

Case Report

Pseudophakic Pupillary Block due to the Capsular Bag Intraocular Lens Implant Located in the Sulcus: A Case Report

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Keywords

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Abstract

Introduction: Pupillary block, a concerning complication of cataract surgery, is heightened when a single-piece acrylic (SPA) intraocular lens (IOL) is implanted in the ciliary sulcus. We report an unusual occurrence of relative pupillary block and chronic angle-closure glaucoma (ACG) identified in the late postoperative period due to unintentional SPA IOL implantation in the sulcus. **Case Presentation:** An 82-year-old woman presented with a history of chronic ACG 5 years after bilateral cataract extraction. Postoperatively, she experienced anterior chamber shallowing, elevated intraocular pressure (IOP), and two acute angle-closure attacks in the left eye, successfully managed with laser peripheral iridotomies (LPIs). Despite neodymium:YAG capsulotomy, elevated IOP persisted. Maximal medical therapy effectively controlled IOP; however, a shallow anterior chamber remained, prompting referral to our glaucoma service. Slit-lamp examination revealed a shallow peripheral anterior chamber, patent LPIs, and an Alcon SA60WF SPA IOL situated posteriorly with the optic against the pupil margin OS. Gonioscopy indicated a closed angle with peripheral anterior synechiae (PAS). Ultrasound biomicroscopy (UBM) confirmed haptics in the sulcus, with the lens optic and haptics anterior to the bag. These findings suggest relative pupillary block as the cause of her chronic ACG. The SPA IOL's bulky haptics in the sulcus likely induced iris bowing, leading to prolonged appositional angle-closure and chronic PAS formation. **Conclusion:** IOLs designed for the capsular bag should not be placed in the sulcus. Therefore, IOLs of varying dimensions should be taken to the operating room in the event of complicated cataract extraction. Finally, UBM proves valuable in identifying causes of pupillary block.

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Introduction

Cataract surgery is one of the most common surgeries globally, with an estimated 20 million cases performed each year [1]. In a recent study of more than 200,000 Medicare beneficiaries, 99.5% of patients who underwent cataract surgery experienced no severe postoperative complications [2]. Nonetheless, potentially vision-threatening complications may occur in a small portion of patients. A particularly alarming postoperative complication of cataract surgery is pseudophakic pupillary block. While uncommon, the risk of pupillary block is increased when a single-piece acrylic (SPA) intraocular lens (IOL) is placed in the ciliary sulcus. This incorrect positioning has been reported to occur in 1.3% of cases [3].

We present a unique case of relative pupillary block diagnosed in the late postoperative period following presumed uncomplicated cataract extraction, secondary to implantation of a SPA IOL in the ciliary sulcus. This case report adhered to the tenets of the Declaration of Helsinki and the Health Insurance Portability and Accountability Act. The CARE Checklist has been completed by the authors for this case report, attached as supplementary material (for all online suppl. material, see <https://doi.org/10.1159/000538343>).

Case Presentation

An 82-year-old woman with a history of chronic angle-closure glaucoma (ACG) in the left eye presented to our ophthalmology clinic complaining of intermittent double vision for 6 months, accompanied with blurry vision while reading and a “sandy” feeling in her eyes. Five years prior, the patient underwent bilateral cataract extraction with no intraoperative complications. Four years postoperatively, she began experiencing intermittent episodes of shallowing of the anterior chamber in her left eye with elevated intraocular pressure (IOP), along with two acute angle-closure attacks, which were successfully treated with laser peripheral iridotomy (LPI). After LPIs were performed, the patient had another episode of acute shallowing of the chamber. Because no ultrasound biomicroscopy (UBM) was available, treatment by neodymium:YAG (Nd:YAG) capsulotomy was done to rule out the possibility of capsular bag distension syndrome and to address concerns of possible aqueous misdirection; however, she continued to experience episodes of elevated IOP afterward. She was started on latanoprost daily and dorzolamide/timolol twice daily.

