CASE REPORT

REVISED Case Report: The efficacy of early phacoemulsification in the intraocular pressure control in primary angle closure glaucoma associated with cataract in a young female [version 2; peer review: 1 approved, 1 approved with reservations]

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Abstract

Glaucoma is a leading cause of irreversible blindness worldwide. Among different types of glaucoma, irreversible bilateral visual impairment is more common in primary angle closure glaucoma (PACG) patients. PACG and cataract often coexist and are both more prevalent among the elderly population, being rare in children and young adults. Here, we discuss the case of a 39-year-old Caucasian woman with unilateral PACG associated with cataract. The patient presented with a several-day history of left sided headache, decreased and blurred vision as well as pain and redness of the left eye (LE). She reported similar episodes in the previous year. Visual acuity (VA) of the LE was limited to counting fingers and intra-ocular pressure (IOP) of the LE was 42 mmHg. Anterior segment examination of the LE revealed: edematous cornea, a peripheral anterior chamber depth corresponding to Van Herick's grade 0, mid-dilated pupil and lens opacities with visible glaukomflecken. Gonioscopic evaluation revealed iridotrabecular contact for 360°, no visible angle structures and a flat-mild convex iris contour. Spectral domain optical coherence tomography suggested only a thinning of neuro-retinal rim at the lower pole. Following treatment of the initial symptoms, phacoemulsification with intra-ocular lens implant was performed. IOP improved and no IOP-lowering medication was required. The patient was monitored for VA, IOP, field of vision changes, and optic disc evaluation every six months for 2 years and no glaucomatous change occurred. The patient also denied ocular symptoms during this period. This case supports the effectiveness of early phacoemulsification in

Open Peer Review

Approval Status ? ✓

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version 2 (revision) 10 Jun 2021	? view	
	↑	
version 1 18 May 2020	? view	✓ view

1. **Lin Fu**, Wenzhou Medical University, Wenzhou, China

Yau Kei Chan, University of Hong Kong, Hong Kong, China

2. **Monica Kenney Ertel**, University of Colorado, Denver, USA

Any reports and responses or comments on the article can be found at the end of the article.

the IOP control in patients with PACG.

Keywords

primary angle closure glaucoma, cataract, phacoemulsification

This article is included in the **Eye Health** gateway.

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Author roles: **Leferman CE:** Conceptualization, Methodology, Resources, Visualization, Writing – Original Draft Preparation; **Cazacut M:** Methodology, Writing – Original Draft Preparation; **Ciubotaru AD:** Conceptualization, Methodology, Resources, Visualization, Writing – Original Draft Preparation

Competing interests: No competing interests were disclosed.

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REVISED Amendments from Version 1

In the new version, revisions in various sections have been made following the reviewers recommendations.

Abstract: For clarity, we cut out the confusing phrases and mentioned the imaging strategy used to evaluate the case.

Introduction: As suggested by the reviewers, we elaborate more about the role of the lens thickness in PAC pathogenesis in the last sentence in the third paragraph.

Case presentation: Following the reviewers recommendation, we included ultrasound biomicroscopy parameters measured for both eyes to present the anterior segment structure- especially the ciliary body, iris and anterior chamber angle - and to rule out other potential etiologies of asymmetric, unilateral narrow angles (Table 1 in the new version). Table 1 from the previous version was modified and became Table 2. Also, we provide a table to show the results of the eye examination to present the VA, IOP, visual field and optic disc evaluation of the left eye at different visits (Table 3 in the new version). Further, we elaborated on findings in the text. We described the type of cataract and added details about the crystalline opacities.

Discussion: We added a few lines in the text in order to highlight differential diagnosis and therapeutic options.

Any further responses from the reviewers can be found at the end of the article

Introduction

Glaucoma is the second leading cause of blindness around the world, being prevalent in 3.5% in those 40 years and older. The number of people with glaucoma worldwide is expected to rise from 64 million to 76 million in 2020 and to 111 million by 2040, with Africa and Asia being affected more heavily than the rest of the world^{1,2}. This disease is generally determined by damage to the optic nerve level as a result of abnormally high intra-ocular pressure.

