Case Report: Retained Lens Fragment in the Anterior Chamber 32 Years after Cataract Surgery

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Abstract
A 73-year-old Asian male presented to the eye clinic reporting a sudden onset of redness, irritation, and light sensitivity of the right eye 32 years after cataract surgery. While retained lens fragment in the anterior segment is an uncommon complication of cataract surgery, this case highlights a unique complication that should be considered as a differential diagnosis for cases of post-operative cataract surgery. It is important to consider a retained lens fragment as a differential when examining pseudophakic patients. Retained lens fragments can present weeks to years after cataract surgery with the more chronic cases secondary to nuclear fragments. Topical medications such as corticosteroids, non-steroidal anti-inflammatories, and cycloplegics can be used in treatment of the acute anti-inflammatory event. If persistent inflammation and/or cystoid macular edema becomes an issue, management with subspecialty ophthalmology to remove the lens fragment is warranted. This case represents the longest time in literature between cataract surgery and the appearance of the retained lens fragment.

Key Words: lens fragment, anterior chamber, anterior uveitis, cystoid macular edema

Introduction
Retained lens fragments of nuclear or cortical etiology in the anterior chamber have the potential to cause ocular complications including anterior uveitis, corneal edema, secondary glaucoma, and cystoid macular edema (CME). Proper diagnosis and treatment with topical and/or surgical co-management are crucial in preventing chronic ocular complications.

Case Report
A 73-year-old Asian male presented to the eye clinic reporting a sudden onset of redness, irritation, and light sensitivity of the right eye. He also reported blurry vision in the right eye similar to looking through a dirty windshield. His last eye examination was two years prior and his ocular history was remarkable for having had cataract surgery in the right eye in 1985 and cataract surgery with phacoemulsification in the left eye in 2012. The patient also had a posterior capsulotomy and laser peripheral iridotomy procedure done at an unknown time frame previously in the right eye. He denied any history of ocular trauma or injury. The patient was a low-risk glaucoma suspect and was previously taking timolol maleate eye drops from 1980 to 2007. The drops were discontinued by ophthalmology in 2007 due to stable visual fields and optic nerve appearance. The patient's medical history was positive for hypertension and pertinent medications include losartan and metoprolol.

On initial examination, his entering distance corrected visual acuities were 20/30 in the right eye and 20/20 in the left eye. Pupils were equal, round, and reactive to light with no afferent pupillary defect. Extraocular motility and confrontation fields were full in both eyes. Manifest refraction revealed myopic astigmatic correction in both eyes with best-corrected visual acuities of 20/30 in the right eye and 20/20 in the left eye. Intraocular pressure was 15 mmHg in the right eye and 15 mmHg in the left eye as measured with Goldmann Applanation Tonometry. Slit lamp biomicroscopy revealed mild conjunctival bulbar injection and a grade 1 anterior chamber reaction in the right eye. A small whitish fragment in a crescent shape form was observed in the inferior portion of the anterior chamber (Fig. 1) with a gonioscopic lens. There was no corneal edema upon examination. Dilated fundus exam revealed mild retinal thickening in the foveal region of the right eye and optical coherence tomography of the macula utilizing the Heidelberg Spectralis (Heidelberg Engineering, Heidelberg, Germany) revealed numerous intraretinal cystic cavities in the foveal region of the right eye confirming the presence of cystoid macular edema (Fig 2). The patient was instructed to start 1% prednisolone acetate eye drops four times daily, 1% cyclopentolate hydrochloride eye drops four times daily, and 0.5% ketorolac tromethamine eye drops four times daily for the anterior uveitis and cystoid macular edema. The patient was scheduled to return for a follow up in 3-4 days for an
anterior segment progress evaluation and an anterior segment OCT. At this time, differential diagnoses that were considered were post-cataract surgery complications including Irvine-Gass Syndrome, idiopathic anterior uveitis, and retained lens fragment induced uveitis.

