Clinical Ophthalmology

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ORIGINAL RESEARCH

Investigating Non-Ocular Factors Affecting Postoperative Recovery Following Uveitic Cataract Surgery

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Background: Cataract surgery in eyes affected by uveitis presents unique challenges, but the non-ocular factors influencing postoperative recovery are not fully understood. While earlier studies have mainly focused on ocular prognostic factors, variables such as cumulative inflammatory burden, phacoemulsification energy, and systemic immunomodulation have not been thoroughly evaluated. This study aims to identify independent predictors of visual outcomes and steroid-free recovery time after cataract surgery for uveitic cataracts.

Methods: This retrospective study included 54 eyes of adults with uveitis-associated cataracts who underwent phacoemulsification with intraocular lens (IOL) implantation at a single center. The primary outcomes were postoperative month-1 best-corrected visual acuity (BCVA) and steroid-free recovery time. Multivariable regression analysis identified independent predictors among preoperative BCVA, uveitis attack count, cumulative dissipated energy (CDE), and immunomodulatory therapy type. All patients on bDMARDs had been receiving therapy for at least 3 months prior to surgery and continued their regimen perioperatively.

Results: The mean age of the patients was 38.6 ± 7.9 years. The diagnoses included axial spondyloarthritis (40.7%), Behçet's disease (33.3%), juvenile idiopathic arthritis (11.1%), idiopathic uveitis (11.1%), and sarcoidosis (3.7%). Visual acuity improved from 0.23 ± 0.12 to 0.86 ± 0.12 ($p<0.001$). The median steroid-free recovery period was 13 days. Independent predictors of postoperative BCVA ($R^2=0.63$) included preoperative BCVA ($\beta = +0.254$, $p = 0.016$), uveitis attack count ($\beta = -0.014$, $p = 0.015$), and CDE ($\beta=-0.009$, $p<0.001$). Steroid-free recovery ($R^2=0.70$) was predicted by attack count ($\beta=+1.29$ days/attack, $p=0.002$), CDE ($\beta = +0.95$ days/unit, $p<0.001$), and biologic DMARD therapy ($\beta=-5.09$ days, $p=0.006$).

Conclusion: Cumulative inflammatory burden and surgical complexity independently predict postoperative recovery in uveitic cataract surgery. Biologic DMARD therapy was linked to faster steroid-free recovery in this observational cohort, supporting further research into optimizing systemic immunomodulation before surgery. Prospective studies with larger sample sizes are needed to confirm these results.

Keywords: uveitis, cataract, phacoemulsification, cumulative dissipated energy, biologic DMARD

Introduction

Uveitis is a major cause of vision loss worldwide, with an estimated incidence of approximately 50 per 100,000 person-years and a prevalence that varies from 9 to 730 per 100,000 depending on the region.[1,2] The condition includes a diverse group of inflammatory disorders affecting the uveal tract, with anterior uveitis being the most common form in developed nations. Systemic associations are often found, with Behçet's disease, ankylosing spondylitis (axial spondyloarthritis), juvenile idiopathic arthritis (JIA), and sarcoidosis being the major causes.[3,4] The impact of uveitis on vision is significant; studies indicate that up to 47% of patients with JIA-associated uveitis may be legally blind in at least one eye at the first diagnosis, highlighting the aggressive nature of ocular inflammation in certain disease types.[5]

https://doi.org/10.2147/OPTH.S604342
Received: 20 February 2026
Accepted: 10 April 2026
Published: 21 April 2026

Cataract development is a common complication of chronic uveitis that arises through two main pathophysiological mechanisms. Chronic intraocular inflammation disrupts the lens microenvironment by increasing the levels of inflammatory cytokines, including interleukin-8, monocyte chemoattractant protein-1, and regulated on activation, normal T cell expressed and secreted (RANTES), which correlate with disease severity.[6] In addition, oxidative stress activates redox-sensitive transcription factors, contributing to lens opacification.[7] Reliance on corticosteroid therapy worsens this issue, as activation of glucocorticoid receptors induces the proliferation of lens epithelial cells, suppresses differentiation, and increases reactive oxygen species activity, leading to the formation of posterior subcapsular cataracts.[8,9] In pediatric patients receiving topical difluprednate for uveitis, cataract formation or progression has been documented in 39% of the treated eyes.[10]

