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Case Report

Late-Onset Capsular Block Syndrome with Pupillary Block Angle Closure after Cataract Surgery with Posterior Chamber Intraocular Lens Implantation: A Case Report

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Keywords
Capsular block syndrome · Pseudophakic pupillary block · Soemmering ring · Case report

Abstract
Introduction: Pseudophakic pupillary block angle-closure glaucoma is an uncommon complication following uneventful cataract surgery with posterior chamber intraocular lens (IOL) implantation. Interestingly, capsular block syndrome (CBS) has been reported as another plausible cause of pseudophakic pupillary block angle-closure glaucoma, especially in the early postoperative period. Unlike early postoperative CBS, late postoperative CBS is not associated with a shallow anterior chamber, myopic shift, or elevated intraocular pressure. We report a case of late postoperative CBS presenting with an acute-onset pupillary block angle-closure attack occurring 13 years after uneventful cataract surgery with posterior chamber IOL implantation, which has not been reported in the literature. ***Case Presentation:*** An 87-year-old male diagnosed with pseudoexfoliation syndrome developed pseudophakic pupillary block following uneventful cataract surgery with posterior chamber IOL implantation. Late-onset CBS has been identified as the underlying cause of the pupillary block. The combination of zonular laxity observed in pseudoexfoliation syndrome and the presence of a Soemmering ring are potential predisposing factors for this condition. After performing laser peripheral iridotomy (LPI) followed by Nd: YAG capsulotomy, the pupillary block was resolved and vision was improved. ***Conclusion:*** CBS should be considered as a potential cause of pseudophakic

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pupillary block, even in the late postoperative period. The management of late-onset CBS accompanied by pupillary block angle-closure glaucoma typically includes LPI to eliminate the pupillary block, followed by Nd: YAG capsulotomy.

Introduction

Pseudophakic pupillary block is a rare complication of cataract surgery with posterior chamber intraocular lens (IOL) implantation due to an expanded anterior chamber after replacing the natural lens with the posterior chamber IOL [1, 2]. There have been a few reports of pupillary block after posterior chamber IOL implantation. In these instances, the pupillary block can be attributed to prolapsed vitreous, which may occur following an undetected rupture of the posterior capsule or due to zonular loss during surgery [1]. Other potential causes include severe postoperative inflammatory reactions leading to the formation of posterior synechiae and fibrin membranes [2]. Furthermore, the presence of retained lens material behind the iris causes the proliferation of residual lenticular epithelial cells leading to the formation of a thick circumferential structure known as the "Soemmering ring" [3]. Additionally, pupillary block can result from changes in the anatomy of the anterior chamber angle. This can occur when the IOL is placed in the ciliary sulcus rather than within the capsular bag [1, 2] or with reverse implantation of the IOL [2]. Interestingly, capsular block syndrome (CBS) has been reported to be another plausible cause of secondary angle-closure glaucoma, especially in the early postoperative period [4–8]. We report a case of late-onset CBS presenting with pupillary block angle-closure glaucoma after uneventful cataract surgery with posterior chamber IOL implantation.

Case Presentation

An 87-year-old male presented with an acute onset of eye pain and blurry vision in his right eye 1 day prior to his presentation to the ER. He had a history of hypertension and dyslipidemia. The patient was diagnosed with pseudoexfoliation syndrome of the left eye in 2013. The intraocular pressure (IOP) was normal without antiglaucoma medication. The patient denied any history of eye trauma. He had undergone uneventful phacoemulsification with posterior chamber IOL implantation using an AcrySof IOL (model SA60AT) in his right eye 13 years previously and in his left eye 10 years previously. Upon examination, the best-corrected visual acuity (BCVA) in the right eye had significantly decreased from 20/40 to counting fingers at three feet; the left eye had a visual acuity of 20/30. The IOP was 56 mm Hg in the right eye and 16 mm Hg in the left eye. Slit-lamp biomicroscopy of the right eye revealed corneal haze grade 1 with epithelial microcysts, an asymmetrical shallow anterior chamber with iris bombe in the superior region without posterior synechiae, and a fix-dilated, non-reactive pupil (shown in Fig. 1). No vitreous or fibrin membranes were observed in the anterior chamber. Neither exfoliative material nor loss of pupillary ruff was observed at the pupillary margin of the right eye. The IOL was clear with suspected homogenous whitish fluid behind the IOL, and no pseudophakodonesis was noted. A Soemmering ring located anterior to the IOL optic, along with a fibrotic edge surrounding a small continuous curvilinear capsulorhexis (CCC) with a size of 5 mm, indicative of an in-the-bag IOL position, was observed. The posterior segments were obscured due to media opacity. Slit-lamp biomicroscopy

