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# FOCAL POINTS®

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Management of Cataract  
Surgery and Uveitis

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## Learning Objectives

Upon completion of this module the reader should be able to:

1. Understand the challenges associated with surgery for uveitic cataracts.
2. Discuss the key elements of pre- and postoperative management of cataract and uveitis, and highlight control of uveitic macular edema.
3. Discuss special surgical considerations in pediatric cataract and uveitis.
4. Delineate current techniques available to optimize cataract surgery complicated by small pupils.
5. Discuss some of the pros and cons of femtosecond laser-assisted cataract surgery (FLACS) versus phacoemulsification cataract surgery (PCS) for uveitic cataracts.

### AUDIO:

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## Introduction

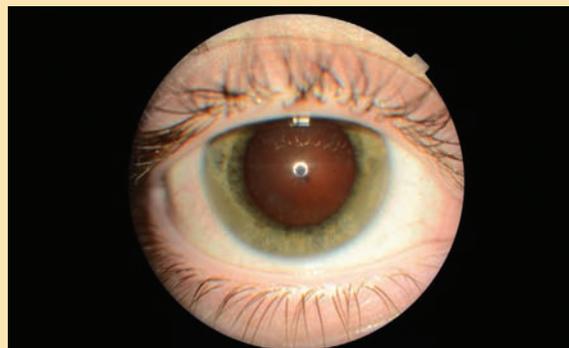
A common complication of uveitis is cataract, which results either from the inflammatory process itself or as a sequela to corticosteroid treatment. Cataract can occur in up to 64% of patients with uveitis, and accounts for 40% of vision loss. Macular edema is the leading cause of vision loss in uveitis. In one study it accounted for 41% of vision loss and 29% of blindness; it is therefore important to manage this structural complication in the preoperative and postoperative phases. Uveitis patients also develop a number of ocular comorbidities that pose unique surgical challenges and risks. Studies confirm that better visual outcomes will result from optimal preoperative and postoperative management.

Anti-inflammatory management may include local, regional, or systemic modalities; advances in these therapeutic agents have greatly enhanced cataract surgery management, and novel medical and surgical advances may improve cataract surgery outcomes. We will highlight optimal preoperative and postoperative inflammation control, with a focus on the structural sequelae of macular edema, and on techniques and devices that aid in cataract extraction for eyes with small pupils. We will consider the future of intraocular lens (IOL) implants and discuss the relevant safety concerns of femtosecond laser-assisted cataract surgery (FLACS, “femtolaser”) versus phacoemulsification cataract surgery (PCS, “phaco”) in the context of inflammation.

## Preoperative Evaluation and Management

Surgery for uveitic cataracts is typically more complicated than for age-related cataracts, as the former may be associated with posterior synechiae, pupillary membranes, and band keratopathy. The uveitic cataract is also more likely to be posterior subcapsular and visually impairing, so patients are eager to have cataract surgery at a younger age (Figure 1). Detailed discussion regarding expectations of surgery, the likely prolonged postoperative course, and adjustment to the new pseudophakic state will help prepare patients. All patients with uveitis should have at least 3 months of quiescence prior to any intraocular surgery. Inflammatory control should be maximized, either with increased systemic immunosuppression, an oral corticosteroid bridge, or adjuvant regional corticosteroid injections, until the eye is quiet and remains quiet on a stable medication regimen.

Outcomes are generally favorable. The Multicenter Uveitis Steroid Treatment (MUST) trial randomized 479 eyes of 255 patients to receive either systemic immunosuppression or a local fluocinolone acetonide implant for control of noninfectious intermediate or posterior uveitis, or panuveitis, over a period of 7 years. One hundred seventeen eyes



**Figure 1** Central posterior subcapsular cataract in a pediatric uveitis patient; this is seen best with retroillumination. Unlike congenital cataracts, these cause visual disturbances and glare.

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from 82 patients developed visually significant cataracts (28 [24%] in the systemic therapy arm of the study and 89 [76%] in the implant arm) and underwent cataract surgery. Seventy-two eyes (62%) had improvement in postoperative visual acuity to 20/40 or better, with no significant differences in outcomes between the 2 study arms.