The patient returned four days later reporting no changes in symptoms from initial examination. He reported excellent compliance with his topical eye medications. Entering distance corrected visual acuities were 20/30 in the right eye and 20/20 in the left eye. The right eye pupil was dilated secondary to the patient’s use of 1% cyclopentolate hydrochloride drops and the left eye pupil was round and reactive to light. There was no afferent pupillary defect by reverse swinging flashlight test. Extra ocular motility and confrontation fields were full in both eyes. Intraocular pressure was 22 mmHg OD and 16 mmHg OS as measured with Goldmann Applanation Tonometry. Slit lamp biomicroscopy of the right eye revealed mild conjunctival bulbar injection and a Grade 1 anterior chamber reaction. There was no corneal edema inferiorly where the lens fragment was situated. Gonioscopy and Visante anterior segment optical coherence tomography (Carl Zeiss, Oberkochen, Germany) were performed confirming the retained lens fragment in the inferior angle of the anterior chamber of the right eye (Fig. 1) Due to patient’s response to steroids (IOP elevation) in the right eye, the patient was appropriately managed with dorzolamide hydrochloride-timolol maleate eye drops twice a day in the right eye. His entering distance corrected visual acuities were 20/30 in the right eye and 20/20 in the left eye. Pupils were equal, round, and reactive to light with no afferent pupillary defect. Extra ocular motility and confrontation fields were full in both eyes. Manifest refraction revealed myopic astigmatic correction in both eyes with best-corrected visual acuities of 20/20 in the right eye and 20/20 in the left eye. Intraocular pressure was 19 mmHg OD and 19 mmHg OS as measured with Goldmann Applanation Tonometry. Slit lamp biomicroscopy of the right eye revealed retained lens fragment inferiorly in the anterior chamber and no anterior chamber inflammation. A follow-up optical coherence tomography of the macula revealed resolved cystoid macular edema and a normal foveal contour in the right eye (Fig. 3). The patient was advised to continue care with the retina specialist for removal of lens fragment.

Management and Outcome
The patient returned four months later reporting improvement of symptoms and vision. He was also concurrently being followed by a retina specialist. He was using 1% prednisolone acetate eye drops twice a day in the right eye and dorzolamide hydrochloride-timolol maleate eye drops twice a day in the right eye. His entering distance corrected visual acuities were 20/30 in the right eye and 20/20 in the left eye. Pupils were equal, round, and reactive to light with no afferent pupillary defect. Extra ocular motility and confrontation fields were full in both eyes. Manifest refraction revealed myopic astigmatic correction in both eyes with best-corrected visual acuities of 20/20 in the right eye and 20/20 in the left eye. Intraocular pressure was 19 mmHg OD and 19 mmHg OS as measured with Goldmann Applanation Tonometry. Slit lamp biomicroscopy of the right eye revealed retained lens fragment inferiorly in the anterior chamber and no anterior chamber inflammation. A follow-up optical coherence tomography of the macula revealed resolved cystoid macular edema and a normal foveal contour in the right eye (Fig. 3). The patient was advised to continue care with the retina specialist for removal of lens fragment.

Surgery was performed on the right eye under local anesthesia to remove the lens fragment with an anterior chamber washout. The time interval between identification of the retained lens fragment and definitive removal was five months. There was post-operative elevated intraocular pressure in the right eye and the patient was instructed to use timolol maleate eye drops once a day in the right eye. The patient returned to the
eye clinic for an annual examination one year from the initial examination when lens fragment was discovered. The previous fragment in the anterior chamber was removed and there was no inflammation in the anterior chamber or cystoid macular edema at the most recent visit. Gonioscopy and anterior segment optical coherence tomography revealed absence of fragment in the inferior angle. (Fig. 4) Optical coherence tomography of the macula revealed fully resolved macular edema and gonioscopy findings revealed absence of lens fragment in the inferior angle (Fig. 4).

The patient was seen for a follow up examination three and a half years from initial examination and two and a half years post-removal of the retained nuclear fragment in the right eye. Measurements of the patient’s axial length on the Zeiss IOL Master and endothelial cell count and morphology analysis on the Konan Medical Specular Microscope were obtained at this visit. The axial length measured for the right eye is 24.93 mm and the axial length measured for the left eye is 25.01 mm. Both values do not correspond to the patient having pathologic myopia before cataract surgery. Pathologic myopia is defined as axial length of >26.5 mm or refractive error of ≥6.00 diopters. Anterior chamber depth (ACD) values in the right eye is 3.33 mm and in the left eye is 4.88 mm. The ACD of the right eye is more shallow than the left eye, though both values are within normal ranges. The average anterior chamber depth is approximately 3.5 mm.1,2

