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The Lens That Lost Its Lustre: Clinical Insights from Five Cases of PCIOL Opacification

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Abstract: ***This article presents five cases of delayed intraocular lens opacification following cataract surgery with hydrophilic acrylic posterior chamber intraocular lens implantation. The cases describe progressive visual decline occurring several years after otherwise successful surgery, with clinical findings, surgical management, and visual outcomes after lens exchange. Common features included optic calcification, reduced visual acuity, and the need for explantation in most affected eyes. The discussion examines possible causes of lens opacification, including material properties, manufacturing factors, disruption of the blood aqueous barrier, diabetes mellitus, and surgical influences. Available evidence on different patterns of calcification, diagnostic methods, and the technical challenges of intraocular lens exchange is also reviewed. The report highlights the need for careful long-term follow-up of patients with hydrophilic acrylic lenses and supports timely recognition and management of this uncommon but vision-limiting postoperative complication.***

Keywords: Cataract surgery, Intraocular lens opacification, Hydrophilic acrylic lens, Lens calcification, Intraocular lens exchange

1. Introduction

Cataract surgery with posterior chamber intraocular lens (PCIOL) implantation is among the most frequently performed surgical procedures.[1] Currently available foldable intraocular lens (IOL) materials include silicone, hydrophobic acrylic, and hydrophilic acrylic or hydrogel.[2] Posterior capsular opacification (PCO) due to lens epithelial cell growth from the remaining lens capsule occurs in up to 19% of eyes three years after cataract surgery with a posterior chamber intraocular lens.[1] A notable late postoperative complication, particularly associated with hydrophilic lenses, is IOL opacification. This condition arises due to the deposition of calcium phosphate either on the surface or within the substance of the IOL. The most common underlying mechanisms include calcification and the formation of glistening within the lens material.[1,2] Several factors contribute to the development of opacification, such as the type of IOL material, host biological environment, packaging conditions, and mechanical factors like impressions from surgical instruments.[3] The incidence of glistening is highly variable and is particularly high- ranging from 66% to 100%- in earlier generations of hydrophilic acrylic lenses.[4]

Here, we report five cases of opacification of IOL, all 5 lenses being hydrophilic acrylic.

Case report 1: A 63-year-old male presented with diminished vision in right eye from the past 5 months. The patient had undergone phacoemulsification with implantation of Hydrophilic acrylic PCIOL in right eye 6 years back elsewhere and achieved 6/6 post operative Best corrected Visual acuity (BCVA). Patient had grade 2 nuclear sclerosis in the left eye. He was a known case of diabetes mellitus for the last 10 years and was well controlled with oral medications. The patient was asymptomatic for 2 years postoperative when he started to notice glare in his vision in the right eye. The glare gradually progressed to diminished vision in the right eye. On slit lamp biomicroscopy, a well centred opacified foldable IOL was seen. Fundus was normal in both eyes. Intraocular pressure (IOP) by Goldmann applanation tonometry (GAT) was 16mm of Hg and 14 mm of Hg in right and left eye respectively. After written consent, patient underwent IOL exchange with rigid PMMA PCIOL which was placed in sulcus as pre operative PCR was present. Patient's post op vision was 6/9 in the right eye. Explanted IOL was single piece with opacification of optic seen on both sides

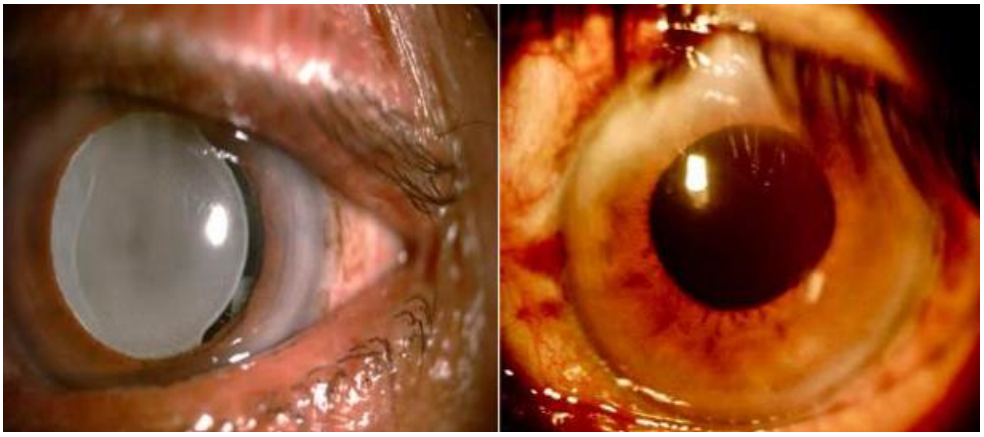

Figure 1: Pre operative (Right) & post operative (Left) images of first case

Case report 2: A 70 years male presented with diminished vision in left eye from the past 3 months. The patient had

undergone Phacoemulsification with implantation of hydrophobic in both eyes. The right eye was operated 5 years back and left eye was operated 6 years back. Patient was a known case of diabetes mellitus under control on oral hypoglycemic agents.