With a particularly high prevalence among particular populations, primary angle closure glaucoma (PACG) is responsible for nearly half the glaucoma-related blindness in the world, despite being much less common than open angle disease³. PACG occurs as a result of an interruption in the physiological mechanism of aqueous outflow in patients with crowded anterior segment anatomy. Demographic risk factors include older age, female gender and Asiatic race¹. Family history of glaucoma increases also the risk of developing the disease. Angle closure is rare in children and young adults, only isolated cases and small series, primarily composed of particular ethnicities, having been reported⁴⁻⁶.

PACG and cataract often accompany one another and are both more common among the elderly population. The crystalline plays a critical role in the pathogenesis of the two diseases because of its anatomical proximity with angle structures. Therefore, cataract extraction can be a viable solution for both conditions, because it can deepen the anterior chamber and mechanically open the iridocorneal angle, thus reversing the underlying process - structural impairment of aqueous humor drainage via the trabecular meshwork - in these patients⁷.

We present a rare case of newly diagnosed PACG associated with cataract in a young female in order to underline the efficacy of early phacoemulsification in the control of intraocular pressure.

Case presentation

A 39-year-old Caucasian woman with a family history of glaucoma in one grandparent presented with a two-day history of left sided headache, decreased and blurred vision, as well as pain and redness of the left eye (LE). The patient reported multiple self-limited episodes of headache and pain of the LE associated with blurred vision with no apparent exacerbating factors during the previous year. She was not taking prescribed topical ocular or systemic medication and no ocular trauma was declared. Ophthalmological medical history revealed hyperopia of both eyes (right eye (RE) = +1.75 D sphere, LE = +3.75 D sphere).

On presentation, visual acuity (VA) of the LE was limited to counting fingers and intraocular pressure (IOP) of the LE was 42 mmHg (Goldmann Tonometry). Slit lamp examination of the left anterior eye segment revealed the following: conjunctival hyperemia, edematous cornea, relatively normal central anterior chamber (AC) depth, a peripheral AC depth corresponding to Van Herick's grade 0 and oval, asymmetric, poorly reactive and mid-dilated pupil. Gonioscopic evaluation revealed iridotrabecular contact for 360°, no visible angle structures and a flat-mild convex iris contour. After indentation, the iris contour slightly changed. She was diagnosed with acute primary angle closure. Also, the patient was found to have cataract (grade C3 after the Lens Opacity Classification System III standardized chart) with visible glaukomflecken in the left lens. Due to corneal edema and lens opacities, fundoscopic examination of the LE was difficult to perform.

The VA of the fellow eye was 100/100 cc (with correction +1.75 D sphere) and IOP 16 mmHg. Anterior segment examination revealed a narrow peripheral AC depth corresponding to Van Herick's grade 2 and gonioscopic evaluation suggested no abnormality. The posterior segment was also normal.

On the first day only, the patient received the following medication: systemic IOP-lowering agents (mannitol 20% 250 ml x2/day intravenous, acetazolamide 250 mg x2/day per os), IOP lowering drops (brimonidine 0.2% 1 drop x2/day) and topical steroid eye drops (dexamethasone 0.1% 1 drop x4/day). The therapy response allowed IOP control using topical drops (brimonidine 0.2% 1 drop x2/day) for the next five days.

After the resolution of the acute attack, gonioscopy of the LE revealed no anterior peripheral synechiae. An ultrasound biomicroscopy was performed in order to exclude other entities due to lens related disorders (Table 1). Fundoscopic examination revealed the optic disc with a cup-disc ratio of 0.4. The other part of retina was normal. Spectral domain optical coherence tomography suggested only a thinning of neuro-retinal rim at the lower pole in the 6-clock hour sector, leading to her

Table 1. Ultrasound biomicroscopy parameters for both eyes at admission.

Variable*	RA	LA
Angle opening distance 500 μ m (AOD ₅₀₀)	0,198	0,035
Trabecular iris angle (TIA)	27,799	3,743
Trabecular ciliary process distance (TCPD)	1,005	0,689
Iris thickness (ID)		
ID1	0,490	0,394
ID2	0,528	0,483
ID3	0,645	0,576
Area of triangle between angle recess, iris and cornea, 750 μ m from scleral spur (ARA ₇₅₀)	0,12	0,06
Iris ciliary process distance (ICPD)	0,395	0,423
Iris-lens contact distance (ILCD)	0,794	0,902

*All values in mm, except TIA, which is in degrees.

diagnosis of PACG and a normal thickness in quadrant sectors (circumpapillary retinal nerve fiber layer in temporal (T) =71.35 μ m, superior (S)=121.61 μ m, nasal (N)=62.82 μ m, inferior (I)=122.41 μ m, circumpapillary ganglion cell layer in T=106.45 μ m, S=154,86 μ m, N=102.67 μ m, I=154.91 μ m).