In the perioperative period, patients may be placed on systemic corticosteroids in addition to their immunomodulatory therapies to reduce the risk of postoperative complications. Typical dosage is 1 mg of oral prednisone per kg of body weight, per day (up to 60 mg), for 3–4 days prior to surgery, to be tapered (back to the baseline level) over the next 2–4 weeks. Patients with previous severe ocular inflammation may also benefit from an intraoperative corticosteroid bolus of methylprednisolone (62.5–125 mg). Caution should be employed with patients who are diabetic or hypertensive; physicians and medical staff should ensure that these patients carefully monitor their blood glucose and blood pressure. Osteoporosis management, if necessary, should also be addressed through primary care.

## Risk of Pupillary Miosis and Techniques for Its Management

In addition to the preoperative requirement of at least 3 months of uveitis quiescence, anatomical risk factors must also be identified prior to surgery. Uveitic cataracts may present with features that result in pupillary miosis, including fibrotic pupillary membrane, capsular membrane, and posterior or anterior synechiae. The resultant small pupil is a well-recognized risk factor for intraoperative and postoperative complications (Figure 2).

The intraoperative difficulties that face the surgeon include:

- a restricted view
- narrowing of the operating field
- increased risk of iris trauma
- iris bleeding
- anterior or posterior capsular rupture
- retained lens material
- prevention of conventional lens placement

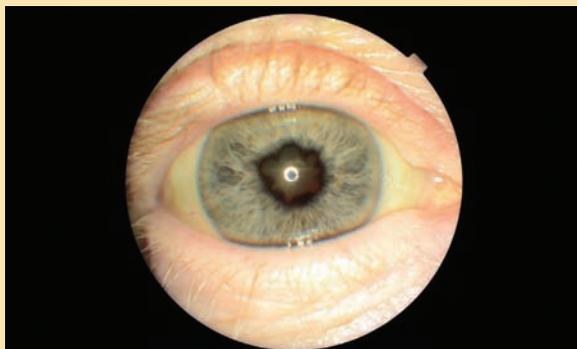
Postoperative complications may include:

- recurrent synechiae
- increased postoperative inflammation
- cystoid macular edema (CME)
- capsular phimosis (Figure 3)
- intraocular lens dislocation
- early visually significant posterior capsular opacification (PCO) (Figure 4)
- recurrent PCO after Nd: YAG laser capsulotomy (Figure 5)

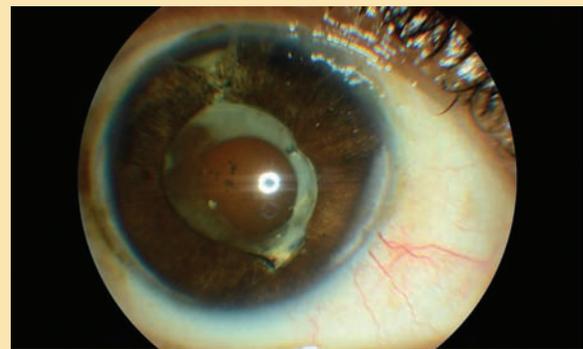
Numerous pharmacological, mechanical, and surgical approaches exist for pupillary miosis; herein we review some recent advances.

### Pharmacological Techniques

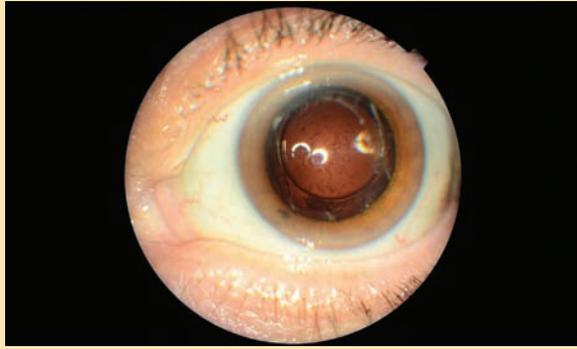
Intracameral combination of a mydriatic agent and an anesthetic agent is now routine. Two approved combinations are marketed: Mydrane in Europe and Omidria in the United States. Mydrane is a combination of tropicamide (0.02%), phenylephrine (0.31%), and lidocaine (1%) and can be used to augment previous topical mydriatic therapy; the components have been shown to be synergistic. Omidria is a combination of phenylephrine (1%) and ketorolac (0.3%). It is added to the irrigation solution to maintain mydriasis and reduce postoperative pain and inflammation. Omidria