On examination, his BCVA was 6/18 in the right eye and 4/60 in the left eye. Intraocular pressure recorded with Goldmann applanation tonometry was 16- and 18-mm Hg in right and left eye respectively. Slit lamp examination of the left eye under pupillary dilatation revealed opacified single piece IOL in the capsular bag. There was no posterior capsular opacification (PCO). Right eye examination showed single piece IOL in the bag with no PCO. Posterior segment showed no diabetic retinopathy in right eye and media was hazy in the left eye. B scan was done which was within normal limit. After written informed consent, patient was taken up for IOL exchange and PCIOL was seen adhered to the capsule. PCIOL was explanted with the bag and Iris claw lens was implanted. Explanted IOL was single piece with opacification of optic seen on both sides. The Explanted IOL was found with very large calcified deposits on the surface of the lens, as well as smaller multiple calcified deposits within the subsurface of the lens, in both optic and haptic components. Post op UCVA was 6/12 in the left eye.

Figure 2: Pre operative (Right) & post operative (Left) images of second case

Case 3: A 67-year-old male presented with gradually progressive decrease in right eye vision since last 6 months. Patient had undergone right eye cataract surgery with implantation of hydrophilic acrylic IOL 6 years back (operated somewhere else). He had no systemic illness and was not on any medications. On examination, his BCVA was 6/60 and 6/6 in right and left eye respectively. IOP recorded with Goldmann applanation tonometry was 19 mm Hg in right eye and 21 mm Hg in left eye. Slit lamp examinatioin of right showed posterior chamber intraocular lens with crescent-shaped opacification of anterior surface of intraocualr lens and total opacification of posterior intraocular lens surface (Fig. 1C). Left eye showed posterior chamber IOL with no significant anterior or posterior capsular opacification. Posterior segment was within normal limits in both eyes. After written informed consent, patient underwent IOL exchange with rigid PMMA PCIOL. Explanted IOL was single piece with asymmetric opacification of IOL optic seen on both sides. Postoperatively patient achieved BCVA of 6/9.

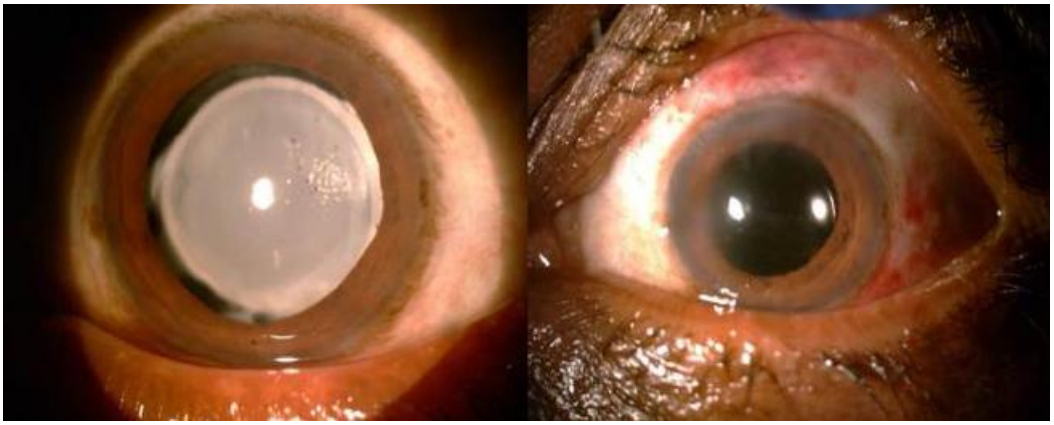

Figure 3: Pre operative (Right) & post operative (Left) images of third case

Case 4: A 68-year-old female presented with gradually progressive decrease in left eye vision since 4 months. Patient had undergone both eye cataract surgery 12 years ago. She is a known case of Diabetes since 6 years and hypertension since 15 years. On examination, BCVA of the right eye was 6/12(p) and left eye finger counting at 2 metres. IOP recorded with Goldmann applanation tonometry was 12 mm Hg in right eye and 11 mm Hg in left eye. Slit lamp examination of right eye showed posterior chamber IOL opacification and left eye showed focal bullous keratopathy. Posterior segment was within normal limits in both eyes. Patient was advised to wait as

vision was 6/12 and patient was not having complaint.

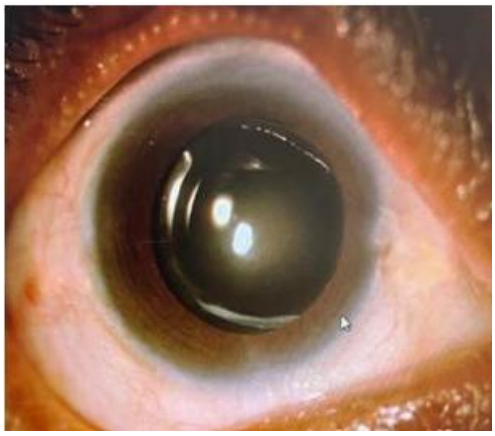

Figure 4: Pre operative image of forth case

Case 5: A 60-year-old male presented with gradually progressive decrease in both eye vision since 2 months. Patient had undergone left eye cataract surgery 2 years back. He had no systemic illness and was not on any medications. On examination, BCVA of the right eye was 3/60 and left eye fingers counting at 2 metres. IOP recorded with Goldmann applanation tonometry was 14 mm Hg in right eye and 13 mm Hg in left eye. Slit lamp examination of left showed posterior chamber IOL with opacification and right eye showed nucleus sclerosis grade 2. Posterior segment was within normal limits in both eyes.

