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Incidence of Cystoid Macular Edema after Cataract Surgery in Patients with and without Uveitis Using Optical Coherence Tomography

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Abstract

Purpose—To determine the incidence of cystoid macular edema (CME) after cataract surgery among eyes with and without uveitis using optical coherence tomography (OCT) and to determine risk factors for post-operative CME among eyes with uveitis.

Design—Prospective comparative cohort study.

Methods—Single-center, academic practice. Forty-one eyes with and 52 without uveitis underwent clinical examination and OCT testing within 4 weeks before cataract surgery and at 1-month and 3-month post-operative visits. Main outcome was incidence of CME at 1 and 3 months after surgery.

Results—Both uveitic and control eyes gained approximately 3 lines of vision ($P = 0.6$). Incidence of CME at 1 month was 12% (5 eyes) for uveitis and 4% (2 eyes) for controls ($P = 0.2$). Incidence of CME at 3 months was 8% (3 eyes) for uveitis and 0 % for eyes without uveitis ($P = 0.08$). Eyes with uveitis treated with peri-operative oral corticosteroids had a 7-fold reduction in post-operative CME (relative risk [RR] = 0.14, $P = 0.05$). In uveitic eyes, active inflammation within 3 months before surgery increased the risk of CME when compared to eyes without inflammation (RR=6.19, $P = 0.04$). CME was significantly associated with poorer vision ($P = 0.01$).

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This study was approved by the Johns Hopkins University School of Medicine's Institutional Review Board in accordance with the Declaration of Helsinki. This study is in compliance with HIPAA regulations.

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Conclusions—Eyes with well-controlled uveitis may obtain similar outcomes to control eyes after cataract surgery (up to 3 months). Use of peri-operative oral corticosteroids and control of uveitis for ≥ 3 months before surgery appeared to decrease the risk of post-operative CME among uveitic eyes in this study.

Introduction

Cystoid macular edema (CME) is a major cause of vision loss after cataract surgery.¹ Fundus fluorescein angiography (FA) is commonly used to confirm its presence.² Optical coherence tomography (OCT) is a new method for high-resolution, cross-sectional imaging that directly and reproducibly measures macular thickness.^{3,4} OCT has become an invaluable diagnostic tool to assess macular disease and offers several advantages over the “gold standard” of FA including patient safety, comfort, and speed. Moreover, OCT has been shown to be as effective as FA in detecting CME in patients with uveitis.⁵

In uveitic patients, CME after cataract surgery can be a frequent complication. Although widely recognized, the incidence of CME after modern cataract surgery in uveitic patients has neither been determined clearly nor has it been risk stratified. Estafanous and coworkers² and Krishna and coworkers⁶ reported a 33% and 56% incidence of post-cataract CME in uveitic patients respectively, but both studies were retrospective and all cataracts were removed via extracapsular extraction. More recently Ganesh and coworkers⁷ reported a 50% incidence of CME in uveitis patients after small incision phacoemulsification, but their study was also retrospective and did not utilize OCT for detection. None of these studies utilized a control group (e.g., patients without uveitis undergoing small incision phacoemulsification cataract surgery) in order to determine if patients with uveitis were at higher risk for post-operative CME or whether certain risk factor altered the risk of CME after cataract surgery in these patients.

The purpose of this study was to determine the incidence of CME after cataract surgery among eyes with and without uveitis using OCT and to determine the risk factors that might alter the likelihood of post-operative CME among patients with uveitis.

Methods

The study was a prospective comparative cohort study that enrolled patients from a single-center academic practice. Study participants consisted of a consecutive cohort of patients undergoing cataract surgery in the Division of Ocular Immunology, The Wilmer Eye Institute of The Johns Hopkins Hospital from August 2005 to August 2006. All patients aged 18 years and older with a diagnosis of non-infectious uveitis scheduled for cataract surgery by the Ocular Immunology Service were eligible for inclusion in the uveitis group. Patients with uveitis were routinely tested for syphilis and Lyme disease and evaluated for sarcoidosis and tuberculosis with a chest radiograph. Additional testing was performed on an individual basis as dictated by the patient's history. Patients scheduled for cataract surgery who did not have uveitis were eligible for enrollment in the control group. Patients without uveitis were proposed enrollment in the study until a number of 52 eyes was reached (estimation in study design). For both groups, patients with retinal disease that could affect retinal thickness, such as diabetic retinopathy or choroidal neovascularization were excluded. This study was approved by the Johns Hopkins University School of Medicine's Institutional Review Board in accordance with the Declaration of Helsinki.