**Figure 2** Posterior synechiae and cataract. A laser iridotomy will not be required unless there is near-total iris–lens adhesion. Cycloplegia and mydriasis during acute exacerbations of inflammation prevent synechiae in the visual axis.



**Figure 3** Capsular phimosis and intraocular lens subluxation. Capsular phimosis occurs rapidly after surgery and can cause lens dislocation, which can affect visual acuity. Creation of a larger anterior capsule opening is recommended for patients with uveitic cataracts.



**Figure 4** Early visually significant posterior capsular opacification (PCO). This can occur within a week of cataract surgery.



**Figure 5** Recurrent PCO. This can be discouraging to the patient and surgeon, and is noted particularly in eyes that are not completely quiet.

was evaluated in a randomized clinical trial with 223 patients at 23 centers in the United States; it was demonstrated that Omidria was superior for maintenance of mydriasis (intraoperative pupil diameter of 6.0 mm or larger) and reduction of postoperative pain than its individual components. The study also concluded that both components contributed to Omidria's therapeutic effects. However, neither Mydrane nor Omidria (nor their generic equivalents) has been evaluated in uveitic eyes on which cataract surgery is performed. Another intracameral option is epi-Shugarcaine, a combination of epinephrine 0.025% and lidocaine 0.75% in fortified balanced salt solution (BSS Plus).

Capsular staining with trypan blue is an invaluable aid in the performance of a continuous, adequately sized capsulorrhexis. The dye must be injected after adequate pupillary dilation has been obtained; thus, techniques to stain underneath the viscoelastic must be used.

## Mechanical Techniques

Posterior synechiae restrict pupil dilation for cataract surgery and often need to be addressed first. Occasionally,

injection under the pupil edge with viscoelastic may be sufficient to break the synechiae; this is the gentlest form of synechiolysis. An iris spatula may be required to sever the attachments to the anterior capsule.

Historically, iris hooks have been important devices in small-pupil cataract surgery, but pupillary expansion rings offer the advantage of not requiring additional incisions for insertion. The following is a review of recent advances in pupil-expansion devices.

- **APX 200 (2015, FCI Ophthalmics):** Allows for pupil expansion with a rectangular shape. Minimal intraocular manipulation is needed to introduce and secure the device. The device will not fall into the vitreous cavity if a posterior capsular rupture occurs.
- **B-Hex (2017, Med Invent Devices):** The ring has a hexagonal shape and is a planar structure; it allows fixation through a 0.9-mm incision without the use of an injector. It is designed to bend the iris and straddle the pupil margin.
- **I-Ring (2015, BVI):** A circle-shaped device made with a soft, resilient polyurethane, which minimizes damage to the iris, cornea, and lens; the device provides a circular pupil 6.3 mm in diameter, which helps to guide capsulorrhexis creation.
- **Malyugin Ring 2.0 (2016, MicroSurgical Technology):** A square-shaped device with the coil located at each corner. It can be introduced through a 2.0-mm corneal incision; this is an advantage in FLACS, because incision leakage during docking of the laser might be more likely with larger incisions. Versions available: 6.25 and 7.0.
- **Xpand NT (2016, Beye):** This device allows a circular mechanical dilation of 6.7 mm. It requires a 2.4-mm incision and an injector.