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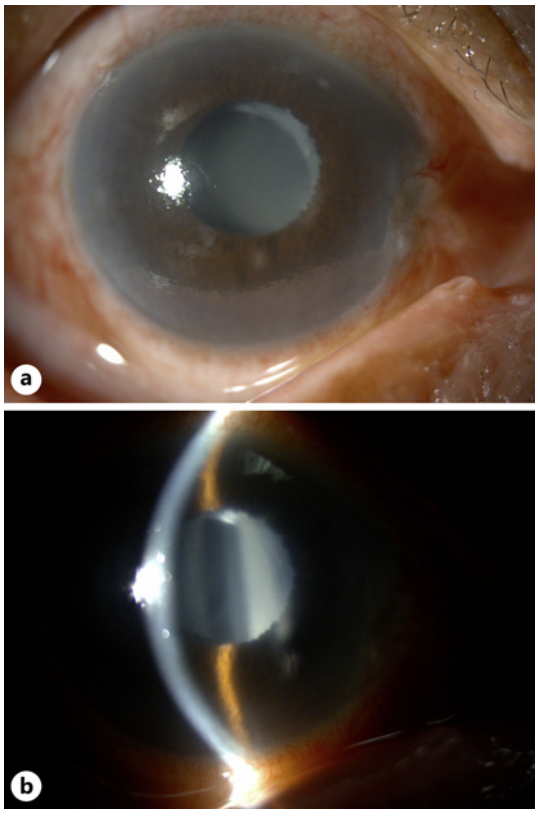

Fig. 1. Slit-lamp biomicroscopy of the right eye revealed corneal haze grade 1 with epithelial microcysts, a shallow anterior chamber with iris bombe at the superior region, without posterior synechiae. The pupil was fixed, dilated, and showed no reactivity. Additionally, a Soemmering ring was observed along with a cloudy intraocular lens (IOL).

of the left eye showed loss of pupillary ruff and exfoliative material at the pupillary margin; otherwise, it was unremarkable. Gonioscopy revealed a convex iris and 360° iridotrabecular contact in the right eye and a wide-open angle in the left eye. In the right eye, the refraction was −6.25 + 2.25 × 1, and the axial length was 23.07 mm. Anterior segment optical coherence tomography (AS-OCT) was performed to identify the cause of angle closure and confirm the diagnosis of CBS. AS-OCT showed a 360° convex iris configuration with hyperreflective material located between the superior pupillary margin and the IOL, as well as capsular bag distention with hyperreflective fluid between the IOL and posterior capsule, without any opacity in the IOL (shown in Fig. 2). Compared with the left eye, the IOL in the right eye was in the anterior position, and the anterior chamber was shallower. It was determined that the patient had CBS with pupillary block angle-closure glaucoma. The IOP was controlled by using systemic and topical antiglaucoma medications before further management. Laser peripheral iridotomy (LPI) was performed to eliminate the pupillary block. Subsequently, posterior capsulotomy with an Nd:YAG laser was performed to release turbid fluid into the vitreous cavity. Prompt therapy resulted in the disappearance of whitish fluid and modest deepening of the anterior chamber without an iris bombe (shown in Fig. 3). The final BCVA was gradually improved to 20/80, and the IOP was decreased to 8 mm Hg with few antiglaucoma medications.

Discussion

Pseudophakic pupillary block angle-closure glaucoma is an infrequent occurrence following uneventful cataract surgery with posterior chamber IOL implantation. This condition can manifest immediately after surgery or within days, weeks, months, or even years

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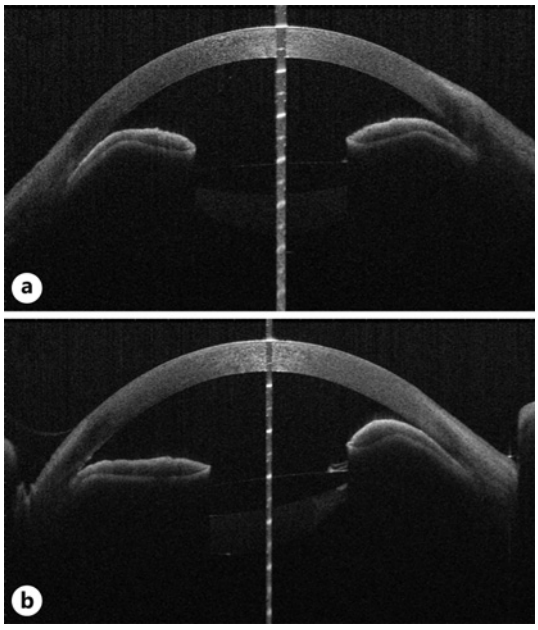