All cataract surgeries were performed using clear corneal incision, phacoemulsification, and posterior chamber intraocular lens placement. A foldable hydrophobic acrylic intraocular lens was used in all surgeries. All pre-operative, intra-operative, and post-operative medical

management was left to the individual decision making of the surgeon. Each study eye underwent OCT testing less than 4 weeks prior to cataract surgery. OCT testing was repeated at 1-month and 3-month post-operative visits. All OCT (Stratus OCT3, Carl Weiss Meditec, Dublin, CA) examinations were performed by an experienced operator through a dilated pupil with close monitoring of patient fixation under direct observation. OCT images were generated with the use of six 6-mm radial scans in a spoke like pattern as described in the user's manual.⁸ The maximal center point thickness in microns was measured by manually placing computerized calipers at the vitreous-retina and retina-RPE interfaces. For the purposes of this study, we defined CME as increased center point thickness (CPT) of 200 microns or more associated with cystoid changes on OCT.

Data collection included demographic characteristics, type and duration of uveitis, history of previous intraocular surgery, systemic medication use, topical corticosteroid use and previous sub-Tenon's or intravitreal injection of triamcinolone acetonide. The duration of inactive uveitis prior to cataract surgery also was recorded as < 3 months, 3–6 months, and > 6 months of inactive inflammation. Use of peri-operative corticosteroids, including dose and route, also was recorded. Surgical complications including posterior capsular rupture, vitreous loss, and need for additional surgery were documented from review of the operative note. Each study eye underwent a complete eye examination within one month prior to cataract surgery and at 1-month and 3-month visits after surgery. Ophthalmic examinations included measurement of best-corrected visual acuity (BCVA) with logarithmic Early Treatment Diabetic Retinopathy Study (ETDRS) visual acuity charts⁹, slit lamp examination, and dilated fundus examination. Intraocular inflammation was graded using the Standardization of Uveitis Nomenclature (SUN) Working Group classification.¹⁰ Inactive anterior uveitis was defined as rare cell (less than 1/field on standard slit lamp examination) or less.¹⁰

The main outcome of this study was incidence of CME (as defined above) at the 1-month and 3-month post-operative visits. Secondary outcomes included mean change in visual acuity measured in logarithm of the minimum angle of resolution (logMAR).

Descriptive statistics including mean and standard deviation were calculated for case characteristics. A paired T test was used to evaluate change within each group. Group comparisons were performed with the Student's T-test using two-sided analysis. Fisher exact test was used to compare incidence of CME between groups. Visual acuities in Snellen equivalents were converted to logMAR units for analysis purposes (0.1 logMAR unit is equivalent to 1 line of vision on the ETDRS chart). A sample size calculation was performed prior to study enrollment. Using an estimated incidence of post-operative CME of 30% for eyes with uveitis (which was the lower limit of reported rates of post-operative CME in uveitic eyes)^{2,6,7} and 10% for eyes without uveitis¹¹, we estimated a sample size of 50 eyes in each group to give an alpha of 0.05 at 80% power.

Results

Characteristics of the Study Population

During the one year enrollment period, a total of 41 eyes of 32 study subjects with uveitis and a total of 52 eyes of 47 study subjects without uveitis were prospectively enrolled in this study. In the uveitis group, 41 eyes completed the 1-month follow-up (100%) and 39 eyes completed the 3-month follow-up (95%). In the control group, 51 eyes completed the 1-month follow-up (98%) and 50 eyes completed the 3-month follow-up (96%). Mean age was 54 years (range 21 to 80) for the uveitis group and 69 years (range 41 to 86) for the control group ($P < 0.05$). There were no significant differences between both groups in the distribution of patients by gender or race. Mean pre-operative BCVA was 0.40 logMAR (equivalent to 20/50, range 20/25 to 20/500) for the uveitis group and 0.39 logMAR (equivalent to 20/50, range 20/25 to 20/320)

for the control group ($P = 0.8$, Table 1). Clinical characteristics of the uveitis group are presented in Table 2. Twenty-four eyes (59%) had anterior uveitis that comprised 2 subgroups: recurrent acute anterior uveitis ($n = 4$, 17%) and chronic anterior uveitis ($n = 20$, 83%); 7 eyes (17%) had panuveitis; 6 eyes (15%) had intermediate uveitis, 1 eye (2%) had posterior uveitis and 3 eyes (7%) had a combination of anterior and intermediate uveitis. Three study eyes with uveitis were on treatment for non-insulin-dependent diabetes, but had no evidence of diabetic retinopathy, while no control eyes were being treated for diabetes. No control eye had a history of prior or subsequent intraocular surgery other than cataract surgery, but 4 uveitic eyes (10%) had such history (2 eyes had previous trabeculectomy, one eye had previous pars plana vitrectomy and one eye underwent tube shunt procedure after the cataract surgery). None of these 4 eyes, however, developed CME during the follow up period of this study.

