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BRIEF REPORT

Cataract Surgery Outcomes in Patients with Non-ocular Autoimmune Disease

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ABSTRACT

Introduction: While phacoemulsification cataract extraction is generally highly effective and safe, patients with a history of uveitis are at higher risk for postoperative complications and often require a modified perioperative medication regimen. No data exists on risks of postoperative complications and persistent anterior uveitis (PAU) in patients with non-ocular autoimmune disease.

Methods: Medical records were reviewed of patients who underwent phacoemulsification cataract surgery with intraocular lens implantation between January 1, 2014 and December 31, 2019 at the University of Colorado Hospital (UCH) as part of a retrospective cohort study. Exclusion criteria included patient history of ocular inflammation and cataract surgery combined with another intraocular surgery. Patients were only included as having autoimmune disease if the diagnosis was confirmed by a relevant specialist at UCH. Patients with autoimmune disease were then stratified into systemic versus organ-specific autoimmune disease, and patients with systemic autoimmune disease were further stratified into immunosuppressed and not immunosuppressed at the time of cataract surgery. Patients with PAU were identified according to the Standardization of Uveitis Nomenclature Working Group. Data including sex, race/ethnicity, intraoperative cumulative dissipated energy (CDE), and postoperative best-corrected visual acuity (BCVA) and intraocular pressure (IOP) were obtained.

Results: A total of 422 eyes from 248 patients had confirmed autoimmune disease, compared to a control group of 10,201 eyes. The autoimmune and systemic autoimmune disease groups were not more likely to have postoperative complications or PAU compared to the control group. Immunosuppression status among the systemic autoimmune disease group was also not associated with postoperative complications or PAU.

Conclusion: Patients with non-ocular autoimmune disease do not appear to be at higher risk for postoperative complications, including worse BCVA or increased rates of IOP elevation and PAU, following phacoemulsification cataract surgery. These patients do not appear to require modification of the typical perioperative medication regimen.

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Key Summary Points

Why carry out this study?

It is unclear if patients with non-ocular autoimmune disease are at higher risk for postoperative complications or persistent anterior uveitis (PAU) following phacoemulsification cataract surgery.

This study reviewed charts and evaluated the outcomes of patients with and without non-ocular autoimmune disease who underwent phacoemulsification cataract surgery.

We hypothesized that patients with non-ocular autoimmune disease would not be at higher risk for postoperative complications or PAU compared to patients without autoimmune disease.

What was learned from the study?

Patients with non-ocular autoimmune disease, regardless of immunosuppression status, were not at higher risk for postoperative complications or PAU following phacoemulsification cataract surgery.

These patients do not appear to require additional preoperative counseling or a modified perioperative medication regimen.

INTRODUCTION

Cataract extraction is one of the most common surgical procedures performed in the USA and around the world. Cataract surgery with modern phacoemulsification techniques is highly successful in the general population, with relatively high rates of improved postoperative best-corrected visual acuity (BCVA) [1], and low rates of complications such as intraocular pressure (IOP) elevation and persistent anterior uveitis (PAU) [2]. However, patients with pre-existing ocular inflammation or uveitis have higher rates of complications following cataract surgery [3]. Therefore, patients with uveitis are generally recommended to have ocular inflammation controlled for at least 1–3 months prior to surgery [4], and are often given additional perioperative corticosteroids to reduce the risk of chronic or recurrent inflammation following surgery [5–7].

For patients with autoimmune disease without ocular involvement, however, there is no existing data to guide clinicians on the potential need for additional preoperative counseling of higher complication rates, or for modification of perioperative medication regimens. In this study, we evaluate the outcomes of this patient population following phacoemulsification cataract extraction surgery.

METHODS

A retrospective cohort study was done via records from the Cataracts Outcome Registry at the University of Colorado School of Medicine Department of Ophthalmology. The study received approval from the Colorado Multiple Institutional Review Board and all research conformed to the tenets of the Helsinki Declaration of 1964 and its later amendments. The registry was used to identify the patients included in this study. Professional research assistants, trained specifically in the abstraction of information related to cataract surgery, review the information from medical charts of patients who undergo cataract surgery at our institution and enter data into REDCap (Research Electronic Data Capture), a secure, web-based application. The registry includes data on demographic information, medical history, preoperative medication history, intraoperative and postoperative complications, and preoperative and postoperative eye examinations.