Fig. 2. Anterior segment optical coherence tomography (AS-OCT) showed a 360° convex iris configuration with hyperreflective material located between the superior pupillary margin and the intraocular lens (IOL). There was also capsular bag distention with hyperreflective fluid observed between the IOL and the posterior capsule, without any opacity in the IOL (**a** horizontal plane, **b** vertical plane).

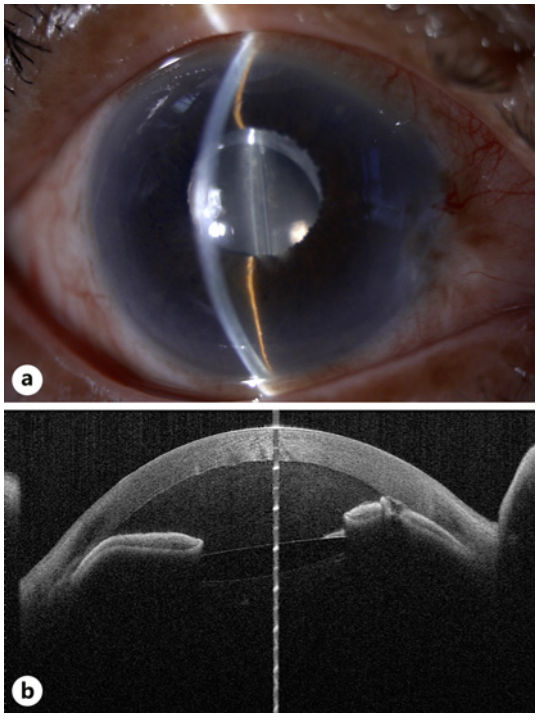

Fig. 3. Following laser peripheral iridotomy (LPI) and Nd: YAG capsulotomy, slit-lamp biomicroscopy and anterior segment optical coherence tomography (AS-OCT) demonstrated the disappearance of whitish fluid, and the anterior chamber was slightly deepening without iris bombe (**a** slit-lamp biomicroscopy, **b** AS-OCT).

postoperatively. In this case, CBS served as another cause of pseudophakic pupillary block angle-closure glaucoma. CBS is a relatively rare complication, with an incidence of 0.73% [7] that may occur following phacoemulsification with posterior chamber IOL implantation. It is characterized by the accumulation of fluid within the capsular bag, particularly in the space between the posterior capsule and IOL [5]. A decline in visual acuity can be caused by ocular media opacity resulting from white turbid fluid and a myopic shift due to capsular distention,

subsequently causing the IOL-iris diaphragm to move forward [5]. Miyake et al. [6] proposed the first classification of CBS in 1998: intraoperative, early postoperative, and late postoperative. A subsequent classification was proposed in 2008 by Kim and Shin [7]. Intraoperative CBS arises during rapid hydrodissection with high pressure and a large volume of balanced salt solution, leading to fluid accumulation between the capsular bag and lens, pushing the lens anteriorly, causing a shallow anterior chamber and elevated IOP, potentially resulting in posterior capsule rupture and posterior lens dislocation [6]. Consequently, careful hydrodissection is crucial for preventing this complication during cataract surgery [6]. Early postoperative CBS occurs within the first 2 weeks after cataract surgery. A possible mechanism is the accumulation of viscoelastic material behind the IOL, as described by Miyake et al. [6], which corresponds to the noncellular postoperative CBS described by Kim and Shin [7]. Another plausible mechanism is the exudative process of lens epithelial cells originating from trapped lens fragments, termed inflammatory postoperative CBS [7]. Fluid accumulation behind the IOL can lead to forward displacement of the IOL-iris diaphragm, resulting in decreased anterior chamber depth, potentially leading to secondary angle-closure glaucoma and a myopic shift [6–8]. This condition could be misdiagnosed as pupillary block glaucoma or endophthalmitis [8]. Late postoperative CBS has been reported between 2 months and 6 years after cataract surgery, with an average onset of 3.8 years following the procedure [6, 9]. This form of CBS arises from fibrosis occurring between the edge of the anterior capsule opening and the IOL optic, resulting in the formation of a closed chamber within the capsular bag [6–9]. It is characterized by the accumulation of whitish fluid behind the IOL, which may originate from the proliferation and metaplasia of lens epithelial cells [6]. Kim and Shin also proposed this condition as fibrotic postoperative CBS [7]. Notably, late postoperative CBS is not associated with a shallow anterior chamber, myopic shift, or increased IOP, which is typically observed in early postoperative CBS [5–9]. Liu and Chou [10] reported a case of late-onset CBS with secondary angle-closure glaucoma occurring 1 year after cataract surgery. In this particular case, a single-piece PMMA lens with ciliary sulcus fixation was implanted, which can significantly increase the risk of developing pseudophakic pupillary block angle-closure glaucoma. However, the patient exhibited a uniformly shallow anterior chamber with elevated IOP, resulting from the forward movement of the iris-IOL diaphragm, representing a non-pupillary block mechanism. Srinivasan et al. [4] also reported a case of secondary angle-closure glaucoma resulting from inflammatory CBS that occurred 7 weeks after uneventful cataract surgery with posterior chamber IOL implantation. Nevertheless, this case presented with intense fibrinous uveitis and secondary angle-closure glaucoma, which are typically classified as delayed presentations of early-onset CBS or inflammatory CBS. This presentation differs from that of our report (shown in Table 1).