On the sixth day, biometry and of the LE was performed in order to plan cataract surgery (Table 2). A-scan biometry found the left lens thickness to be 4.22mm. The glaukomflecken could not be identified by anterior segment optical coherence tomography or ultrasound biomicroscopy. Endothelial cell count was in normal range. On the seventh day, the patient underwent uneventful phacoemulsification with an intraocular lens implant.

The day after surgery, the VA of the LE was 60/100 sc (without correction) and IOP was 17 mmHg. At discharge the VA of the LE was 80/100 sc (without correction) and the IOP was 13 mmHg. The patient followed the standard post-cataract surgery care (week 1 to 2: topical tobramycin/dexamethasone 3 mg/1 mg/ml 1 drop x4/day and topical bromfenac 0.9 mg/ml 1 drop x4/day, week 3 to 4: topical tobramycin/dexamethasone 3 mg/1 mg/ml 1 drop x2/day and topical bromfenac 0.9 mg/ml 1 drop x2/day).

At the six-week evaluation, VA of the LE was 100/100 sc (without correction) and IOP was appropriate. The field of vision investigated by automated perimetry (Humphrey) appeared normal.

The patient was monitored for VA, IOP (office-hour IOP and diurnal variation test ≤ 5 mmHg), field of vision changes, and optic disc evaluation every six months for 2 years and no

Table 2. A-scan Ultrasound Biometry prior to phacoemulsification in the left eye.

Parameters	RE	LE
Axial diameter	22,19	21,78
AC	2,62	2,16
Lens	4,16	4,22
Vitreous	15,41	15,39

RE, right eye; LE, left eye; AC, anterior chamber; (all values in mm).

glaucomatous change occurred (Table 3). She also declared no ocular symptom in all this period of time.

Discussion

A case with unilateral PACG associated with cataract in such a young patient with no systemic co-morbidities is an unusual presentation. The diagnosis of PACG was preferred, rather than simply primary angle closure, due to the modification of the neuro-retinal rim and the risk factors of the patient, including family history.

PACG and PAC tend to be bilateral. As such, the observation of a wide-open angle in the opposite eye suggests a diagnosis other than PACG. Using ultrasound biomicroscopy, we were able to rule out other unilateral and bilateral lens related disorders like ectopia lentis or zonula weakness that cause secondary anterior chamber angle closure.

Table 3. Postoperative follow-up visits left eye.

Follow-up appointment post-surgery	VA	O-H IOP range (mmHg)	CDR (Avg/vertical)	cpRNFL thickness (μm) in the 4 quadrants sectors	cpGCL (μm) in the 4 quadrants sectors	VF
6 months	1 sc	12–16	0.492/ 0.427	T=71.37, S=121.65, N=62.85, I=122.43	T=106.47, S=154.83, N=102.65, I=154.94	No changes
12 months	1 sc	13–15	0.488/ 0.417	T=71.24, S=121.46, N=62.74, I=122.22	T=106.25, S=154.51, N=102.44, I=154.52	
18 months	1 sc	11–14	0.475/ 0.419	T=71.27, S=121.23, N=62.63, I=122.29	T=106.11, S=154.15, N=102.33, I=154.55	
24 months	1 sc	11–15	0.481/ 0.421	T=71.03, S=121.18, N=62.42, I=122.17	T=105.87, S=153.92, N=102.02, I=154.27	

VA-visual acuity, O-H IOP-office-hour intraocular pressure, Avg-average, CDR- cup to disc ratio, cpRNFL – circumpapillary retinal nerve fiber layer, cpGCL- circumpapillary ganglion cell layer, VF- visual field, sc – without correction, T-temporal, S-superior, N-nasal, I-inferior.

This case of unilateral PACG associated with cataract in a young patient with no systemic diseases underlines three aspects: the importance of the risk factors in glaucoma, the relationship between the pathophysiologic mechanisms of the two conditions, and the effectiveness of the phacoemulsification in the IOP control.