This study included patients who underwent phacoemulsification cataract surgery with

intraocular lens implantation between January 1, 2014 and December 31, 2019 at our institution. Exclusion criteria were history of ocular inflammation or cataract surgery combined with another intraocular surgery. Charts of patients who were noted in the registry to have a history of autoimmune disease were further evaluated. Patients were only included as having autoimmune disease if the diagnosis was confirmed by a specialist at the University of Colorado Hospital. Patients who were identified as having autoimmune disease in the registry but were not confirmed by a specialist were excluded from both the autoimmune and control groups. The following autoimmune diseases were characterized as systemic: rheumatoid arthritis, multiple sclerosis, systemic lupus erythematosus, inflammatory bowel disease, psoriasis, Sjögren disease, polymyalgia rheumatica, giant cell arteritis, sarcoidosis, ANCA-associated vasculitis, systemic sclerosis, scleroderma, dermatomyositis, polymyositis, ankylosing spondylitis, reactive arthritis, and Behçet's disease; whereas the following were characterized as organ-specific: myasthenia gravis, Hashimoto thyroiditis, autoimmune hepatitis, Graves' disease, autoimmune encephalitis, and pemphigoid.

Cataract surgeries were performed using phacoemulsification with clear corneal incisions. Brand moxifloxacin was either injected intracamerally at the end of surgery or placed topically via a soaked collagen shield. Following surgery, patients were typically prescribed a topical postoperative eyedrop regimen consisting of a fluoroquinolone antibiotic, non-steroidal anti-inflammatory drug, and corticosteroid. This regimen did not differ between patients with or without a history of autoimmune disease. The antibiotic was typically discontinued at the week 1 postoperative appointment. Depending on surgeon preference, the steroid was either prescribed as one drop two times daily for 2 weeks (using brand difluprednate 0.05%) or four times daily for 1 week followed by a weekly taper for 3 weeks (using generic prednisolone acetate 1%). However, if there was persistent intraocular inflammation, topical steroids were continued after the month 1 postoperative visit.

The following data were collected: age, self-reported race/ethnicity, sex, laterality of surgery, identification as complex surgery, length of surgery, cumulative dissipated energy (CDE) in seconds used during phacoemulsification, as well as measures of BCVA in logMAR, IOP in mmHg, grading of anterior chamber (AC) cell, presence of cystoid macular edema (CME) on macular optical coherence tomography (OCT), and steroid usage at 3, 6, and 12 months postoperatively. PAU was defined as at least 0.5 + anterior chamber cell and/or continuation of corticosteroid therapy at or beyond 3 months postoperatively with no other etiology found other than postoperative state. If no specific diagnosis was indicated from patient history, patients with presumed PAU generally underwent serological testing for syphilis and a chest radiograph. Patients with autoimmune disease were compared to patients without autoimmune disease during the study time period. However, the control group for PAU analysis was obtained from our prior paper and included eyes from 2014 to 2016 [2]. Postoperative IOP spike was defined as IOP greater than 30 mmHg or 10 points higher than preoperative IOP at the postoperative day 1 visit. Systemic immunomodulatory therapy (IMT) and corticosteroid use and dosage at the time of cataract surgery were also recorded among patients with autoimmune disease. Patients were considered to be on immunosuppression if they were being treated with IMT or at least 7.5 mg of oral prednisone-equivalent daily.

Statistical Analysis

Basic frequencies and percentages were calculated for categorical variables to compare patient eyes with autoimmune disease and those without. Continuous variables were summarized with mean and standard deviation for patient age, and means, standard deviations and medians for IOP, BCVA, and CDE measures. The two groups were compared with logistic regression modeling with generalized estimating equations utilizing an unstructured correlation to account for many patients having two eyes included in the study. Patient eyes on IMT

were also compared to no IMT with the same statistical methods.

RESULTS

There were 762 eyes from 524 patients identified as having an autoimmune disease without ocular involvement within the Cataract Outcome Registry for the specified time period. After further chart review of these 524 patients, 422 eyes from 248 patients were found to have a confirmed autoimmune diagnosis by a specialist at the University of Colorado Hospital. The most common autoimmune diseases included rheumatoid arthritis (148 eyes), multiple sclerosis (52 eyes), systemic lupus erythematosus (39 eyes), and inflammatory bowel disease (36 eyes) (Table 1). There were 10,201 eyes among patients without a history of autoimmune disease or ocular inflammation included within the control group. For PAU specifically, there were 3013 eyes included in the control group.