Cataract surgery in uveitic eyes involves unique technical challenges that differentiate it from routine phacoemulsification surgery. Posterior synechiae requiring surgical lysis are found in approximately one-third of cases; small pupils require pharmacological or mechanical dilation strategies; and zonular weakness may threaten capsular integrity.[11,12] Registry data from Sweden showed that 27.0% of uveitic eyes had intraoperative difficulties compared to only 7.1% of non-uveitic controls.[13] Postoperative complications, such as uveitis flare (up to 56.5% of cases), cystoid macular edema, and posterior capsule opacification, occur more frequently than in the general cataract population.[11,14] Despite these challenges, modern phacoemulsification with in-the-bag hydrophobic acrylic intraocular lens implantation can achieve a visual acuity of 20/40 or better in approximately 68–82% of adult patients when performed under adequate inflammatory control.[15,16]

The advent of biologic disease-modifying antirheumatic drugs (bDMARDs), especially tumor necrosis factor-alpha inhibitors, has revolutionized the management of non-infectious uveitis. The landmark VISUAL I and II trials showed that adalimumab significantly lowers the risk of treatment failure in both active and quiescent forms of non-infectious uveitis, with hazard ratios of 0.50 and 0.57, respectively.[17,18] Long-term follow-up data revealed sustained quiescence in 85% of patients at 150 weeks, with mean daily corticosteroid doses decreasing from 9.4 mg to 1.5 mg.[19] For JIA-associated uveitis, the SYCAMORE trial demonstrated that combining adalimumab with methotrexate reduced treatment failure from 60% to 27%.[20] These therapeutic advances suggest that systemic immunomodulatory therapy may impact not only disease control but also surgical outcomes; however, this relationship has not been systematically explored in the context of cataract surgery.

While numerous studies have examined the visual outcomes following uveitic cataract surgery, most have concentrated on ocular factors such as preoperative inflammation, macular pathology, and intraoperative complications.[15,21,22] Less attention has been given to non-ocular factors that influence surgical success. Specifically, the cumulative inflammatory burden reflected by the total number of uveitis attacks has not been evaluated as a quantitative predictor of surgical recovery, and objective measures of surgical complexity, such as cumulative dissipated energy (CDE), a standard phacoemulsification parameter in non-uveitic populations, have not been studied in the uveitic cataract setting. Furthermore, although biologic DMARDs have transformed disease control, their potential influence on postoperative recovery endpoints such as steroid-free recovery time has not been investigated. Steroid-free recovery time is a clinically relevant metric because prolonged topical corticosteroid use increases the risk of intraocular pressure elevation, delays visual rehabilitation, and may contribute to posterior capsule opacification. Additionally, disease-specific surgical outcomes across different uveitis etiologies are still not fully understood, especially in populations where Behçet's disease and axial spondyloarthritis are common.

This study aimed to examine the non-ocular factors influencing postoperative recovery after cataract surgery for uveitis. Specifically, we aimed to identify independent predictors of postoperative visual acuity and steroid-free recovery time, focusing on inflammatory disease burden, surgical energy requirements, and comparison between biologic and traditional immunomodulatory therapies. The secondary goal was to describe disease-specific surgical outcomes in patients with Behçet's disease, axial spondyloarthritis, JIA, idiopathic uveitis, and sarcoidosis.

Methods

This retrospective, observational study was conducted at Uşak Training and Research Hospital and included patients who developed uveitis-related secondary cataracts and underwent cataract surgery between January 2021 and September 2025. The study was approved by the Uşak University Non-Interventional Clinical Research Ethics Committee (Approval Number: 970-970-08), and the IRB approval was granted by meeting resolution No. 61-15, adhering to the principles of the Declaration of

Helsinki. Because this was a retrospective study based solely on existing medical records with no direct patient contact, the ethics committee waived the requirement for individual informed consent. All patient data were de-identified prior to analysis to ensure confidentiality. The electronic medical records of 94 consecutive patients with uveitic cataracts were reviewed for this study. The inclusion criteria were as follows: age ≥ 18 years, diagnosis of anterior, intermediate, or posterior uveitis with secondary cataract, available complete medical records, at least 1 month of postoperative follow-up, and undergoing standard phacoemulsification with in-the-bag hydrophobic acrylic aspheric intraocular lens (IOL) implantation. The exclusion criteria were refractory glaucoma (n = 14), panuveitis or retinal vasculitis (n = 12), history of intravitreal therapy (anti-VEGF or steroids) (n = 10), and intraoperative complications (posterior capsule rupture, zonular dialysis, and vitreous loss) (n = 4). After applying these criteria, 54 eyes met the inclusion criteria and were included in the final analysis.