After written informed consent, patient was taken up for IOL exchange and PCIOL was seen adhered to the capsule. PCIOL was explanted with the bag and Iris claw lens was implanted.

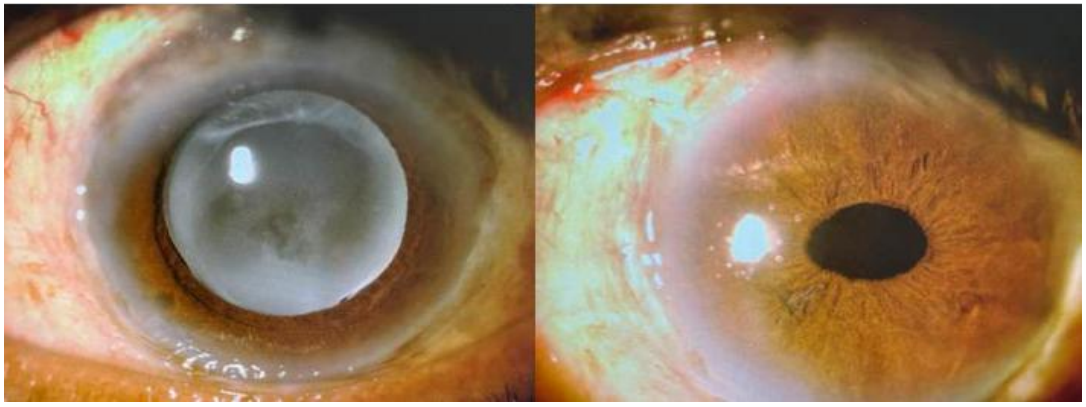

Figure 5: Pre operative (Right) & post operative (Left) images of fifth case

2. Discussion

Silicone and acrylic IOL are foldable and therefore more useful in small incision surgeries while PMMA are excellent for their rigidity and are used for scleral sutured IOLs in complicated cases.4 Hydrophobic lenses are more likely to result in glistening whereas hydrophilic lenses are more likely to result in PCO.[5] While posterior capsular opacification (PCO) remains the most frequent late complication following phacoemulsification with posterior chamber intraocular lens (PCIOL) implantation, opacification of the IOL itself represents another significant cause of delayed visual deterioration, particularly in patients with hydrophilic acrylic IOLs.[2,3] Reports from various authors worldwide have documented optic opacification in IOLs composed of different biomaterials.

Based on clinical and microscopic evaluation of over 400 explanted lenses, Neuhann et al. classified IOL calcification into three main types:

1) Primary calcification: Attributed to factors such as improper polymer formulation, manufacturing defects, faulty packaging, mechanical impressions from surgical instruments, and certain viscoelastic substances.
2) Secondary Calcification: Resulting from alterations in the intraocular environment, particularly in cases with compromised blood-aqueous barrier (BAB) function.
3) Pseudo Calcification: where other pathological changes are mistaken for true calcification.[6]

One of the critical contributors to both calcification and glistening formation is disruption of the blood aqueous barrier (BAB), which alters the composition of aqueous humor. This disruption is commonly observed in systemic conditions such as diabetes mellitus, which has been frequently associated with IOL opacification.[7,8]

The interval between IOL implantation and the onset of opacification ranges from 11 to 46 months, according to published data.[9,10] Bucher and coauthors described calcification of an IOL one day after surgery.[11] Yu et al reported a maximum of 10 Snellen lines of visual loss (mean loss of 2.8 Snellen lines) in eyes with calcified hydrogel IOLs.[12] Although most confirmed cases of calcification have involved hydrophilic IOLs, isolated cases have also been reported in hydrophobic acrylic and silicone IOLs- the latter particularly in the presence of asteroid hyalosis- indicating that calcification is not exclusive to hydrophilic lenses.[4,6]

Emerging diagnostic techniques, including energy-dispersive X-ray spectroscopy (EDS) and optical coherence tomography (OCT), have recently been employed to detect calcification in hydrogel IOLs.[13,14]

Despite being a rare indication, IOL calcification may necessitate IOL exchange. Successful explantation hinges on careful dissection of the IOL from the capsular bag using viscoelastic agents. However, potential intraoperative complications include posterior capsular rupture and zonular

dehiscence.

3. Conclusion

We describe five cases of IOL optic opacification. Various factors related to IOL manufacturing, storage, surgical technique and adjuvants may be involved in the process of IOL opacification. Opacification may be observed intraoperatively, early or late postoperatively. Further investigation is warranted to ascertain other possible causes of this phenomenon.

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