The autoimmune group was more likely to be female (79.6% versus 56.4%) and the two groups were similar with regards to race/ethnicity (Table 2). The autoimmune group and control group had no statistically significant differences with regard to preoperative IOP, surgery length, postoperative BCVA, rates of postoperative day 1 IOP spike, postoperative IOP, and PAU, whereas the control group had worse preoperative BCVA and required higher CDE during surgery (Table 3).

Within the autoimmune group, 378 of the 422 eyes were included in the systemic autoimmune group, whereas 44 eyes were defined as having organ-specific autoimmune disease. Comparison of the systemic autoimmune group and control group had similar findings as the overall autoimmune and control groups, with no statistically significant differences with regard to preoperative IOP, surgery length, postoperative BCVA, rates of postoperative day 1 IOP spike, postoperative IOP, postoperative IOP, and PAU. Again, the control group had worse preoperative BCVA and required higher CDE during surgery (Table 4).

Patients within the systemic autoimmune group were further stratified into those who were and were not on systemic IMT at the time of cataract surgery. There were 253 eyes included in the immunosuppressed group and 124 eyes who were not immunosuppressed. The non-immunosuppressed group had more African-Americans compared to the immunosuppressed group ($p = 0.013$). There were no statistically significant differences between these two groups with regards to preoperative IOP and BCVA, surgery length, CDE,

Table 1 Autoimmune disease entities

Autoimmune disease	Number of eyes
Rheumatoid arthritis	148
Multiple sclerosis	52
Systemic lupus erythematosus	39
Inflammatory bowel disease	36
Psoriasis	21
Sjögren	18
Myasthenia gravis	17
Hashimoto thyroiditis	14
Polymyalgia rheumatica	12
Giant cell arteritis	12
Sarcoidosis	10
Crohn's disease	22
ANCA-associated vasculitis	10
Autoimmune hepatitis	7
Systemic sclerosis	6
Graves' disease	4
Scleroderma	4
Dermatomyositis	4
Polymyositis	2
Ankylosing spondylitis	2
Autoimmune encephalitis	1
Pemphigoid	1
Behçet's disease	1
Reactive arthritis	1

Table 2 Baseline demographics for autoimmune patients and controls

	Autoimmune group (n = 422 eyes)	Control group (n = 10,201 eyes)	P value
Sex			
Male	86 (20.4%)	4448 (43.6%)	< 0.0001
Female	336 (79.6%)	5753 (56.4%)	
Race/ethnicity			
White	305 (72.3%)	7505 (73.6%)	Reference
African American	37 (8.8%)	811 (8.0%)	0.525
Hispanic	43 (10.2%)	900 (8.8%)	0.342
Asian	21 (5.0%)	469 (4.6%)	0.548
Other/unknown	16 (3.8%)	516 (5.1%)	0.374
Age, years			
Mean (SD)	68.3 (9.9)	69.4 (10.1)	0.196

SD standard deviation

postoperative BCVA and IOP, and rates of postoperative day 1 IOP spike. The non-immunosuppressed group did have higher rates of PAU (5.6% versus 1.6%), but this did not reach statistical significance (p = 0.065) (Table 5).

DISCUSSION

Whereas there is a known higher risk of complications and persistent inflammation following cataract surgery in patients with uveitis or ocular inflammation, necessitating additional preoperative counseling and modified perioperative medications [3], there is no similar data or guidance for patients with non-ocular autoimmune disease undergoing cataract surgery. In this study, patients with confirmed non-ocular autoimmune disease, diagnosed by specialists at our hospital, were not at higher risk for postoperative complications or PAU compared to patients without autoimmune disease. Importantly, the autoimmune and control groups both had similar percentages of African-American patients. Previous studies from our group [2] and others [8] have found that patients who self-identified as African-American have higher rates of PAU following cataract surgery compared to Caucasians.