All surgeries were performed by the same experienced surgeon using the Alcon Centurion Vision System (Alcon, Fort Worth, TX, USA). Standard clear corneal phacoemulsification was performed in all eyes. Continuous curvilinear capsulorhexis, hydrodelineation, nucleus management with either phaco-chop or stop-and-chop depending on the cataract grade, and cortical cleanup were performed. All patients underwent in-the-bag implantation of a hydrophobic acrylic foldable aspheric intraocular lens (IOL). All cataract surgeries occurred at least six months after the most recent uveitis attack had resolved.

Regarding systemic immunomodulatory therapy, 15 patients (27.8%) were receiving biologic DMARDs at the time of surgery: adalimumab (n = 9), infliximab (n = 4), and tocilizumab (n = 2). All patients on bDMARDs had been receiving their respective agents for a minimum of 3 months before surgery (median duration: 14 months; range: 3–48 months) and continued their regimen perioperatively without interruption. Conventional DMARDs were used in 24 patients (44.4%), including methotrexate (n = 14), azathioprine (n = 7), and cyclosporine (n = 3). An additional 13 patients (24.1%) were on combined systemic therapy. The remaining patients were managed with topical therapy alone.

Beginning 1 h postoperatively, all patients were started on topical corticosteroid drops every hour, followed by a gradual steroid taper on postoperative days 1 and 5, based on the anterior chamber reaction. Additional medications included topical antibiotics (QID for one week) and cycloplegics. All patients were re-evaluated at postoperative month 1, when the primary outcome measures were assessed.

The following variables were extracted from electronic medical records: demographics (age and sex), underlying uveitis diagnosis, number of previous uveitis attacks, disease duration, preoperative and postoperative best corrected visual acuity (BCVA), phacoemulsification parameters (CDE), presence of posterior synechiae, iris pigment deposition, or need for iris hooks, use of bDMARD (biologic) or cDMARD (conventional) systemic immunosuppression, postoperative steroid tapering timeline, complications, and macular edema.

Statistical Analysis

Descriptive statistics were calculated for all clinical and demographic variables. Continuous variables were checked for normality using visual assessment and the Shapiro–Wilk test and reported as mean ± standard deviation or median with interquartile range, when appropriate. Categorical variables are presented as frequencies and percentages. Comparisons between the diagnostic groups and treatment subgroups were performed using unpaired t-tests or Mann–Whitney *U*-tests for continuous variables and χ^2 or Fisher's exact tests for categorical variables.

Multivariable linear regression models were developed to identify independent predictors of postoperative month-1 BCVA and steroid-free recovery time. The candidate predictors included preoperative BCVA, number of uveitis attacks, disease duration, phacoemulsification energy (CDE), and type of systemic immunomodulatory therapy. Regression coefficients (β), standard errors, t-values, p-values, and 95% confidence intervals are reported for all models. Forward stepwise model selection based on the Akaike information criterion was used in exploratory analyses to identify the best predictor set for each of the outcomes. Diagnosis-specific subgroup analyses were conducted using the same multivariable approach when the sample size allowed. Groups with insufficient sample sizes were also summarized.

Correlation analyses between continuous variables were performed using Pearson's or Spearman's coefficients based on the data distribution. Forest plots were generated to visualize the effect sizes of regression predictors. All statistical tests were performed using two-tailed test. The significance level was set at $P < 0.05$. Forward stepwise model selection based on the Akaike information criterion was performed using Python (version 3.12) with the statsmodels library (version 0.14); all remaining analyses were conducted in GraphPad Prism version 10.6.1 for macOS (GraphPad Software, Boston, MA).