The majority of patients in the uveitis group were on treatment regimens pre-operatively to control their uveitis, which included topical corticosteroids, systemic corticosteroids, and systemic immunosuppressive medications. At the pre-operative visit, inflammation in 7 eyes (17%) was controlled without the use of any topical or systemic therapy. Twenty-one eyes (51%) were on topical corticosteroids only, 4 eyes (10%) were treated with systemic corticosteroids, and 9 eyes (22%) were treated with systemic corticosteroids and immunosuppressive drugs (5 treated with mycophenolate mofetil, 3 with methotrexate, 1 with a combination of mycophenolate mofetil and cyclosporine). A concerted effort was made in each case to achieve quiescent disease for a minimum of 3 months before cataract surgery. Thirty-three eyes (80%) were quiescent for at least 3 months before cataract surgery, while 8 eyes (20%) had documented active inflammation within the 3-month period before surgery. Of these 8 eyes, 4 eyes had chronic anterior uveitis and 4 eyes had intermediate uveitis.

Among the 8 eyes with active inflammation during the 3 months period before cataract surgery, 4 eyes had active inflammation at the pre-operative examination performed within 1-month before surgery. Two eyes had a level of 0.5+ aqueous inflammatory cells (1 to 5 cells/field) and 2 eyes had a level of 1+ aqueous inflammatory cells (6 to 15 cells/field). For each case, that level of inflammation was the best that could be achieved.

Two eyes (5%) in the uveitis group had clinically detectable CME at the pre-operative visit and were treated with periocular sub-Tenon's injection of triamcinolone acetate (40 mg) with resolution on subsequent clinical examination and OCT prior to cataract surgery. Both eyes developed post-operative CME at 1-month. No eyes in the control group had clinical or OCT evidence of CME on the pre-operative visit.

Peri-operative management of eyes with uveitis included the use of oral corticosteroids alone in 16 of 41 eyes (39%). The standard use of peri-operative oral corticosteroids was 1 mg/kg daily of prednisone (maximum 60 mg daily) for 2 days before surgery, 60 to 125 mg of intravenous methylprednisolone intra-operatively, and 1 mg/kg/day of prednisone for 2 days after surgery followed by a taper over 20 days. Of the remaining 25 eyes, 4 eyes (10%) were treated with the use of increased dosage of topical corticosteroids in conjunction with oral corticosteroids (as above), 6 eyes (15%) were treated with the use of both peri-operative oral corticosteroids and intra-operative periocular sub-Tenon's injection. The remaining 15 eyes were not treated with oral corticosteroids. Of those, 6 eyes (15%) were treated with intra-operative periocular sub-Tenon's injection, 3 eyes (7%) were treated with intra-operative intravitreal injection of triamcinolone acetate, 5 eyes (12%) were treated with only increased dosage of topical corticosteroids before surgery and 1 eye (2%) received no peri-operative treatment. None of the control eyes were treated with pre-operative or intra-operative corticosteroids. Both groups were treated with topical corticosteroids post-operatively. No eye in either group was treated with non-steroidal anti-inflammatory medications.

Manual pupillary dilation was necessary in 13 eyes (32%) with uveitis at the time of surgery because of posterior synechiae. Iris manipulation at the time of surgery was not associated with increased risk of post-operative CME. Surgery was complicated by capsular rupture, vitreous loss, and sulcus intraocular lens placement in 1 eye (2.5%) in the uveitis group and 1 eye (2%) in the control group. None of these 2 eyes developed CME during the follow up period of this study. All remaining eyes underwent uncomplicated surgery.

Visual Acuity after Cataract Surgery

Significant improvement from the baseline mean logMAR visual acuity was observed at 1-month in both groups. In the uveitis group, visual acuity improved from 0.40 logMAR (20/50) pre-operatively to 0.13 logMAR (20/25–1) at 1-month ($P = 0.001$) and to 0.12 logMAR (20/25–1) at 3-month follow-up. In the control group, visual acuity improved from 0.39 logMAR (20/50) pre-operatively to 0.08 logMAR (20/25+1) at 1-month ($P = 0.001$) and to 0.04 logMAR (20/20–2) at 3-month follow-up (Table 3). Overall, both groups gained on average 3 lines of visual acuity after cataract surgery. There was no significant difference between both groups in the mean change in visual acuity from baseline at 1-month ($P = 0.6$) and at 3-month ($P = 0.6$).