Five years after cataract extraction, she was referred to our outpatient glaucoma service for evaluation of left eye intermittent chamber shallowing and UBM assessment. Visual acuity of the left eye was 20/150 without correction and 20/40-2 with correction as the patient had planned monovision with her initial cataract surgery. Visual acuity of the right eye was 20/25 without correction and 20/20 with correction. Goldmann applanation tonometry revealed IOP measurements of 14 mm Hg OS and 16 mm Hg OD. Slit-lamp examination OS demonstrated a shallow peripheral anterior chamber, patent LPIs at 3 and 9 o'clock positions in the iris, and an Alcon SA60WF IOL located posterior to the iris plane with optic against the posterior pupil margin. Slit-lamp examination OD was unremarkable as evidenced by a deep and quiet anterior chamber, a well-positioned PCIOL in the capsular bag, and a round and reactive iris. Normal pupil constriction and dilation were observed in both eyes. Gonioscopy OS demonstrated a closed angle 360° with peripheral anterior synechiae (PAS) and no visible angle structures with the lens implant touching the posterior iris surface at the pupil. Gonioscopy OD showed adequate visualization of the posterior trabecular meshwork (TM). Gonioscopy and dynamic gonioscopy results of the left eye indicated the presence of chronic PAS in the peripheral chamber due to inability to visualize angle structures. Posterior vitreous detachment was observed in both eyes. UBM confirmed the presence of IOL haptics in the

sulcus OS, with the lens optic and haptics anterior to the capsular bag. While no evidence of effusions or anterior rotation of ciliary processes were noted, UBM images also revealed the presence of a Soemmering's ring and chronic angle-closure findings OS. Optical coherence tomography of the optic nerve showed a healthy retinal nerve fiber layer in both eyes.

At most recent follow-up, the patient's IOP was effectively controlled on drops, with stable optical coherence tomography and VF findings. The patient declined further intraocular intervention at this time. She returned to her referring ophthalmologist on drops with follow-up to monitor her chronic angle closure.

Discussion

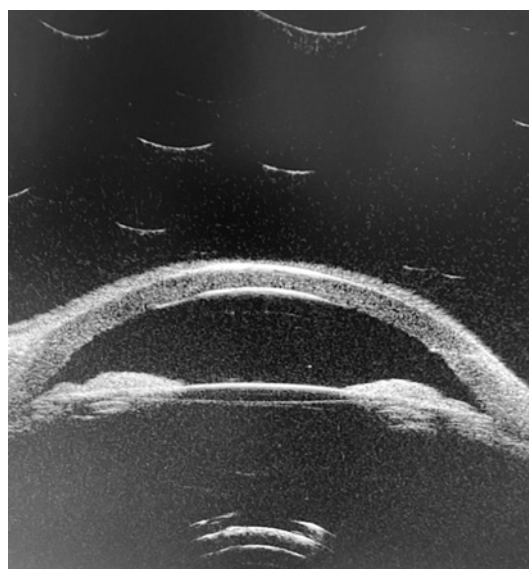
We present a unique case of chronic ACG secondary to relative pupillary block in a pseudophakic eye presenting 5 years after presumed uncomplicated cataract extraction. To date, previous reports of pseudophakic pupillary block largely involve sulcus-designed IOL implantation and subsequent vaulting of the lens against the posterior surface of the iris [4–6]. Interestingly, our patient experienced anterior chamber shallowing, uncontrolled IOP, and acute and chronic ACG postoperatively after having a SA60WF capsular bag SPA IOL unintentionally implanted in the sulcus or less likely lens subluxation out of the capsular bag and into the sulcus postoperatively.

Relative irido-lenticular pupillary block in a pseudophakic eye is a condition that occurs when the normal flow of aqueous humor is obstructed, due to apposition between the iris and the IOL at the pupillary margin. The resultant resistance to aqueous flow between the posterior and anterior chamber increases, causing forward bowing of the peripheral iris and subsequently occluding the TM. This leads to angle closure and subsequent shallowing of the peripheral anterior chamber and elevated IOP. Relative pupillary block can cause acute ACG, a sight-threatening, emergent condition characterized by severe unilateral eye pain, headache, redness, blurred vision, and even permanent vision loss due to damage to the optic nerve [7]. If left untreated or inadequately managed, repeated episodes of relative pupillary block may produce PAS causing residual damage to the TM and chronic ACG [8].

To ascertain relative pupillary block as the causative factor of our patient's chronic ACG, it was crucial to eliminate other potential primary angle-closure causes. Absolute irido-lenticular block was ruled out through clinical examination and observation of freely mobile, the absence of iris bombe, and the absence of a secluded pupil. The previous literature estimates that the prevalence of aqueous misdirection after anterior segment surgery is between 0.6% and 4%, with the highest incidence in patients treated for angle closure [9]. Given our patient's history of peripheral anterior chamber shallowing in the presence of patent LPs after cataract surgery, the possibility of cilio-vitreo-lenticular block or aqueous misdirection was also considered and addressed by disrupting the posterior capsule with Nd:YAG capsulotomy; however, the patient continued to exhibit elevated IOPs. Furthermore, classical cilio-vitreo-lenticular block presents with shallowing of both the peripheral and central chambers due to the forward bowing of lens structures. Our patient, however, only demonstrated a shallow peripheral anterior chamber, allowing us to exclude aqueous misdirection as the primary cause of her chronic ACG after unsuccessful Nd:YAG capsulotomy and a deep central chamber observation. At this point, she was referred to our service for UBM, which demonstrated a SA60WF SPA IOL with posterior iris touch, haptics in the sulcus, and optic pupil block – all pertinent findings for relative pupillary block in a pseudophakic eye (shown in Fig. 1) [10].