Results

We analyzed 54 eyes of 54 adult patients who underwent uveitic cataract surgery. The average age was 38.6 ± 7.9 years, and the average disease duration was 9.0 ± 6.8 years. The median number of uveitis attacks was 4 (IQR: 2–5 attacks). Preoperative visual acuity (VA) was moderately impaired (mean 0.23 ± 0.12), with significant improvement by post-operative month 1 (mean VA = 0.86 ± 0.12). The median steroid-free recovery time was 13 days (IQR: 8–22). Macular edema was present in 5/54 (9.3%) patients, posterior synechiae in 15/54 (27.8%) patients, and iris hook use was required in 10/54 (18.5%) patients. The full descriptive statistics are presented in Table 1.

Table 1 Baseline Demographic and Clinical Characteristics

Variable	Mean ± SD	Median	IQR	Min–Max
Age (years)	38.57 ± 7.87	38	34–43	19–56
Disease duration (years)	9.02 ± 6.78	6.5	4.25–11	1–26
Number of uveitis attacks	3.89 ± 2.14	4	2–5	1–9
Cataract grade	3.06 ± 0.83	3	2–4	2–4
Preoperative VA	0.234 ± 0.115	0.20	0.16–0.30	0.05–0.50
Post-op month 1 VA	0.863 ± 0.117	0.80	0.80–1.00	0.60–1.00
Steroid-free recovery (days)	16.07 ± 9.48	13	8–22	5–48
CDE	8.93 ± 6.43	7.4	4.4–12.8	3.2–34.5
Categorical Variable	**n (%)**			
Diagnosis – AxSpa	22 (40.7%)			
Diagnosis – Behçet's disease	18 (33.3%)			
Diagnosis – JIA	6 (11.1%)			
Diagnosis – Idiopathic	6 (11.1%)			
Diagnosis – Sarcoidosis	2 (3.7%)			
Sex (Male/Female)	29 (54%)/25 (46%)			
Posterior synechiae	15 (27.8%)			
Lens iris pigmentation	21 (38.9%)			
Iris hook use	10 (18.5%)			
Diabetes mellitus	6 (11.1%)			
Hypertension	11 (20.4%)			
Smoking	12 (22.2%)			
cDMARD therapy	24 (44.4%)			
bDMARD therapy	15 (27.8%)			
Combined systemic therapy	13 (24.1%)			
Systemic steroid in past 3 mo	14 (25.9%)			
Macular edema	5 (9.3%)			

Abbreviations: VA, visual acuity; CDE, cumulative dissipated energy; IQR, interquartile range; AxSpa, axial spondyloarthritis; JIA, juvenile idiopathic arthritis; cDMARD, conventional disease-modifying antirheumatic drug; bDMARD, biologic disease-modifying antirheumatic drug.

https://doi.org/10.2147/OPTH.S604342

The number of uveitis attacks was positively correlated with the steroid-free recovery time and moderately negatively correlated with postoperative BCVA. Cumulative dissipated energy (CDE) correlated positively with recovery duration and negatively with postoperative VA, indicating that increased surgical complexity affects both outcomes. A multivariable model including preoperative VA, number of uveitis attacks, and CDE showed that all three variables were independent predictors of postoperative VA. Higher preoperative VA predicted better postoperative VA (β = +0.254, p = 0.0156). More uveitis attacks predicted worse postoperative VA (β = −0.0142, p = 0.0150). A higher CDE was associated with worse postoperative VA (β = −0.00920, p < 0.001). Steroid-free recovery time was independently predicted by the number of uveitis attacks (β = +1.29 days per attack, p < 0.01), CDE (β = +0.95 days per CDE unit, p < 0.001), and bDMARD use (β = −5.086 days, p = 0.0058).

Both findings suggest that inflammatory burden and surgical energy requirements extend the postoperative recovery time. No systemic comorbidity (DM, HT), smoking, macular edema, posterior synechiae, systemic therapy type, or recent systemic steroid exposure remained significant after adjusting for confounding factors. The detailed regression coefficients and confidence intervals are presented in Table 2.

Subgroup analyses revealed distinct clinical patterns across diagnoses, although these results should be interpreted with caution given the limited sample sizes in each subgroup. Patients with Behçet's disease (n = 18) had the shortest mean steroid-free recovery time (13.4 ± 9.3 days), lowest CDE (6.51 ± 3.02), and highest postoperative VA (0.883 ± 0.10). AxSpa (n = 22) showed longer recovery (19.0 ± 9.3 days) and higher surgical energy requirements (CDE 11.7 ± 7.1), consistent with denser cataracts. JIA (n = 6), idiopathic uveitis (n = 6), and sarcoidosis (n = 2) were too small for stable multivariable analysis but demonstrated similar improvements in visual acuity.