Incidence of Cystoid Macular Edema

The incidence of CME 1 month after cataract surgery was 12% (5 eyes) in the uveitis group and 4% (2 eyes) in the control group ($P = 0.2$, Fisher exact test). At 3 months, 3 eyes (8%) had CME in the uveitis group (2 persistent cases, and 1 new case) with no cases in the control group ($P = 0.08$, Table 4). In the uveitis group, eyes with CME gained on average 1 line of vision compared to 3 lines for those without CME. In the control group, eyes without CME at 1 month gained 3 lines of vision compared with no gain in vision for eyes with CME. Overall, eyes with CME at 1 month gained half a line of vision compared to a gain of 3 lines of vision for eyes without CME at 1 month ($P = 0.01$).

In the uveitis group, 26 out of 41 study eyes (63%) were treated with peri-operative oral corticosteroids while the other 15 eyes (37%) did not receive such treatment. The incidence of CME 1 month after cataract surgery in eyes treated with oral corticosteroids was 4% (1 eye) compared to 27% (4 eyes) for those untreated with oral corticosteroids (relative risk [RR] = 0.14, $P = 0.05$). More details about peri-operative treatments received and the distribution of the cases of CME at 1-month in the uveitis group are presented in Table 5.

The date of most recent activity of uveitis was within 3 months of surgery for 8 eyes (20%), between 3 and 6 months for 13 eyes (31%) and more than 6 months for 20 eyes (49%). Incidence of CME at 1 month was 37.5% (3 eyes) among eyes with active inflammation during the 3-month period before cataract surgery compared to only 6% (2 eyes) among eyes with no active inflammation for at least 3 months before surgery (relative risk [RR] = 6.19, $P = 0.04$, Table 6). Eyes with active inflammation during the 3-month period before surgery had a significantly higher incidence of CME at 1-month (38%) compared to controls (4%), (Table 4).

Among the 8 eyes with active inflammation within 3 months before surgery, 3 eyes were treated with periocular injection at the time of surgery, 2 eyes were treated with intravitreal injection of triamcinolone acetonide at the time of surgery and 3 eyes received only topical corticosteroids. None of those 8 eyes were treated with peri-operative oral corticosteroids. Three of those 8 eyes (37.5%) developed macular edema at 1 month after cataract surgery (1 eye treated only with periocular injection at the time of surgery and 2 eyes treated only with topical corticosteroids). Among the 33 eyes with more recent episode of active inflammation greater than 3 months before surgery, 26 eyes were treated with peri-operative oral corticosteroids and 7 eyes did not receive such treatment. One eye (3.8%) treated with oral

corticosteroid developed CME at 1-month and 1 eye (14%) not treated with oral corticosteroids developed CME at 1-month.

Eleven study eyes with uveitis (27%) had a history of CME with the last documented episode occurring between 9 years and 1 month before cataract surgery. Among eyes with a previous history of CME, the incidence of CME at 1 month was 27% (3 eyes) compared to only 7% (2 eyes) in eyes with no prior history ($RR = 3.62$, $P = 0.14$). Furthermore, eyes with CME within 3 months before cataract surgery had an increased risk of developing CME ($RR = 6.17$, $P = 0.06$, Table 7).

Eyes detected with CME at the 1-month post-operative visit ($n = 5$) were treated with periocular sub-Tenon's injection of triamcinolone acetate. Among those eyes, 3 showed resolution of CME on OCT by the 3-month visit. The remaining 2 eyes had persistent CME at the 3-month visit.

In total, 121 OCT tests were performed for the uveitis group and 153 OCT tests for the control group. CME was demonstrated by OCT 12 times in the uveitis group and twice in the control group. Based on clinical examination, CME was detected in only 6 of the 12 cases with CME (50%) in the uveitis group. Both cases of CME in the control group were detected by clinical examination.

Discussion

Over one million cataract surgeries are performed each year, and CME remains the most frequent cause of limited visual recovery.¹² Patients with uveitis constitute a particular challenge due to their early formation of cataracts and increased risk of post-operative CME. Previous studies have reported results of cataract surgery in eyes with uveitis but our study is, to our knowledge, the first one to prospectively compare these results with a control group. Recent studies from Ching HY et al.¹³ and Perente I et al.¹⁴ have reported OCT changes after cataract surgery in healthy subjects. These studies used different definitions for CME and the timing of the OCT measurements were also different. Obtaining data on a cohort of healthy subjects from the same center, using similar surgical technique, and using the same CME definition allowed us to directly compare the incidence of CME between eyes with and without uveitis. Obtaining preoperative and postoperative OCT measurements at 1 and 3 months allowed us to directly quantify changes in macular thickness (as opposed to the qualitative nature of FA or clinical exam) and correlate these changes with preoperative risk characteristics.