The etiology of angle closure in young people is different from that of the older population and is typically associated with structural or developmental ocular particularities: plateau iris, iridociliary cysts, nanophthalmos, etc. In the presented case, the patient had moderate hyperopia in the affected eye and low hyperopia of the fellow eye. Hyperopia is mentioned in literature as a risk factor for PACG⁸. There are, however, studies that did not find any statistically significant correlation between refractive error and PACG^{9,10}. Biometrical parameters such as axial length and AC depth were strongly correlated with PACG¹⁰. The small axial length (AL) with a normal size lens or even growing lens, as it is in cataract, leads to a crowded anterior segment and a shallow anterior chamber⁹. Thus, the uni-laterality of the condition could be explained in part by the differences in the biometrical parameters (AL, AC depth and lens thickness) between the eyes, the affected having lower values of these parameters. Also, the fellow eye is at risk of developing primary angle closure, and should be monitored.

Another particularity of the disease is the association between the two conditions at the time of diagnosis. The way in which PACG and cataract influence each other in a young patient could be explained, in part, by the presence of glaukomflecken composed of necrotic lens epithelial cells and degenerated sub-epithelial cortex. These two diseases seem to reinforce each other. Thus, on one side markedly elevated IOP in PACG determined epithelial and anterior cortical lens opacities, on the other side the affected lens growth can compromise the aqueous flow between the lens and iris at the pupil¹¹. Therefore, the

pupillary block suggested as a mechanism of PACG in older patients could as well appear, even though rare, in younger patient⁴.

Initial therapeutic approach consisted of IOP-lowering medication and, after resolution of the acute attack, phacoemulsification with intraocular lens implant. Given the patient's age iridotomy could have been another viable treatment option. The presence of a cataractous lens and the risk of iridotrabecular contact persistence with angle closure progression dictated though cataract extraction, which is demonstrated to have more favorable results in similar conditions, despite loss of accommodation¹². The patient's IOP improved, as it is also described in the literature in other cases, after cataractous lens extraction^{12,13}. The patient required no IOP-lowering medication and the first 2 years follow up glaucoma revealed no other glaucomatous damage.

Conclusions

The therapeutic choice in PACG (iridotomy vs. phacoemulsification) should be guided by risk factors and the subsequent pathophysiological mechanisms. As our case of PACG associated with cataract in a young patient confirmed, early phacoemulsification proved its effectiveness in the IOP management. Although the risks of surgical approach are well known, the benefits are undeniable: a good IOP control, decrease need for IOP-lowering drugs and a significant improvement of VA with a better quality of life for the patient.

Data availability

All data underlying the results are available as part of the article and no additional source data are required.

Consent

Written informed consent for the publication of this case report was obtained from the patient.