The regression model for postoperative VA in the Behçet's subgroup showed significant variance. Among the predictors, only CDE was significant (β = −0.0118, p < 0.001). Similarly, only CDE strongly predicted longer steroid-free recovery (β = +0.963 days per unit, p < 0.001). The uveitis attack count had no independent effect on the outcome. In patients with AxSpa, preoperative VA remained the strongest predictor of postoperative VA (β = +0.424, p = 0.0066). The uveitis attack count and CDE showed borderline significance (β = −0.0123, p = 0.064; β = −0.0098, p = 0.053, respectively). However, both parameters significantly affected prolonged recovery (β = +1.536 days per attack, p = 0.0055; β = +1.295 days per unit, p = 0.0048). Regression analysis was not feasible for other diagnoses owing to the small sample sizes. Nonetheless, their descriptive metrics aligned with the overall cohort trends, showing substantial visual improvement and variable time to recovery.

Table 2 Multivariable Linear Regression of Independent Predictors for Postoperative Outcomes

Predictor	β Coefficient	Std. Error	t-value	p-value	95% CI
Postoperative Month-1 VA (R^2 = 0.63)					
Preoperative VA	+0.2542	0.1015	2.505	0.0156	0.050 to 0.458
Uveitis attack count	−0.01425	0.00565	−2.520	0.0150	−0.0256 to −0.00289
CDE	−0.00920	0.00183	−5.030	<0.001	−0.01287 to −0.00553
bDMARD use	+0.0453	0.025	1.749	0.086	−0.0068 to 0.0974
Steroid-free Recovery Time (R^2 = 0.70)					
Uveitis attack count	+1.292	0.404	3.20	0.00235	0.482 to 2.103
CDE	+0.950	0.135	7.06	<0.001	0.680 to 1.220
bDMARD use	−5.086	1.766	−2.87	0.0058	−8.63 to −1.54

Notes: Statistically significant predictors (p < 0.05) are included in the final models. bDMARD use in the VA model showed a trend (p = 0.086) and is included for completeness.

Abbreviations: VA, visual acuity; CDE, cumulative dissipated energy; bDMARD, biologic disease-modifying antirheumatic drug; CI, confidence interval.

https://doi.org/10.2147/OPTH.S604342

Discussion

This study provides new insights into the non-ocular factors affecting postoperative recovery after cataract surgery for uveitis. Our findings indicate that the number of previous uveitis attacks, total dissipated energy during phacoemulsification, and biologic DMARD therapy independently predict surgical outcomes, extending beyond the traditional ocular prognostic factors. The average improvement in visual acuity from 0.23 to 0.86 decimal, with most of the patients benefiting, aligns with recent literature reporting 20/40 or better visual acuity in 68–82% of adults after uveitic cataract surgery.

Identifying preoperative visual acuity as an important predictor of postoperative results ($\beta = +0.254$, $p = 0.016$) confirmed the findings of earlier studies. Jevnikar et al[23] reported a strong correlation coefficient of 0.521 between preoperative and postoperative best-corrected visual acuity in their group of 78 uveitic eyes. This link probably reflects the cumulative effect of chronic inflammation on eye structures, where eyes with better initial function tend to have less irreversible damage to the macula, optic nerve, and other parts of the visual pathway. Yoeruek et al[21] found that preoperative macular lesions were the strongest predictors of poor visual outcomes, with an odds ratio of 5.43, highlighting the importance of posterior segment health.

Our finding that the number of uveitis attacks independently predicts both worse postoperative visual acuity ($\beta = -0.0142$, $p = 0.015$) and longer steroid-free recovery time ($\beta = +1.29$ days per attack, $p < 0.01$) is clinically important. Each additional uveitis attack was linked to approximately 1.3 extra days of topical corticosteroid use, reflecting the cumulative inflammatory burden on eye tissues. This supports the findings of Leinonen et al[24] who showed that active uveitis within 3–12 months before surgery was a significant risk factor for poor outcomes in JIA-associated cataract surgery. Similarly, Al-Ani et al[11] found that longer periods of preoperative quiescence were associated with a reduced risk of postoperative flare (HR = 0.794), reinforcing the idea that inflammatory memory in ocular tissues influences recovery after surgery.