Both uveitic and control eyes gained on average 3 lines of vision. This comparable improvement in vision among uveitic and control eyes in this study was unexpected and in contrast to the visual results of uveitic eyes published in several reports.^{2,6,7,15–17} Many factors could explain this finding including improvements in surgical technique and decreased number of severe cataract cases (white cataracts, severe synechiae) because of greater awareness and better management of uveitis cases by community ophthalmologists. Since this study was performed in a tertiary referral center, the uveitic eyes may represent the upper range of disease severity (thus eyes with mild uveitis may have not been included as they were not referred to us for surgery), and one might have expected to observe higher rates of CME in uveitic eyes than observed in control eyes. However, none of the eyes with uveitis presenting for cataract surgery during the study period had a white cataract, so it is possible that the most severe cases of uveitic cataract were not included in this study as well. Furthermore, all patients with uveitis enrolled in this study were managed by experienced uveitis specialists under close supervision and scheduled for surgery only after the best possible control of inflammation was achieved. Consequently, results of this study pertain to eyes with well-controlled uveitis, and

the overall incidence of CME after cataract surgery in eyes with active uveitis may be higher than the incidence that we observed in this study.

Not surprisingly, eyes that developed CME had less visual improvement in both groups. The incidence of post-operative CME at 1 month was higher in patients with uveitis than controls (12% versus 4%, respectively), although this difference did not achieve conventional statistical significance. Overall, the incidence of CME in uveitic eyes in this study was approximately 3-fold lower than previously published studies, which likely would have reduced our ability to observe a statistically significant difference if in fact, a true difference existed (type 2 error).^{2,6,7} In addition, the incidence of CME among control eyes in our study (4%) was also lower than our initial assumption from the literature (10%). It is also possible that a higher proportion of our patients with uveitis received peri-operative oral corticosteroids or had controlled uveitis for a longer period of time prior to cataract surgery than the patients described previously in the literature; however, this would not explain the lower incidence of CME in the control group. Further, the lower rates of CME in both groups could be a result of our definition of CME, which required increased macular thickness (>200 microns) and cystoid changes in the macula. Consequently, we could have missed mild cases of CME that did not meet both criteria. However, when we reviewed each OCT, we found no cases of cystoid changes which did not meet the second requirement and only one patient that had a macular thickness of > 200 microns without cystoid macular changes. Repeating the analyses including this additional patient (as a case of CME) would have increased the incidence of CME at 1 month to 15% compared to 4% in the control group ($P = 0.13$). Regardless, the lower incidences of CME at 1 and 3-months after cataract surgery among uveitic eyes suggests that when carefully managed, eyes with uveitis can achieve post-operative outcomes similar to eyes without uveitis, at least out to 3 months.

Among our patients with uveitis, the use of peri-operative oral corticosteroids appeared to reduce the incidence of post-operative CME at 1 month when compared to eyes of patients with uveitis who did not receive oral corticosteroids. Typically we use some form of corticosteroid prophylaxis for the majority of our uveitis cases to avoid a flare-up of uveitis in the postoperative period. Oral corticosteroids were prescribed for the majority of the uveitic eyes (63%) undergoing cataract surgery. Pre-operative, intra-operative, and post-operative management was not standardized, and the use of peri-operative corticosteroids (including the route of delivery) was left to the best medical judgment of the surgeon. Patients for which a decision was made not to treat with oral corticosteroids could have been those with milder disease or those that the treating physician thought were less at risk of CME. If this was the case, the bias probably would have resulted in an underestimation of the benefits of peri-operative oral corticosteroids in preventing post-operative CME. However, it is also possible that patients with uveitis did not receive peri-operative oral corticosteroids because the treatment was contraindicated (due to other co-morbidities or lack of compliance) or the patient refused such treatment. These situations as well as other unrecognized biases could have potentially affected our results in a different direction. We did not collect data as to why a particular peri-operative corticosteroid regimen was selected. Although our results seem to support the use of peri-operative oral corticosteroids for patients with uveitis undergoing cataract surgery, these findings cannot be generalized to all uveitis patients. Some subgroups of uveitis patients, such as those with episodic disease or those with long-term well-controlled disease might not require oral corticosteroids before cataract surgery to prevent the development of CME, but our study did not allow for this type of subgroup analysis due to small sample size.

Our typical practice also is to completely suppress the intraocular inflammation for at least 3 months prior to cataract surgery as evidenced by the fact that 80% of eyes had controlled uveitis for durations of 3 months or longer. Although this duration of disease control is arbitrary, our

study suggests that this practice is beneficial, since eyes with active uveitis within 3 months prior to surgery were more likely to develop post-operative CME (37% of eyes versus 6% of eyes with controlled disease for 3 months or longer prior to cataract surgery). However, other factors such as type of uveitis, history of CME prior to cataract surgery, and use of corticosteroids in the peri-operative period potentially could confound these data. A larger study of eyes with uveitis undergoing cataract surgery would allow for multivariate analyses to better evaluate the potential benefit of suppressing uveitis for at least 3 months prior to cataract surgery. Nonetheless we believe that this remains a reasonable practice to decrease the likelihood of postoperative CME.