Endothelial cell count for both the central endothelial cells and inferior endothelial cells were obtained. The average endothelial cell density (ECD) by the age of 70 and over is approximately 2,300-2,500 cells/mm².3 ECD for the central cornea was 2278 cells/mm² in the right eye and 3067 cells/mm² in the left eye. ECD for the inferior cornea was 2421 cells/mm² in the right eye and 2857 cells/mm² in the left eye. The patient’s central and inferior endothelial cell count is within expected age norms, but the right eye’s central ECD is much less than the left. Percentage of hexagonal cells for the central endothelium is 30% in the right eye compared to 50% in the left eye. The inferior endothelium values for hexagonality are more comparable, respectfully at 40% for the right eye and 42% for the left eye. This indicates that there may have been some endothelial decompensation reflected by the degree of polymegathism and polymorphism in the right eye. One would expect the inferior endothelium to be more affected than the central endothelium with respects to the location of the retained nuclear fragment in the right eye.

Discussion
Retained lens fragments within the anterior chamber following successful cataract surgery are typically rare in occurrence. It has been reported by Dada et al that this condition occurs in less than 1% of routine cataract surgeries.4 Reports of frequency of retained lens fragments or dropped nuclei after phacoemulsification procedures is estimated to be between 0.3% and 1.1%.4,5,8,17 An exact incidence is difficult to conclude as the number of existing studies on incidence rate of retained lens fragments are too few to allow for definitive conclusions. The largest study to date included 16 patients and was limited to diagnosis of retained nuclear lens fragments. With new lens fragmentation devices available, the incidence of retained lens fragments may increase.4,6

Retention of lens material from phacoemulsification has the potential to induce anterior chamber inflammation and/or cystoid macular edema even decades after cataract surgery. Late-onset inflammation following cataract surgery is classically related to uveitis, infection, retinal detachment, epithelial downgrowth, or masquerade syndromes.9 Retained lens fragments can be hidden for years before they cause inflammation in the eye. The retained fragment may potentially be part of the nucleus or the cortex of the previous old lens. In previous studies, retained cortical fragments tend to have higher chances of resolution of inflammation and resorption of cortical material with topical corticosteroid therapy.4,6 In one of the largest studies of retained lens fragment by Zachary et al, observation of retained cortex material within the capsular bag following uncomplicated cataract surgery does not seem to produce inflammation or corneal edema.4,6
On the other hand, retained nuclear fragments tend to cause persistent inflammation and corneal edema. Nuclear fragments tend to not reabsorb with topical corticosteroids and will remain in the anterior chamber, often inciting prolonged inflammatory reaction or mechanical damage to the corneal endothelium leading to localized corneal edema. Inflammation may be seen immediately after cataract extraction, but also may occur much later. Kang et al reported a case of retained nuclear fragments 15 years postoperatively.

The pathophysiology for retained lens fragment remains unclear. There have been multiple hypotheses of this occurrence in the anterior chamber. Some researchers have hypothesized that the lens fragment may have been hidden behind the iris, trapped in the main incision or the side port incision, or hidden in the posterior chamber after cataract surgery. During this extensive period of time, the lens fragment may not produce an anterior chamber inflammation nor cystoid macular edema. This case report illustrates a delayed appearance and induced inflammatory response to unencapsulated nuclear material that has been hidden in the eye for 32 years. The lens fragment was not visualized at previous examinations on slit lamp biomicroscopy and gonioscopic evaluation.

The lack of chronic inflammatory reaction over the past three decades concludes that the lens fragment may have had a delayed presence in the anterior chamber. Alternatively, the lens fragment may have become sequestered in the posterior capsule with no inflammation after cataract surgery. The postulation of fragments becoming trapped in the main incision or side port incision have been discussed in Dada et al study. The study of 1000 cases of phacoemulsification revealed that lens fragments were present after phacoemulsification in 33 cases in the 2:30 position side port, 21 in the 12 o’clock incision, 8 over the iris, and 3 under the iris. In those cases in which the lens fragment was located under the iris, the pupil was noted to be small. However, there were no eyes in the Dada et al study that presented with postoperative retained fragments.