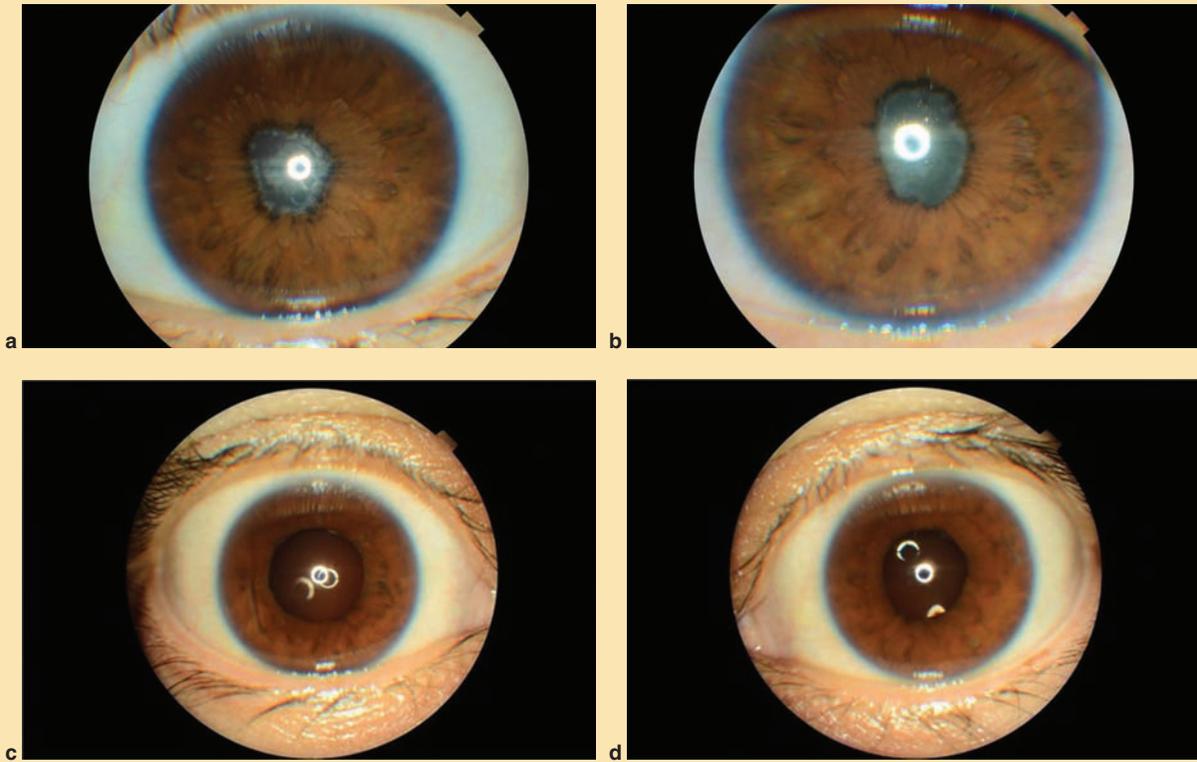
**Uveitic Cataract/Posterior Synechiae: Synechiolysis, Pupillary Expansion with the Malyugin Ring 2.0, and Phacoemulsification**



VIDEO 1

Figure 6 shows the preoperative and postoperative appearance of posterior synechiae in uveitic cataract surgery.

Drawbacks to pupillary expansion devices include cost and difficulty in visualizing a capsulorrhexis that extends peripherally. Regardless of which device is used, an adequately dilated pupil (ie, at least 6 mm) is critical to achieve an appropriate capsulorrhexis size and to reduce the incidence of recurrent posterior synechiae and the development of capsular phimosis.



**Figure 6** Preoperative posterior synechiae and cataract in the right eye (a) and left eye (b). Right-eye (c) and left-eye (d) pseudophakia after synechiolysis.

## Surgical Techniques

PCS is now the most commonly used method of cataract extraction. It provides great control of the intraocular environment and, when coupled with current pupillary mydriatic techniques as described above, results in fewer complications and faster visual rehabilitation for uveitis patients.