One-half of the cases of CME detected by OCT in the uveitis group were missed by clinical examination, which supports the value of OCT in this situation. Decreased visibility by media opacity pre-operatively (e.g. posterior sub-capsular cataract) and chronic macular changes in eyes with uveitis might explain the difficulty in detecting CME clinically. Since the presence of CME within 3 months before cataract surgery was associated with an increased risk of postoperative CME, pre-operative screening of uveitic eyes with OCT may be prudent to allow for timely detection and treatment of CME before elective surgery. It has been estimated that uveitis causes 10% of the cases of blindness in the United States.¹⁸ CME is a leading cause of an unfavorable outcome in patients with uveitis.¹⁹ Identifying predisposing risk characteristics to stratify uveitic patients would aid in early detection, treatment, and prophylaxis. The results of this study suggest that OCT is an effective means of detecting postsurgical CME in uveitic patients as early as 4 weeks and following its progression and response to treatment.

For the results presented in this manuscript, there was no adjustment for analysis undertaken for correlations expected when both eyes of a patient were study eyes in this study, as was true for 9 of the 32 subjects with uveitis and 5 of 47 control subjects who participated. However, all statistical analyses also were performed using only one eye for each patient (the first eye undergoing cataract surgery) and the results and statistical significance remained the same. Limitations aside, the prospective nature of our study with its uniform schedule of testing, recruitment of study participants at a single institution, and the presence of a comparative control cohort strengthens our observations.

In conclusion, lower rates of post-operative CME and improved visual outcomes after cataract surgery may be achieved for uveitic eyes with well-controlled disease. Use of peri-operative oral corticosteroids and control of inflammation for at least 3 months before cataract surgery may prevent the development of post-operative CME and improve visual outcome among eyes of patients with uveitis.

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References

1. Nelson ML, Martidis A. Managing cystoid macular edema after cataract surgery. *Curr Opin Ophthalmol* 2003;14:39–43. [PubMed: 12544809]
2. Estafanous MF, Lowder CY, Meisler DM, Chauhan R. Phacoemulsification cataract extraction and posterior chamber lens implantation in patients with uveitis. *Am J Ophthalmol* 2001;131:620–625. [PubMed: 11336937]
3. Huang D, Swanson EA, Lin CP, et al. Optical coherence tomography. *Science* 1991;254:1178–1181. [PubMed: 1957169]

4. Puliafito CA, Hee MR, Lin CP, et al. Imaging of macular diseases with optical coherence tomography. *Ophthalmology* 1995;102:217–229. [PubMed: 7862410]
5. Antcliff RJ, Stanford MR, Chauhan DS, et al. Comparison between optical coherence tomography and fundus fluorescein angiography for the detection of cystoid macular edema in patients with uveitis. *Ophthalmology* 2000;107:593–599. [PubMed: 10711901]
6. Krishna R, Meisler DM, Lowder CY, Estafanous M, Foster RE. Long-term follow-up of extracapsular cataract extraction and posterior chamber intraocular lens implantation in patients with uveitis. *Ophthalmology* 1998;105:1765–1769. [PubMed: 9754189]
7. Ganesh SK, Babu K, Biswas J. Phacoemulsification with intraocular lens implantation in cases of pars planitis. *J Cataract Refract Surg* 2004;30:2072–2076. [PubMed: 15474816]
8. Optical Coherence Tomography Scanner Three: Owner's Manual. Dublin, CA: Zeiss-Humphrey Systems; 2002.
9. Early Treatment Diabetic Retinopathy Study Research Group. Photocoagulation for diabetic macular edema: Early Treatment Diabetic Retinopathy Study report number 1. *Arch Ophthalmol* 1985;103:1796–1806. [PubMed: 2866759]
10. Jabs DA, Nussenblatt RB, Rosenbaum JT. Standardization of Uveitis Nomenclature (SUN) Working Group. Standardization of uveitis nomenclature for reporting clinical data. Results of the First International Workshop. *Am J Ophthalmol* 2005;140:509–516. [PubMed: 16196117]
11. Mentes J, Erakgun T, Afrashi F, Kerici G. Incidence of cystoid macular edema after uncomplicated phacoemulsification. *Ophthalmologica* 2003;217:408–412. [PubMed: 14573973]
12. Rossetti L, Autelitano A. Cystoid macular edema following cataract surgery. *Curr Opin Ophthalmol* 2000;11:65–72. [PubMed: 10724830]
13. Ching HY, Wong AC, Wong CC, Woo DC, Chan CW. Cystoid macular oedema and changes in retinal thickness after phacoemulsification with optical coherence tomography. *Eye* 2006;20:297–303. [PubMed: 15818389]
14. Perente I, Utine CA, Ozturker C, et al. Evaluation of macular changes after uncomplicated phacoemulsification surgery by optical coherence tomography. *Curr Eye Res* 2007;32:241–247. [PubMed: 17453944]
15. Kawaguchi T, Mochizuki M, Miyata K, Miyata N. Phacoemulsification cataract extraction and intraocular lens implantation in patients with uveitis. *J Cataract Refract Surg* 2007;33:305–309. [PubMed: 17276275]
16. Alio JL, Chipont E, BenEzra D, Fakhry MA. International Ocular Inflammation Society, Study Group of Uveitic Cataract Surgery. Comparative performance of intraocular lenses in eyes with cataract and uveitis. *J Cataract Refract Surg* 2002;28:2096–2108. [PubMed: 12498843]
17. Elgohary MA, McCluskey P, Towler HM, et al. Outcome of phacoemulsification in patients with uveitis. *Br J Ophthalmol* 2007;91:916–921. [PubMed: 17229800]
18. Nussenblatt RB. The natural history of uveitis. *Int Ophthalmol* 1990;14:303–308. [PubMed: 2249907]
19. Rothova A, Suttrop-van Schulten MS, Frits Treffers W, Kijlstra A. Causes and frequency of blindness in patients with intraocular inflammatory disease. *Br J Ophthalmol* 1996;80:332–336. [PubMed: 8703885]