We present a case of CBS that manifested 13 years after uneventful cataract surgery with posterior chamber IOL implantation. To the best of our knowledge, we identified a late postoperative CBS presenting with an acute-onset pupillary block angle-closure attack, which has not been previously reported in the literature. Kim and Shin [7] found that a long axial length greater than 25 mm and the type of IOL, particularly the 4-haptic IOL (Akreos Adapt) with no posterior angulation, are statistically significant risk factors for the development of postoperative CBS. Additionally, Theng et al. [8] also found that smaller CCC, typically with a diameter of 4.5–5.0 mm, may potentially increase the risk of postoperative CBS. This might be attributed to the greater surface area of contact between the anterior capsule and the entire IOL optic. In our particular case, the use of the AcrySof IOL (model SA60AT), a hydrophobic acrylic IOL with zero angulation, in conjunction with a small CCC could potentially be a risk factor for the development of late postoperative CBS. Although clinical signs of pseudoexfoliation syndrome are observed only in the fellow eye, the natural history of pseudoexfoliation syndrome often exhibits bilateral asymmetry. It was postulated

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Table 1. Summary of 5 case reports of CBS with secondary angle-closure glaucoma, including this case report

Source	Age (years)/ sex	Onset	Presentation	Type of cataract surgery	Type of IOL	Type of CBS
This case	87/M	13 years	Iris bombe + shallow anterior chamber, IOP 56 mm Hg	PE + PC IOL	Foldable acrylic AcrySof IOL (SA60AT)	Late-onset [6] or fibrotic [7] CBS
Srinivasan et al. [4]	78/F	7 weeks	Shallow anterior chamber, intense fibrinous anterior uveitis with 360° posterior synechiae, IOP 59 mm Hg	PE + PC IOL	One-piece acrylic IOL (CT Asphina 409 MP)	Early-onset [6] or inflammatory [7] CBS
Theng et al. [8]	60/F	1 day	Mid-dilated pupil with shallow anterior chamber, IOP 30 mm Hg	PE + PC IOL	Foldable acrylic AcrySof IOL	Early-onset [6] or noncellular [7] CBS
	73/F	1 day	Shallow anterior chamber, IOP 35 mm Hg	PE + PC IOL	Foldable acrylic AcrySof IOL	Early-onset [6] or noncellular [7] CBS
Liu and Chou [10]	83/M	1 year	Uniformly shallow anterior chamber, IOP 33 mm Hg	PE + ciliary sulcus fixation PC IOL	PMMA IOL	Late-onset [6] or fibrotic [7] CBS

