonide injections compared to standard cataract surgery. It is in agreement with recent studies on the frequency of infectious endophthalmitis after intravitreal injections of triamcinolone acetonide without additional surgery. In these latter studies, the risk of an infectious endophthalmitis was about 1 per 500 injections (44, 47, 49-52). The frequency of a secondary ocular hypertension after the combined procedure of cataract surgery and intravitreal triamcinolone acetonide is similar to the frequency of secondary ocular hypertension after the intravitreal injection without additional procedure (46).

The results of the present study may, therefore, suggest that for a mean follow-up of about 9 months, frequency and amount of complications of an intravitreal injection of triamcinolone acetonide, such as increased IOP, do not markedly differ whether the injection is or is not combined with a standard cataract surgery under topical anesthesia. In all patients included in the present study, the intravitreal injection was not markedly painful and did not result in intraocular lesions. Within 1 to 3 days, the triamcinolone acetonide crystals settled in the preretinal vitreous cortex in the inferior fundus without interfering with vision. Postoperative intraocular inflammation as assessed by slit lamp biomicroscopy was low, and it was lower than expected in eyes after cataract surgery with additional diseases such as diabetic retinopathy. The rate of postoperative complications such as increased IOP after the injection did not vary significantly between the patients of the study group and patients of the control group. Taking into account that it was not the purpose of the present study to evaluate the clinical effectiveness of intravitreal triamcinolone acetonide, one may conclude that the intravitreal injection of triamcinolone acetonide may be combined with routine cataract surgery and implantation of a posterior chamber lens without markedly increasing the number and amount of side effects of the therapy. Considering the lack of comparable studies on the frequency of complications after a combined procedure of cataract surgery and intravitreal triamcinolone acetonide injections, no safe conclusion can yet be reached regarding differences in frequencies of postoperative endophthalmitis among the studied groups, as the incidence of that complication in the general population is too low to be adequately included in a group of only 60 eyes.

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