The SA60WF SPA design renders sulcus implantation susceptible to developing relative pupillary block for many reasons. In contrast to the thinner, 3-piece posterior chamber IOL, the SA60WF SPA IOL has thick, bulky haptics that can touch the posterior iris when implanted

Fig. 1. Ultrasound biomicroscopy (UBM) of the left eye 5 years post cataract extraction. A posterior chamber IOL exhibiting contact with the posterior iris is seen with haptics positioned within the sulcus. The interaction between the iris and the TM indicates the presence of chronic angle closure. The depiction of a Soemmering's ring is also notable.



in the sulcus. The size and coarse, acrylic material of SA60WF SPA haptics can rub against the posterior iris causing UGH syndrome – uveitis, glaucoma, and hyphema [11]. Additionally, the haptics themselves are planar, as opposed to anteriorly angled and C-shaped which would help to displace the optic away from the iris pigment epithelium [12]. In the setting of eyes with longer ciliary sulcus dimensions, the 13.0 mm end-to-end length and 6.0 mm optic size of the SPA IOL increase the risk of decentering over time and damaging the posterior iris [10]. Overall, these disadvantageous features of a SA60WF SPA IOL implanted in the sulcus precipitated intermittent relative pupillary block in our patient by bowing the peripheral iris anteriorly. Given the patient's 5-year postoperative history of acute angle-closure attacks and elevated IOP, prolonged episodes of appositional angle closure likely led to PAS formation and subsequent chronic ACG finding [13]. Surgical removal of the IOL could be considered in the future if IOP becomes uncontrolled on maximal medical therapy and if the patient experiences additional acute closed angle attacks.

Finally, our case evidences the importance of UBM in promptly diagnosing pupillary block and restoring normal fluid flow to prevent progression to chronic ACG. UBM allows for the identification of the exact configuration of the lens-iris diaphragm and helps visualize the structures involved in the angle-closure mechanism, such as convex iris configuration and a shallow anterior chamber [14]. In a case study by Zhang et al., anterior segment UBM was used to diagnose pseudophakic pupillary block 5 years after reverse implantation of a sulcus IOL [6]. In our case, while gonioscopy showed a convex iris appearance and contact between the IOL and posterior iris surface, anterior segment UBM reliably confirmed the etiology of the relative pupillary block by revealing haptics in the sulcus (shown in Fig. 1). As such, other potential causes of pupillary block such as aqueous misdirection and plateau iris were excluded. In conclusion, we suggest using anterior segment UBM early in the diagnostic workup, if accessible, for pseudophakic patients experiencing chronic ACG.

Conclusion

This case demonstrates how IOLs designed for the capsular bag should not be placed in the ciliary sulcus. Due to a higher risk of decentering and posterior iris displacement, SPA IOLs in the sulcus can precipitate relative pupillary block and subsequent chronic ACG, as seen in

our patient. For this reason, backup IOLs of varying sizes and designs should be taken to the operating room in the event of complicated cataract extraction, such as a posterior capsular bag rupture. Furthermore, UBM has proven to be a valuable tool in identifying the underlying causes of pupillary block. This case adds to the growing body of knowledge surrounding the diagnosis of relative pupillary block and the short-term and long-term complications of SPA IOL implantation in the sulcus.

Statement of Ethics

This case report adhered to the tenets of the Declaration of Helsinki. This retrospective review of patient data did not require ethical approval in accordance with local guidelines. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images, all of which have been de-identified.

Conflict of Interest Statement

All the authors have no conflicts of interest.

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Author Contributions

Y.B. contributed to the chart review, literature search, and writing and editing of the manuscript draft. J.D. and A.H. contributed to the literature search and writing and editing of the manuscript draft. D.B. and S.D. saw the patient in clinic, performed surgery, and edited the manuscript.

Data Availability Statement

All data generated or analyzed during this study are included in this article and its supplementary material files. Further inquiries can be directed to the corresponding author.

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