FLACS utilizes photodisruption to perform clear corneal incisions, anterior capsulotomy, lens softening and cleavage, and posterior capsulotomy. While FLACS anterior capsulotomy has resulted in greater precision in size and shape, compared to manual capsulorrhexis, it also has been shown to induce higher levels of aqueous humor prostaglandins compared to conventional phacoemulsification. This increase in prostaglandins may result in higher rates of postoperative inflammatory response and an increase in CME; careful planning of perioperative inflammatory management is imperative in this setting. In eyes with small pupils, such as in uveitis patients, FLACS anterior capsulotomies may be small, which increases the risk of iris damage intraoperatively and capsule phimosis postoperatively. As discussed above, pharmacologic or mechanical methods should be implemented to prevent or decrease intraoperative miosis. Precautions, such as frequent refilling of the anterior chamber with viscoelastic during capsulorrhexis creation when mechanical pupil-expansion devices are being used, will help prevent radial capsular tears.

## FLACS and Pediatric Cataracts

Creating anterior and posterior capsulorrhexes can be challenging in pediatric eyes due to the elastic nature of their capsules. Newborns, infants, and children younger than 8 years will develop rapid posterior capsular opacification. In order to prevent this visually impactful event, a primary posterior capsulotomy is typically performed. FLACS offers an advantage in creating both anterior and posterior capsulotomies in pediatric patients because it is less affected than manual capsulorrhexis by capsule elasticity. Some surgeons add a reverse optic-capture technique to a posterior capsulorrhexis; this prolapses the posterior chamber IOL optic anterior to the anterior capsule in order to prevent capsular phimosis and irido-capsular adhesions.

## Implant Considerations

Advances in cataract extraction technique, intraocular inflammation management, and intraocular implant designs have created a paradigm shift away from leaving uveitis patients aphakic. Cataract extraction with placement of an intraocular implant (in eyes that have been quiet for 3 months

or longer) is currently the standard approach, although in very young patients aphakia remains a viable option.

A 2014 meta-analysis concluded that more patients who underwent uveitic cataract surgery with IOL implantation achieved  $\geq 20/40$  postoperative vision, compared to the patients who were left aphakic. Notably, eyes that received heparin-surface-modified polymethylmethacrylate (HSM-PMMA) or acrylic IOLs had better visual outcomes than eyes that received silicone or non-HSM IOLs. However, because the studies were not randomized or controlled, accurate comparisons cannot be made.

A hydrophilic IOL is best suited for the uveitic eye because it induces a lesser inflammatory response when in direct contact with uveal tissue than a hydrophobic IOL does; this is critical to take into account in considering postoperative inflammation and the development of synechiae. However, the surface properties of hydrophilic IOLs are associated with a higher rate of posterior capsular opacification (PCO) and IOL glistenings. To address this issue, the development of a hybrid lens coating that would combine the best qualities of hydrophilic, hydrophobic, and hygroscopic materials may hold the most promise. Many surgeons, though, believe that tight control of uveitis preoperatively and postoperatively may be more important than the type of IOL used.

## Postoperative Management

The most common postoperative complications after cataract surgery include prolonged or recurrent inflammation, development of pupillary membranes, and posterior capsular opacification. Structural changes such as CME and epiretinal membranes (ERM) are also frequently noted after cataract surgery. A multicenter database study in the UK compared 1173 uveitic eyes to 95,573 control eyes that underwent cataract surgery during the same time period. Although around 70% of uveitic eyes had postoperative visual acuity of 20/40 or better, there were statistically significant better visual acuity outcomes among eyes that did not have uveitis. This underscores the need to discuss and manage, as appropriate, patient expectations prior to surgery.

The pathogenesis of uveitic CME is still not clearly understood. Possibilities include vascular permeability from the underlying inflammation, a dysfunctional retinal pigment epithelial pump mechanism, and a combination of the two. Controlling inflammation with systemic immunosuppressive medications or regional corticosteroid injections improves the macular edema in around 65% of patients. The POINT (PeriOcular versus INTravitreal corticosteroids for uveitic macular edema) trial compared the effectiveness of 3 different regional corticosteroid injections in eyes with uveitic (not pseudophakic) CME. It concluded that 4 mg of triamcinolone given intravitreally and placement of a 0.7-mg dexamethasone intravitreal implant resulted in greater improvement in macular thickness at 8 weeks compared to a 40-mg periocular triamcinolone injection; however, periocular injections had a lower risk of IOP elevation compared to the intravitreal

corticosteroid injections. Whether these differences would occur in uveitic eyes with CME that developed after cataract surgery has yet to be determined.