Biographies

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Marie-Lyne Bélair, MD, FRCSC, is an Assistant Professor of Ophthalmology at the University of Montreal, Quebec, Canada. Dr. Belair did her medical degree and her Ophthalmology residency at the University of Montreal School of Medicine. She completed a fellowship in ocular immunology and uveitis at the Wilmer Eye Institute of the Johns Hopkins University in 2006. Her research interests include the study of treatments and surgical outcomes in inflammatory eye diseases.

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Dr. Kim is a graduate of Duke University and Johns Hopkins School of Medicine. He completed his ophthalmology training at the Wilmer Eye Institute in 2005. He completed a uveitis fellowship at Wilmer in 2006 and a vitreoretinal fellowship at Emory in 2008.

Dr. Kim's research interests focus on intravitreal nonsteroidal anti-inflammatory drugs and post-surgical macular edema.

Table 1
 Characteristics of patients with and without uveitis undergoing cataract surgery

Baseline Characteristics	Uveitis (N=41)	Controls (N=52)
Age (yrs)		
Mean	54	69
Range	21–80	41–86
Sex		
Female	31 (76%)	32 (62%)
Male	10 (24%)	20 (38%)
Race		
White	26 (64%)	31 (60%)
African American	14 (34%)	20 (38%)
Asian	1 (2%)	1 (2%)
Pre-op BCVA logMAR (Snellen)	0.404 (20/50)	0.389 (20/50)

BCVA = best corrected visual acuity.

logMAR = Logarithm of the minimum angle of resolution.

Table 2
Characteristics of patients with uveitis undergoing cataract surgery

Characteristics	#Eyes n=41 (%)
Location of Uveitis	
Anterior	24 (59%)
Recurrent AU	4 (17%)
Chronic AU	20 (83%)
Intermediate	6 (15%)
Anterior and intermediate	3 (7%)
Posterior	1 (2%)
Panuveitis	7 (17%)
Associated Ocular diagnosis	
Retinal vasculitis	2 (5%)
Birdshot chorioretinopathy	3 (7%)
Pars planitis	3 (7%)
Post-VZV chronic anterior uveitis	2 (5%)
Fuch's heterochromic iridocyclitis	2 (5%)
MFCPU	1 (2%)
Intermediate uveitis other than pars planitis	1 (2%)
Associated systemic diagnosis	
Spondyloarthropathy (HLA-B27+)	10 (24%)
Sarcoidosis	3 (7%)
IBD	1 (2%)
No associated systemic disease	27 (66%)
Peri-operative Treatment	
Oral corticosteroids (pre-op initiation or increase)	16 (39%)
Oral corticosteroids + increase in topical corticosteroids	4 (10%)
Oral corticosteroids + periocular (Sub-Tenon)	6 (15%)
Periocular (Sub-Tenon) only at time of surgery	6 (15%)
Intravitreal corticosteroids injection at time of surgery	3 (7%)
None or only increase in topical corticosteroids	6 (15%)

AU: Anterior uveitis, MFCPU: Multifocal choroiditis and panuveitis, VZV: Varicella zoster virus, IBD: inflammatory bowel disease.