that the patient had subtle zonular laxity, which predisposed the IOL to move forward. Additionally, the persistent presence of the Soemmering ring could contribute to pupillary block angle closure by promoting the proliferation of retained lens epithelial cells, leading to thickening of the equatorial zone and subsequent blockage of aqueous flow at the IOL-iris interface [3]. We hypothesized that the Soemmering ring may share a common mechanism with fibrotic CBS. This mechanism could involve the proliferation of residual lens epithelial cells, leading to increased contact between the anterior capsule opening and the IOL optic, which creates a closed space behind the IOL, resulting in the development of fibrotic CBS. Even in cases of late postoperative CBS, fluid accumulation behind the IOL can initiate a posterior pushing mechanism that moves the IOL forward to the prominently positioned Soemmering ring located in the superior region between the IOL and anterior capsule. This blockage impedes aqueous flow, resulting in an asymmetrically shallow anterior chamber with an iris bombe in the superior region, indicative of pupillary block angle-closure glaucoma along with a significant myopic shift. Although late CBS can often be diagnosed based on clinical history and careful slit-lamp examination, imaging modalities such as ultrasound biomicroscopy (UBM) or AS-OCT prove valuable in confirming the diagnosis and distinguishing it from other potential causes [5]. AS-OCT, as a noninvasive diagnostic technique, offers high resolution, low variability, and ease of use [5]. In cases of suspected CBS, AS-OCT can precisely assess the location and characteristics of the IOL and determine the depth of opacity, which is a crucial factor in distinguishing IOL opacity or posterior capsule opacity from CBS [11]. AS-OCT findings for CBS typically reveal a fibrotic anterior capsulotomy margin, the presence of a hyperreflective substance behind the IOL within an enlarged capsular bag with an intact posterior capsule, and a clear IOL [11]. Accurate diagnosis of CBS and differentiation from IOL opacity or posterior capsule opacity are crucial

for proper management, avoiding unnecessary invasive procedures [11]. Late CBS may resolve spontaneously owing to the contraction of fibrosis in the anterior capsule, creating an opening for fluid drainage [9]. Nevertheless, most patients require treatment. Nd:YAG capsulotomy is the treatment of choice for late-onset CBS [5, 12]. This procedure can be performed using both anterior and posterior techniques [5, 13]. Anterior capsulotomy has a lower success rate and a higher recurrence rate than posterior capsulotomy [5, 14]. This technique requires dilation of the iris beyond the IOL optic to facilitate fluid egress [13]. Performing an anterior capsulotomy can potentially result in a sudden rise in IOP due to the rapid release of milky white fluid containing collagen and extracellular matrix into the anterior chamber, which may pose challenges in terms of drainage through the trabecular meshwork [5, 12, 14]. On the other hand, posterior capsulotomy is safe and effective because it releases fluid into the vitreous cavity, resulting in the restoration of visual acuity [15]. Nonetheless, performing a posterior capsulotomy can be challenging in cases when the posterior capsule is distended within the mid-vitreous or when the fluid is turbid and opaque [12–15]. Therefore, in cases of late CBS with poor mydriasis and opaque fluid, Nd:YAG LPI followed by anterior capsulotomy is an alternative procedure [13]. Surgical management of late CBS is a safe and effective approach, particularly when capsulotomy cannot be easily performed [5, 12]. In this case, LPI was performed at the 2 o'clock position to eliminate the pupillary block from aqueous accumulation between the posterior iris surface and the superiorly located Soemmering ring. After the LPI procedure, the iris bombe was successfully resolved, the IOP decreased, and the anterior chamber deepened, although it remained shallow. Subsequently, a posterior capsulotomy was performed, which led to the disappearance of the white turbid fluid located behind the IOL, resulting in an improvement in vision.

Pseudophakic pupillary block angle-closure glaucoma following uneventful cataract surgery with posterior chamber IOL implantation is uncommon. This condition can be attributed to various causes. CBS should be considered as a potential cause, even in the late postoperative period. The zonular laxity observed in pseudoexfoliation syndrome, in conjunction with the presence of a Soemmering ring, could potentially act as a predisposing factor for late-onset CBS accompanied by pupillary block. The management of late-onset CBS with pupillary block angle-closure glaucoma includes LPI to alleviate pupillary block, followed by a subsequent Nd:YAG capsulotomy. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000536118).

Statement of Ethics

This study was reviewed and approved by the Institutional Review Board (IRB), Royal Thai Army Medical Department, approval number 0052/2566. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

All authors attest that they meet the current ICMJE criteria for authorship. The authors confirm their contribution to the paper as follows: Study conception and design: Panhathai Yaisiri, Panrapee Funarunart, and Isaraporn Treesit. Sourcing and editing of clinical images and drafting of the text: Panhathai Yaisiri. Data analysis and interpretation, reviewing the text critically for important intellectual content, and approving the final version of the manuscript: Panhathai Yaisiri, Panrapee Funarunart, and Isaraporn Treesit.

Data Availability Statement

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

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