Late-onset angle closure in pseudophakic eyes with posterior chamber intraocular lenses

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CASE REPORT

Two patients presented with angle closure many years after cataract extraction. The first patient presented with acute intraocular pressure (IOP) elevation and closed iridocorneal angle that resolved with a laser iridotomy. The second patient presented with an insidious course of high IOP and progressive narrowing of the iridocorneal angle, ultimately requiring a pars plana vitrectomy and glaucoma valve implant, with subsequent normalization of pressure and angle anatomy.

Although rare, angle closure in eyes with posterior chamber intraocular lenses is a dangerous complication that can occur many years after cataract extraction. Retained lens fragments, and perhaps repeated intravitreal injections, might place susceptible patients at risk.

J Cataract Refract Surg 2020; 46:e48–e51 Copyright © 2020 Published by Wolters Kluwer on behalf of ASCRS and ESCRS

Angle closure in the pseudophakic eye with a posterior chamber intraocular lens (IOL) is uncommon owing to the deepening of the anterior chamber that occurs with posterior chamber IOL implantation. However, this secondary angle closure is an important and dangerous complication that requires timely intervention to prevent irreversible vision loss. It typically occurs by 1 of 2 primary mechanisms—pupillary block or aqueous misdirection, the latter also known as malignant glaucoma. Whereas pupillary block occurs when aqueous flow from the posterior chamber is impeded by the strong apposition of the pupillary margin with adjacent structures, aqueous misdirection is classically believed to occur secondary to posteriorly diverted aqueous fluid, resulting in positive vitreous pressure causing a forward displacement of the lens–iris diaphragm. Although pseudophakic pupillary block typically resolves with a laser iridotomy, aqueous misdirection requires disruption of the anterior hyaloid face, which often necessitates a pars plana vitrectomy. These processes can manifest in the early postoperative period but presentation months to years postoperatively has also been described. Although these 2 mechanisms have different pathophysiology, there might be overlap in predisposing risk factors. We present 1 case of pupillary block and 1 case of aqueous misdirection that both occurred many years after cataract extraction. Awareness of the rare and possibly late-onset complication of angle closure in eyes with posterior chamber IOLs and the underlying mechanisms is imperative to guiding appropriate management.

This retrospective clinical case series was in accordance with the tenets of the Declaration of Helsinki and was approved by the institutional review board. The study involved the chart review of 2 pseudophakic patients with posterior chamber IOLs who presented with late-onset angle closure at the Edward S. Harkness Eye Institute of the Columbia University Irving Medical Center. Both patients also had a history of neovascular age-related macular degeneration (ARMD) and received regular intravitreal injections of antivascular endothelial growth factor. Clinical information obtained included patient history, corrected distance visual acuity (CDVA), pupillary reflexes, intraocular pressure (IOP), and findings from slitlamp biomicroscopy and fundus examination. The results of ultrasound biomicroscopy were also reviewed.

CASE REPORTS

Case 1

A 92-year-old man presented with 2 days of sudden onset pain in the right eye and blurry vision. His medical history was only significant for hyperlipidemia. He had uneventful cataract extraction with posterior chamber IOLs approximately 10 years ago. He had neovascular ARMD in both eyes with progressive disciform macular scarring in the right eye and received regular intravitreal injections of...
afibercept (2.0 mg). Since 2013, he had received 24 injections in the right eye, most recently 3 months prior to presentation.

On examination, CDVA in the right eye was counting fingers at 3 feet, which was his baseline. IOP was 70 mm Hg, compared with 15 mm Hg in the other eye. The right pupil was middilated and nonreactive, but there was no relative afferent pupillary defect. The cornea had epithelial edema and bullae. The anterior chamber was very narrow especially peripherally, but the IOL was well centered, with no pseudophakodonesis and no posterior synechiae. Pseudoxfoliative material was visible along the pupillary margins bilaterally. Gonioscopy showed a closed iridocorneal angle in all quadrants, whereas the left eye was open to ciliary body. There was no peripheral anterior synechiae in either eye. There were no choroidal effusions on fundus examination. Despite oral acetazolamide, topical pressure-lowering eye drops, and cycloplegics (for presumed aqueous misdirection), the pressure remained at 50 mm Hg the following day. Ultrasound biomicroscopy showed a shallow anterior chamber with a closed iridocorneal angle, anterior displaced IOL, and retained lens material in the capsular bag (*). There were no choroidal effusions visualized.