Uveitis patients need closer postoperative monitoring than nonuveitis patients do after cataract surgery. A typical postoperative anti-inflammatory eyedrop schedule includes use of difluprednate 0.05% eyedrops 4 times daily, or prednisolone acetate 1% eyedrops 4 times daily, and slow tapering over a period of 6–8 weeks.

Compliance with complicated postoperative eyedrop regimens may be difficult for some patients. Many uveitic cataract surgeons supplement the perioperative regimen with sustained-release corticosteroids that range from subconjunctival triamcinolone acetonide to intravitreal medications such as dexamethasone intraocular suspension (Dexycu 9% [517 mcg], Icon Bioscience, Inc.) to reduce dependence on topical corticosteroids such as prednisolone acetate 1% or difluprednate 0.05%. However, the efficacy of such medications to reduce postoperative inflammation and pseudophakic CME after uveitic cataract surgery remains unproven.

Recent retrospective studies suggest that recurrent inflammation in the postoperative period is associated with development of CME and PCO. These findings suggest that modifications in the oral corticosteroid taper in the postoperative period should be guided by the extent of intraocular inflammation. Treatment for PCO with Nd:YAG laser may cause transient increase in inflammation, which can be managed with topical corticosteroids before and after treatment. A typical regimen might be use of prednisolone acetate 1% 6 times a day or difluprednate 0.05% 4 times a day for a week before and after the procedure. It is essential that CME and uveitis be consistently controlled before cataract surgery, and surgeons should keep in mind that pseudophakic CME may not develop for a month or more after surgery, thus necessitating anti-inflammatory therapy for much longer than for most age-related cataract operations.

## Special Considerations: Juvenile Idiopathic Arthritis–Associated Cataracts

Cataract in pediatric uveitis is fairly common. Estimates show a prevalence of 40%–50%. Incident cataract formation is now known to be more closely related to intraocular inflammation and its secondary complications in the eye, rather than to treatment with systemic and topical corticosteroids. Risk factors associated with cataract development are related to the control of inflammation, including the number of recurrent uveitis flare-ups per year (hazard ratio [HR] = 3.06 [95% confidence interval {CI}, 2.15–4.35],  $P < 0.001$ ), cystoid macular edema (HR = 2.87 [95% CI, 1.41–5.82],  $P = 0.004$ ), and posterior synechiae (HR = 2.85 [95% CI, 1.53–5.30],  $P = 0.001$ ). Juvenile idiopathic arthritis

(JIA) is the most common systemic association in pediatric uveitis. Despite established guidelines on regular screening, patients may still present with advanced complications of inflammation due to the asymptomatic nature of the disease. As with adult cataracts, aggressive control of inflammation (often in partnership with a pediatric rheumatologist) and a quiescent period of 3 months are required prior to any ocular surgery. Furthermore, pediatric cataracts have their unique challenges. Pediatric lenses are softer, and postsurgical inflammation is usually more robust; these factors necessitate primary posterior capsulorhexis, in some cases (in children 8 years and younger) combined with anterior vitrectomy.

Pediatric ophthalmologists are likely to implant intraocular lenses in cataract surgery performed on children older than 2 years. While fewer data are available on pediatric uveitic cataract surgery than adult uveitic cataract

surgery, case series show that well-controlled inflammation in the perioperative period is conducive to good visual acuity outcomes. The perioperative steroid regimen for children is similar to the regimen for adults, with 1 mg of oral prednisone per kg of body weight, per day (up to 60 mg), for 3–4 days prior to surgery, to be tapered (back to the baseline level) over the next 2–4 weeks. A topical steroid, typically prednisolone acetate 1%, 4 times daily, is also commonly tapered postoperatively over 6–8 weeks.

## Conclusion

Cataract surgery in uveitis patients can be challenging, but with careful planning, visual outcomes continue to improve. Key factors are optimization of inflammation control, close consideration of implant choices, and utilization of appropriate techniques and devices.

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