In further analysis, patients with *organ-specific* autoimmune disease, such as myasthenia gravis and Hashimoto thyroiditis, which tend not to cause inflammation outside the relevant anatomical area or organ system, were excluded and only patients with *systemic* autoimmune disease, such as rheumatoid arthritis and systemic lupus erythematosus, were compared to the control group and, again, not found to be at higher risk for postoperative complications. Patients with systemic autoimmune disease were then stratified into an immunosuppressed group, who were on systemic IMT or at least 7.5 mg of oral prednisone-equivalent daily at the time of cataract surgery, and non-immunosuppressed group. Patients who were not immunosuppressed were also not more likely to have postoperative complications compared to the immunosuppressed group, although the non-immunosuppressed group was found to have an increased likelihood of PAU that trended towards statistical significance. This result, however, may have been confounded by the higher number of African-American patients within the non-immunosuppressed group. Taken together, these

Table 3 Clinical outcomes for all autoimmune cases and control groups

	Autoimmune group (N = 422 eyes)	Control group (n = 10,201 eyes)	P value
Preoperative IOP (mmHg)			
n	413	10,011	
Mean (SD)	14.9 (2.9)	14.7 (3.0)	0.593
Median	15.0	14.0	
Postoperative IOP[a] (mmHg)			
n	353	7993	
Mean (SD)	13.5 (2.5)	13.5 (2.8)	0.652
Median	13.0	13.0	
Preoperative BCVA (logMAR)			
n	422	10,183	
Mean (SD)	0.28 (0.35)	0.36 (0.48)	< 0.0001
Median	0.176	0.301	
Postoperative BCVA (logMAR)			
n	398	9071	
Mean (SD)	0.07 (0.25)	0.09 (0.25)	0.334
Median	0.0	0.0	
CDE mean (seconds)			
n	401	9717	
Mean (SD)	6.9 (5.4)	7.7 (8.5)	0.016
Median	5.5	5.7	
Surgery length			
n	419	10,164	
Mean (SD)	18.2 (10.0)	17.8 (10.2)	0.497
Median	15.0	15.0	
Postoperative day 1 IOP spike[b]	12 (3.0%)	446 (4.8%)	0.172
Cohort evaluated for PAU, *n*	421	3013	
PAU	11 (2.6%)	61 (2.0%)	0.513

IOP intraocular pressure, *BCVA* best-corrected visual acuity, *CDE* cumulative dissipated energy, *PAU* persistent anterior uveitis, *SD* standard deviation

[a]Postoperative IOP obtained between postoperative months 1 and 3

[b]IOP spike defined as IOP > 30 mmHg at postoperative day 1 or a greater than 10-point change between preoperative and day 1 postoperative IOP

Table 4 Clinical outcomes for systemic autoimmune cases and control groups

	Systemic autoimmune group (*n* = 378 eyes)	Control group (*n* = 10,201 eyes)	*P* value
Preoperative IOP (mmHg)			
n	369	10,011	
Mean (SD)	14.9 (2.9)	14.7 (3.0)	0.651
Median	15.0	14.0	
Postoperative IOP[a] (mmHg)			
n	314	7993	
Mean (SD)	13.4 (2.5)	13.5 (2.8)	0.676
Median	13.0	13.0	
Preoperative BCVA (logMAR)			
n	378	10,183	
Mean (SD)	0.28 (0.35)	0.36 (0.48)	< 0.0001
Median	0.176	0.301	
Postoperative BCVA (logMAR)			
n	355	9071	
Mean (SD)	0.07 (0.25)	0.09 (0.25)	0.268
Median	0.0	0.0	
CDE mean (seconds)			
n	358	9717	
Mean (SD)	6.8 (5.2)	7.7 (8.5)	0.006
Median	5.4	5.7	
Surgery length			
n	375	10,164	
Mean (SD)	18.3 (10.4)	17.8 (10.2)	0.359
Median	15.0	15.0	
Postoperative IOP spike[b]	12 (3.4%)	446 (4.8%)	0.251
Cohort evaluated for PAU, *n*	421	3013	
PAU	11 (2.9%)	61 (2.0%)	0.367

IOP intraocular pressure, *BCVA* best-corrected visual acuity, *CDE* cumulative dissipated energy, *PAU* persistent anterior uveitis, *SD* standard deviation

[a]Postoperative IOP obtained between postoperative months 1 and 3

[b]IOP spike defined as IOP > 30 mmHg at postoperative day 1 or a greater than 10-point change between preoperative and postoperative day 1 IOP