Given lack of improvement, laser iridotomies were performed in the nasal and temporal quadrants. The anterior chamber deepened, and the pressure the following day was 14 mm Hg with resolution of the patient’s pain and blurry vision. Repeat ultrasound biomicroscopy showed a normal anterior chamber configuration with an open iridocorneal angle (Figure 1, B). The patient was followed up for 7 months; he maintained a deep anterior chamber and good IOP control on pressure-lowering eyedrops.

Case 2
An 87-year-old woman initially presented with asymptomatic shallowing of the anterior chamber in her left eye. Her medical history was notable for hypertension and previous pulmonary embolism. Her ocular history was notable for bilateral laser iridotomies for narrow angles and uneventful cataract extraction with posterior chamber IOLs in both eyes approximately 30 years ago. She had neovascular ARMD in both eyes and received regular anti-vascular endothelial growth factor injections. Since 2012, she had received 16 intravitreal injections of bevacizumab (1.25 mg) in the left eye. Beginning in 2017, she had received 6 injections of afibercept (2.0 mg) in that eye, most recently 2 months prior to presentation. She also had glaucoma managed with topical therapy. Previous gonioscopy 8 years ago was open to the scleral spur in both eyes, with scattered peripheral anterior synechiae in the left eye occupying less than 50% of the angle.

On initial presentation, the patient had no acute visual symptoms. CDVA in the left eye was 20/70, and pressure was 14 mm Hg, both of which were near her baseline. The pupil was round and reactive with no relative afferent pupillary defect. The anterior chamber was moderately shallow, and the iridotomy was patent. The IOL was well centered with no posterior synechiae. Ultrasound biomicroscopy showed narrow to closed iridocorneal angles in all quadrants and probable retained lens material in the capsular bag pushing the iris forward, with no identifiable choroidal effusions (Figure 2, A). Given normal IOP, the patient was initially observed.

Over the next several months, the patient’s chamber remained moderately shallow, but pressure was well controlled on topical therapy. During this period, she received 3 intravitreal injections of afibercept. At approximately 10 months after initial presentation, pressure was noted to be 26 mm Hg, with further narrowing of the anterior chamber and now closed iridotomy. Repeat iridotomy was performed, and additional topical pressure-lowering eyedrops were added, but the anterior chamber remained narrow and the pressure uncontrolled. The patient ultimately underwent a pars plana vitrectomy with an Ahmed glaucoma valve implant. Postoperatively, the anterior chamber was deep with an open angle, with IOP of 10 mm Hg. The patient was followed up for 2 years postoperatively; she maintained a deep anterior chamber and good pressure control on topical therapy.

DISCUSSION
We reported 2 cases of pseudophakic angle closure that occurred many years after cataract extraction and IOL implantation. The first case demonstrates pupillary block with an acute presentation of elevated IOP and shallow anterior chamber that was relieved with a laser iridotomy, whereas the second case chronicles an insidious course of...
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Figure 2. Case 2. A: Ultrasound biomicroscopy of the left eye demonstrating a narrow iridocorneal angle and moderately shallow anterior chamber, with probable retained lens material in the capsular bag (*). B: Ultrasound biomicroscopy of the patient’s right eye, which has a normal angle configuration with a deep anterior chamber.

Aqueous misdirection that ultimately required a pars plana vitrectomy and Ahmed glaucoma valve implant. Both pupillary block and aqueous misdirection are uncommon in pseudophakic eyes with posterior chamber IOLs because of the normal expansion of the anterior chamber that occurs with posterior IOL implantation. They are even more unlikely to occur as late complications many years after cataract surgery. Although these 2 mechanisms classically have distinct underlying pathophysiology, there might be some shared predisposing risk factors.