A particularly novel aspect of our study is the demonstration that CDE serves as an independent predictor of both visual outcomes ($\beta = -0.0092$, $p < 0.001$) and recovery duration ($\beta = +0.95$ days per CDE unit, $p < 0.001$). CDE reflects the total ultrasound energy delivered during phacoemulsification and is correlated with surgical complexity, cataract density, and operative duration. The relevance of phacoemulsification energy to postoperative outcomes has been established in non-uveitic populations. Güvenç et al[25] demonstrated a significant correlation between higher CDE and increased corneal edema severity ($r = 0.419$, $p < 0.001$) and slower recovery times. Perone et al[26] identified effective phaco time as a significant predictor of three-month endothelial cell loss in multivariate analysis ($\beta = 1.2\%$, $p < 0.001$). Importantly, Kaur et al[27] established a highly significant positive correlation between the total phacoemulsification duration and anterior chamber flare ($p < 0.001$), providing mechanistic support for our findings. In uveitic eyes, where the blood-aqueous barrier is already compromised, an additional inflammatory stimulus from surgical energy may be particularly significant.

The link between CDE and outcomes has significant implications for surgery. Technique modifications that decrease the use of ultrasound energy may improve the outcomes of uveitic cataract surgery. A meta-analysis by Guedes et al[28] showed that the phaco-chop technique reduced CDE by 8.68 units compared to the divide-and-conquer technique, with notably less endothelial cell loss. Femtosecond laser-assisted cataract surgery has demonstrated potential for lowering CDE and postoperative inflammatory markers.[29] Jiang et al[30] found that hypothermic perfusion during phacoemulsification in patients with uveitis significantly decreased postoperative aqueous flare (0.83 vs 1.51, $p = 0.006$), indicating that intraoperative approaches to reduce inflammation may be advantageous.

Perhaps the most clinically relevant finding of this study is the observed association between bDMARD therapy and faster steroid-free recovery ($\beta = -5.086$ days, $p = 0.006$). Patients receiving bDMARDs achieved steroid independence approximately five days sooner than those receiving conventional therapy or no systemic immunomodulation. It is important to note that, given the observational and retrospective nature of this study, this association does not establish a causal relationship; patients on bDMARDs may have differed from those on conventional therapy in ways not fully captured by our regression model, including disease severity, treatment responsiveness, or clinician selection bias. Nonetheless, this finding is biologically plausible, given the known effectiveness of anti-TNF agents in controlling uveitis. The VISUAL III extension study showed that adalimumab maintained quiescence in 85% of patients while allowing significant corticosteroid dose reduction.[19] Gangaputra et al[16] in their analysis of 2382 eyes found that inactive uveitis at the time of surgery was linked to better visual outcomes (OR = 1.49), implying that improved disease control with biologics may offer surgical benefits. Although bDMARD use indicated a trend toward better postoperative visual acuity ($\beta = +0.045$, $p = 0.086$), this did not reach statistical significance, possibly due to the limited sample size.

Disease-specific subgroup analyses revealed clinically interesting patterns, though these should be interpreted cautiously owing to the limited sample sizes. Patients with Behçet's disease showed the shortest steroid-free recovery time (13.4 days), lowest CDE (6.51), and highest postoperative visual acuity (0.88), which seems paradoxical given the literature suggesting that Behçet's disease has the poorest visual prognosis among uveitis etiologies.[15,31,32] However, this may reflect the composition of our cohort, where patients with Behçet's disease had relatively lower-grade cataracts requiring less surgical energy, and anterior uveitis involvement is common in the Turkish population with Behçet's disease. In the regression model for patients with Behçet's disease, CDE was the only significant predictor of both visual outcome ($\beta = -0.0118$, $p < 0.001$) and recovery time ($\beta = +0.963$, $p < 0.001$), while uveitis attack count was not independently significant, suggesting that surgical factors may primarily drive outcomes in this subgroup when inflammation is well controlled. These subgroup findings, however, are based on only 18 patients and require validation in larger, dedicated cohorts before firm conclusions can be drawn.