Table 5 Clinical outcomes of autoimmune patient eyes by immunosuppression status for patients with systemic autoimmune disease

	Immunosuppressed (n = 253)	Not immunosuppressed (n = 124)	P value
Sex			
Male	51 (20.2%)	18 (14.5%)	0.250
Female	202 (79.8%)	106 (85.5%)	
Race/ethnicity			
White	187 (73.9%)	82 (66.1%)	Reference
African American	11 (4.4%)	24 (19.4%)	0.013
Hispanic	34 (13.4%)	7 (5.6%)	0.110
Asian	13 (5.1%)	8 (6.4%)	0.485
Other/unknown	8 (3.2%)	3 (2.4%)	0.260
Age, years			
Mean (SD)	66.3 (10.1)	71.2 (8.5)	< 0.001
Preoperative IOP (mmHg)			
n	249	119	
Mean (SD)	14.8 (2.9)	15.2 (3.0)	0.391
Median	15.0	15.0	
Postoperative IOP[a] (mmHg)			
n	210	103	
Mean (SD)	13.3 (2.6)	13.8 (2.5)	0.220
Median	13.0	14.0	
Preoperative BCVA (logMAR)			
n	253	124	
Mean (SD)	0.27 (0.33)	0.27 (0.32)	0.937
Median	0.176	0.238	
Postoperative BCVA (logMAR)			
n	242	112	
Mean (SD)	0.07 (0.22)	0.05 (0.11)	0.218
Median	0.0	0.0	
CDE mean (seconds)			
n	246	111	
Mean (SD)	6.7 (5.5)	7.1 (4.6)	0.821
Median	4.9	5.9	
Surgery length			

Table 5 continued

	Immunosuppressed (n = 253)	Not immunosuppressed (n = 124)	P value
n	251	123	
Mean (SD)	18.0 (10.3)	18.9 (10.7)	0.294
Median	15.0	15.0	
Postoperative IOP spike[b]	8 (3.3%)	4 (3.4%)	0.769
PAU	4 (1.6%)	7 (5.6%)	0.065

Immunosuppressed was defined as any systemic immunomodulatory therapy or at least 7.5 mg of oral prednisone-equivalent daily at the time of cataract surgery

IOP intraocular pressure, *BCVA* best-corrected visual acuity, *CDE* cumulative dissipated energy, *PAU* persistent anterior uveitis, *SD* standard deviation

[a]Postoperative IOP obtained between postoperative months 1 and 3

[b]IOP spike defined as IOP > 30 mmHg at postoperative day 1 or a greater than 10-point change between preoperative and postoperative day 1 IOP

findings suggest that patients with non-ocular autoimmune disease, regardless of immunosuppression state, do not appear to require additional preoperative counseling or a modified perioperative corticosteroid regimen.

Other findings from this study include that patients with autoimmune disease in this cohort were more likely to be female than patients in the control group, which is consistent with the known demographics of autoimmune disease [9]. The autoimmune group also required less CDE during surgery than the control group. This could be related to increased systemic corticosteroid exposure in the autoimmune group, leading to higher rates of posterior subcapsular versus nuclear sclerosis cataract.

The primary limitation of this study is its retrospective nature. However, this study design allowed for the large sample sizes of both autoimmune disease and control patients. We also attempted to minimize the misclassification of patients by only including patients as having an autoimmune disease if the diagnosis was confirmed by a relevant specialist at our hospital. This also allowed us to confirm systemic medication use at the time of surgery.

CONCLUSION

Patients with non-ocular autoimmune disease do not appear to be at higher risk for postoperative complications, including worse BCVA or increased rates of IOP elevation and PAU, following phacoemulsification cataract surgery. These patients likely do not require modification of the typical perioperative medication regimen, unlike patients with ocular autoimmune disease.

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Data Availability. The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval. The study received approval from the Colorado Multiple Institutional Review Board and conformed to the requirements of the United States Health Insurance Portability and Privacy Act. All research conformed to the tenets of the Declaration of Helsinki of 1964, as revised in 2013, concerning human and animal rights, and Springer's policy concerning informed consent was followed.

Conflict of Interest. Rachel A. Scott, Shane A. Nau, Jennifer L. Patnaik, Christopher B. Le, Jason R. Kolfenbach, Alan G. Palestine and Amit K. Reddy have no competing interests.

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