Contributing factors to incidence of retained lens fragments include axial myopia, presence of a hard nucleus, miotic pupils with limited pupillary dilation, previous vitrectomy, traumatic cataract, disorders such as pseudoexfoliation syndrome (PXF) or Marfan syndrome that predisposes to weakening of lens zonules, surgeon’s inexperience with phacoemulsification technique, and patient movement during cataract surgery. Individuals who are highly myopic often have deeper chambers due to longer axial lengths, which may allow smaller fragments behind the iris in these larger eyes.

The diagnosis of retained lens fragments can be difficult, often requiring high suspicion to perform the necessary ancillary testing for confirmation of the fragment. Slit lamp biomicroscopy is important for confirmation of retained lens fragments, likely located in the inferior angle or the interior anterior chamber. In cases where inferior corneal edema is present, gonioscopy is warranted to check for the retained lens fragment in the inferior angle. In a retrospective study by Zachary et al, all lens fragments were located in the inferior angle or the inferior anterior chamber. 13% of the cases in the study required gonioscopy for diagnosis. Other important diagnostic tools include anterior segment optical coherence tomography to visualize the fragment in the angle of the anterior chamber as well as optical coherence tomography of the macula to check for any induced cystoid macular edema.

Retained lens fragments causing an inflammatory reaction can be treated with topical corticosteroids. With lens fragments that also induce cystoid macular edema, an additional topical non-steroidal anti-inflammatory medication should be added. Generally, the inflammation should subside and lens fragment should reabsorb with topical medications. If this is the case, the fragment is likely a cortical remnant. Retained unencapsulated nuclear material frequently causes persistent inflammation and no reabsorption after topical medications. Nuclear fragments also tend to be more dense in comparison to cortical fragments, which appear more cotton-like and wispy.

The few cases in literature of retained nuclear fragments with persistent inflammation required surgical removal to improve the anterior chamber reaction and/or cystoid macular edema. Conventionally, most clinicians favor surgical intervention to remove the nuclear harder, appearing-lens fragments. For the softer epinuclear and cortical-appearing fragments, conservative treatment with topical corticosteroid therapy is generally favored. For chronic cases of inflammation secondary to a retained lens fragment, an anterior chamber washout is necessary to remove the fragment.

Looking at a clinical standpoint, the study by Zachary et al found that upon removal of lens fragments, 83% of patients with corneal edema had resolution within 1 month, though there were 5 patients whose corneal edema did not resolve after surgical removal of lens fragments. This suggests that the longer the lens fragment remains dislodged in the anterior chamber, the more the patient is at risk for permanent endothelial damage. It has been proposed previously by Guarnieri et al that the number of endothelial cell count decreases with longer duration of corneal edema related to retained lens material in the anterior chamber. It is important to be aware that corneal decompensation can result from corneal edema secondary to retained lens fragments. A retained lens fragment causing persistent corneal edema should be surgically removed.

This case highlights a unique complication that should be considered as a differential diagnosis for cases of post-operational cataract surgery even decades after cataract surgery. This case has shown that the time interval between cataract surgery and the appearance of a lens fragment in the anterior chamber can be as long as 32 years. Due to chronicity of the lens fragment in the patient’s eye, the fragment is considered to likely be nuclear. Understanding the contributing factors for patients more at risk with having retained lens material is important. Important ancillary testing...
such as gonioscopy and an anterior segment ocular coherence tomography are important to perform when a pseudophakic patient presents with anterior uveitis to evaluate the angle and confirm retained lens fragments. Treatment for anterior uveitis and cystoid macular edema include topical corticosteroids and topical non-steroidal anti-inflammatory medications. Other diagnostic testing that could have been obtained during the initial presentation of the lens fragment is endothelial cell density (ECD). However, at the most recent examination which was three and a half years from the initial presentation, ECD was measured for educational purposes and revealed that there may have been some endothelial decompensation with the retained lens fragment when comparing cell density and morphology of both eyes. Overall, it is important to refer patients for cases of persistent inflammation that may require surgical intervention to remove the retained nuclear fragment, as prolonged inflammation can lead to more ocular complications.

REFERENCES