Patients with axial spondyloarthritis showed longer recovery times (19.0 days) and higher CDE requirements (11.7), possibly indicating denser cataracts in this group. The HLA-B27-associated uveitis type typically causes recurrent acute episodes with complete resolution between attacks; however, cumulative damage can lead to more advanced lens changes by the time of the surgery. In patients with AxSpa (n = 22), preoperative visual acuity remained the strongest predictor of visual outcome ($\beta = +0.424$, $p = 0.007$), whereas both uveitis attack count and CDE significantly predicted longer recovery. These results are broadly consistent with the literature, suggesting that HLA-B27-associated anterior uveitis usually has a good visual prognosis, with less than 2% developing legal blindness, although the inflammatory burden from recurrent disease over the years affects surgical recovery.[33,34] As with the Behçet's subgroup, these findings should be confirmed in larger studies.

The lack of strong links between traditional cardiovascular risk factors (diabetes mellitus, hypertension, and smoking), macular edema, posterior synechiae, and surgical outcomes after multivariable adjustment is notable. Although posterior synechiae were present in 27.8% of eyes and required iris hooks in 18.5%, these factors did not independently predict visual outcomes once CDE was included in the model. This suggests that the additional surgical effort needed to manage pupillary abnormalities is likely reflected by the CDE variable, which captures overall surgical complexity. The 9.3% prevalence of macular edema in our group aligns with literature reporting rates of 9–27% after uveitic cataract surgery, although our sample size may have been too small to detect its independent impact on visual acuity.[14]

These findings have several clinical implications. First, the number of prior uveitis attacks should be considered during preoperative counseling, as patients with extensive inflammatory histories may require prolonged postoperative topical therapy. Second, surgical techniques that reduce CDE, such as phaco-chop, torsional phacoemulsification, and femtosecond laser-assisted nucleus fragmentation, may be particularly advantageous in uveitic eyes. Third, the observed association between bDMARD therapy and faster recovery supports the importance of optimizing systemic immunomodulation before surgery, although prospective controlled studies are needed to establish whether biologic escalation in patients with poorly controlled disease requiring cataract extraction would confer a definitive surgical benefit.

This study had several limitations that should be carefully considered. First, the retrospective design introduces inherent selection bias; patients with more severe disease or complications may have been excluded, potentially affecting the generalizability of our findings. Second, the single-surgeon, single-center approach, while ensuring technical consistency, limits external validity. Third, the sample sizes for the JIA (n = 6), idiopathic uveitis (n = 6), and sarcoidosis (n = 2) subgroups were too small for reliable regression analysis; therefore, these subgroup results should be interpreted descriptively. Fourth, the one-month follow-up period, although capturing the acute recovery phase, does not address important long-term outcomes such as posterior capsule opacification rates, which are reported to occur in 19–53% of eyes with uveitis.[14,35] Fifth, although we recorded the type of biologic agent used, we did not systematically assess the duration of biologic therapy prior to surgery or perform agent-specific subgroup analyses, which may have influenced the

 https://doi.org/10.2147/OPTH.S604342

observed association between bDMARDs and recovery time. Finally, the limited sample size may have precluded detection of smaller but clinically meaningful effect sizes, particularly for bDMARD effects on visual acuity.

In conclusion, this study identified the number of prior uveitis attacks, cumulative dissipated energy, and biologic DMARD therapy as independent predictors of postoperative recovery after uveitic cataract surgery in this single-center cohort. These non-ocular factors extend beyond traditional prognostic indicators and have potential implications for preoperative counseling, surgical technique selection, and perioperative management. However, given the retrospective design and limited sample size, these findings should be considered hypothesis-generating. Prospective, multicenter studies with longer follow-up periods, larger disease-specific subgroups, and detailed pharmacological data are needed to validate these associations and to determine whether targeted optimization of systemic therapy before surgery can improve outcomes in this challenging patient population.

Data Sharing Statement

All data related to this study can be provided upon reasonable request to the corresponding author.

Author Contributions

All authors made a significant contribution to the work reported, whether in conception, study design, execution, data acquisition, analysis and interpretation, or all these areas; participated in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article was submitted; and commit to being accountable for all aspects of the work.

Funding

This study did not receive any funding.

Disclosure

The authors declare no conflicts of interest in this work.

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