Pupillary block in pseudophakia occurs when aqueous flow from the posterior chamber is obstructed by apposition between the pupillary margin and adjacent structures. This has been frequently described with anterior chamber lenses because of occlusion of the pupil by the lens optic, leading to the current practice of performing a prophylactic iridectomy for all cases involving anterior chamber IOL placement. With posterior chamber IOLs, this sequela is much less frequent but can occur due to formation of peripheral anterior synechiae in the setting of inflammation, retained lens material behind the iris, free vitreous block, or blockage by silicone oil. Laser iridotomy or surgical iridectomy typically relieves the pupillary block. Our first patient seems to have been at risk for this complication because of retained lens fragments in the capsular bag. Gradual proliferation of retained lens epithelial cells postoperatively over many years might have led to thickening of the equatorial zone and eventual blockage of aqueous flow at the lens–iris interface, pushing the iris forward due to mass effect and further closing the angle. Furthermore, the pupillary findings consistent with pseudoxefoliation syndrome suggest that a component of anterior lens dislocation secondary to zonular laxity might have also played a role. Resolution after laser iridotomy supports pupillary block as the diagnosis for the first case.

Aqueous misdirection (also commonly known as malignant glaucoma) is postulated to occur due to anterior rotation of the ciliary body with posteriorly diverted aqueous fluid that then pushes the lens–iris diaphragm forward, closing the iridocorneal angle. It can ensue after cataract extraction and after trabeculectomy, glaucoma drainage device implantation, or other anterior segment procedures. Aqueous misdirection classically presents with uniform shallowing of the anterior chamber, as opposed to the peripheral narrowing in pupillary block. Most patients presenting with aqueous misdirection have an anatomical predisposition with a history of angle closure or narrow iridocorneal angle, and women have physiologically more narrow anterior chambers compared with men and are, therefore, at higher risk. In addition, the presence of a patent iridotomy and absence of choroidal effusions or hemorrhage help to establish the diagnosis. Medical therapy involves aqueous suppression and cycloplegia to pull the lens–iris complex posteriorly, whereas laser iridotomy with anterior hyaloidotomy, and posterior capsulotomy to disrupt the anterior hyaloid face with subsequent release of trapped aqueous, have also been successful. However, surgical therapy with a pars plana vitrectomy to prevent aqueous accumulation in the vitreous cavity is ultimately required in a large proportion of patients. Our second patient was at risk for aqueous misdirection because she had received laser iridotomies in the past for narrow angles and had evidence of chronic angle closure with peripheral anterior synechiae on gonioscopy. There was also probable retained lens material in the capsular bag, which might have contributed to the narrowing of the anterior chamber. Persistence of a shallow anterior chamber with uncontrolled IOP in the presence of a patent iridotomy points to aqueous misdirection as the primary mechanism behind the second case.

A commonality between these 2 patients is that they both had neovascular ARMD and received regular intravitreal injections. Anterior segment optical coherence tomography has demonstrated narrowing of the anterior chamber angle after intravitreal injections, and IOP elevation has been observed afterward as well. Although both patients reported in this study had received their most recent injection 2 to 3 months prior to presentation, we propose that there might be a component of chronic vitreous expansion that occurs with repeated intravitreal injections, and this might further predispose susceptible eyes to angle closure.

Angle closure in pseudophakic eyes with posterior chamber IOLs is a rare but potentially devastating sequela that can occur many years after cataract extraction. Although pupillary block and aqueous misdirection represent the 2 distinct primary mechanisms underlying this disease process, there might be some shared risk factors that predispose...
patients to developing this type of angle closure. Our 2 patients reported in this study demonstrate that retained lens fragments, and perhaps repeated intravitreal injections leading to chronic vitreous expansion, might place susceptible patients at risk. Understanding these mechanisms is critical to guiding proper management and preventing permanent vision loss in the acute setting, and might also help identify those at high risk for developing this secondary angle closure in the future.

**WHAT WAS KNOWN**

- Angle closure in pseudophakic eyes with posterior chamber intraocular lenses (IOLs) is uncommon and is especially rare many years after cataract extraction.
- There are certain risk factors that might predispose eyes to this presentation.

**WHAT THIS PAPER ADDS**

- Retained lens fragments, and perhaps in combination with repeated intravitreal injections, might place susceptible patients at risk for both acute and chronic late-onset angle closure in the presence of a posterior chamber IOLs.

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**Disclosures:** None of the authors has a financial or proprietary interest in any material or method mentioned.