Table 3

Preoperative, 1-month and 3-month post-cataract surgery best corrected visual acuity (BCVA) for eyes with uveitis and controls

	Uveitis	Controls
Preoperative BCVA logMAR (Snellen)	0.40 (20/50) n=41	0.39 (20/50) n=52
1-month BCVA logMAR (Snellen)	0.13 (20/25 -1) n=41	0.08 (20/25 +1) n=51
3-month BCVA logMAR (Snellen)	0.12 (20/25 -1) n=39	0.04 (20/20 -2) n=50

logMAR: Logarithm of the minimum angle of resolution.

BCVA: Best corrected visual acuity.

Incidence of cystoid macular edema (CME) at 1-month and 3-month postoperative examinations in patients with and without uveitis

Table 4

	Control group	Uveitis group	P (FET)	Uveitis group—active* only	P (FET)	Uveitis group—inactive* only	P (FET)
CME at 1 month	2 (4%)	5 (12%)	0.20	3 (38%)	0.01	2 (6%)	0.64
CME at 3 months	0 (0%)	3 (8%)	0.08	1 (13%)	0.14	2 (6%)	0.14

CME being defined as macular thickness of more than 200 microns with the presence of cysts on OCT. P (FET): p-value using Fisher Exact Test.

* The “active only” group contains eyes with active uveitis within 3 months before cataract surgery; the “inactive only” group contains eyes with no active uveitis within the 3 months prior to cataract surgery. P(FET) is compared to control group.

Uveitis Group - Cases of cystoid macular edema at 1-month Descriptive characteristics

Table 5

	Age	Gender	Type of uveitis	Hx of CME/period between last episode and surgery	Duration of inactivity before surgery	Maintenance treatment before surgery	Peri-operative treatment
1	31	F	CAU	Yes – 2 months	< 3 months	Top	↑Top, PST
2	54	F	P, Birdshot	Yes – 1 month	> 6 months	Top, Pred (5mg/day), MMF (1gBID)	↑Top, ↑Pred, PST
3	64	F	PU	No	< 3 months	Top	None
4	57	M	CAU, Fuchs	No	< 3 months	None	↑Top
5	61	F	PU, MFCPU	Yes – 72 months	> 6 months	Top	↑Top

F: female, M: male, CAU: Chronic anterior uveitis, P: posterior uveitis, PU: panuveitis, MFCPU: multifocal choroiditis and panuveitis, Hx of CME: history of cystoid macular edema, Top: topical corticosteroids drops, Pred: Prednisone per os, MMF: Mycophenolate Mofetil, ↑Top: increase in dosage of topical corticosteroids drops, ↑Pred: increase in Prednisone per os dosage (60 mg with tapering back to maintenance therapy), PST: Periocular sub-Tenon's injection of triamcinolone acetonide at the time of surgery.

Table 6

Peri-operative treatment and distribution of cases of CME at 1-month among patients with uveitis undergoing cataract surgery

Peri-operative Treatment	#Eyes in sub-group	#Eyes with CME at 1-month
Oral corticosteroids (includes eyes treated with other forms of corticosteroids [*])	26 (63%)	1
Oral corticosteroids only	16	0
No oral corticosteroids, but treated with other forms of corticosteroids	14 (34%)	3
Periocular (Sub-Tenon) at time of surgery	6	1
Intravitreal injection at time of surgery	3	0
Increase in dosage of topical corticosteroids	5	2
No peri-operative corticosteroid treatment	1 (2%)	1

* Others included: increased dosage of topical corticosteroids or periocular Sub-Tenon injection at the time of surgery.

CME = cystoid macular edema.

Table 7

Risk factors for developing cystoid macular edema at 1 month after cataract surgery for the uveitis group

	RR	95% CI	P (FET)
Uveitis vs controls	3.11	0.64 – 15.2	0.2
History of CME vs no history of CME	3.62	0.69 – 19.03	0.14
Use of peri-operative oral corticosteroids vs no use of peri-operative oral corticosteroids	0.14	0.02 – 1.17	0.05
Active uveitis < than 3 months vs no active uveitis < 3 months before surgery	6.19	1.23 – 31.08	0.04
Presence of CME < 3months before cataract surgery vs no CME <3 months before surgery	6.17	1.43 – 26.6	0.06

CME: Cystoid macular edema; RR = relative risk; 95% CI = 95% confidence interval; P (FET) = p value using the Fisher exact test.