References

1. Tham YC, Li X, Wong TY, *et al.*: **Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis.** *Ophthalmology.* 2014; **121**(11): 2081–2090.
[PubMed Abstract](#) | [Publisher Full Text](#)
2. Quigley HA, Broman AT: **The number of people with glaucoma worldwide in 2010 and 2020.** *Br J Ophthalmol.* 2006; **90**(3): 262–267.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
3. Cho HK, Kee C: **Population-based glaucoma prevalence studies in Asians.** *Surv Ophthalmol.* 2014; **59**(4): 434–447.
[PubMed Abstract](#) | [Publisher Full Text](#)
4. Ritch R, Chang BM, Liebmann JM: **Angle closure in younger patients.** *Ophthalmology.* 2003; **110**(10): 1880–1889.
[PubMed Abstract](#) | [Publisher Full Text](#)
5. Chhipa SA: **Angle Closure Glaucoma with Myopia.** *Pak J Ophthalmol.* 2009; **25**(3).
[Reference Source](#)
6. Alzuhairy S: **Bilateral angle closure glaucoma in a teenage girl - A rare presentation in Arab population - A case report.** *Int J Health Sci (Qassim).* 2019; **13**(2): 56–58.
[PubMed Abstract](#) | [Free Full Text](#)
7. Melese E, Peterson JR, Feldman RM, *et al.*: **Comparing Laser Peripheral Iridotomy to Cataract Extraction in Narrow Angle Eyes Using Anterior Segment Optical Coherence Tomography.** *PLoS One.* 2016; **11**(9): e0162283.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
8. Shen L, Melles RB, Metlapally R, *et al.*: **The Association of Refractive Error with Glaucoma in a Multiethnic Population.** *Ophthalmology.* 2016; **123**(1): 92–101.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
9. Kim YY, Lee JH, Ahn MD, *et al.*: **Angle Closure in the Namil Study in Central South Korea.** *Arch Ophthalmol.* 2012; **130**(9): 1177–83.
[PubMed Abstract](#) | [Publisher Full Text](#)
10. van Romunde SHM, Thepass G, Lemij HG: **Is Hyperopia an Important Risk Factor for PACG in the Dutch Population? A Case Control Study.** *J Ophthalmol.* 2013; **2013**: e630481.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
11. Lowe RF: **Aetiology of the anatomical basis for primary angle-closure glaucoma. Biometrical comparisons between normal eyes and eyes with primary angle-closure glaucoma.** *Br J Ophthalmol.* 1970; **54**(3): 161–169.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
12. Lam DSC, Leung DYL, Tham CCY, *et al.*: **Randomized trial of early phacoemulsification versus peripheral iridotomy to prevent intraocular pressure rise after acute primary angle closure.** *Ophthalmology.* 2008; **115**(7): 1134–1140.
[PubMed Abstract](#) | [Publisher Full Text](#)
13. Römkens HCS, Beckers HJM, Schouten JSAG, *et al.*: **Early Phacoemulsification After Acute Angle Closure in Patients With Coexisting Cataract.** *J Glaucoma.* 2019; **28**(2): e34–e35.
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Current Peer Review Status: ? ✓

Version 2

Reviewer Report 06 July 2021

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Yau Kei Chan

Department of Ophthalmology, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong, China

I think the author should provide the ultrasound biomicroscopy (UBM) images to rule out secondary causes of angle closure glaucoma. Only presenting the UBM values in Table 1 is not enough.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Ophthalmic surgical research, Ocular tissue engineering, Eye-on-a-chip.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Version 1

Reviewer Report 29 October 2020

<https://doi.org/10.5256/f1000research.26337.r72882>

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Monica Kenney Ertel

Department of Ophthalmology, University of Colorado, Denver, CO, USA

Summary: This was an interesting case of a young 39-year old patient who developed acute angle closure presumably phacomorphic in etiology. In order to manage her elevated intraocular pressure, the authors performed cataract surgery which successfully reduced her IOP and deepened her angle.

Comments:

1. Can the authors elaborate on the cataract in the case presentation? Which type of cataract and which grade of cataract? It seems atypical for such a young patient to have a unilateral, visually significant cataract. Were other systemic illnesses ruled out? The authors include that the patient denies trauma but were there any other exam findings that suggest trauma? Could there be zonular insufficiency secondary to trauma which would explain the asymmetric narrow angle and the cataract?
2. Did the authors obtain UBM to image the angle and to rule out other potential etiologies of asymmetric, unilateral narrow angles?
3. The first sentence in paragraph 6 in case presentation is missing information. Biometry and what were performed? Was the difference in axial length between the two eyes confirmed with A-scan?
4. Can the authors elaborate on findings of the post-operative follow-up visits? Was formal glaucoma imaging with OCT RNFL, OCT GCC testing performed to evaluate for damage to the optic nerve?
5. In the second to last paragraph in the discussion, the authors seem to suggest that the anterior capsular changes that occurred during her acute angle attack led to pupillary block from the lens. However, the lens thickness between the two eyes is minimal, much smaller than the difference in axial length between the two eyes. Can the authors elaborate?
6. Were the anterior capsular changes the only lenticular changes present? In this young patient who still has accommodation, removing her accommodation with cataract extraction seems to be a large risk when she may have done well with an LPI. I think this thought process and the authors rationale for their treatment choices is a very important part of this case. They seems to only mention that the presence of a cataract was their reasoning but it seems there are other points which should be addressed.
7. The authors suggest that the patient is a case of PACG, however based on her lack of optic nerve cupping and mentioned normal testing - she would not qualify as PACG. Can the authors please address?

Is the background of the case's history and progression described in sufficient detail?

Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?

Partly

Is sufficient discussion included of the importance of the findings and their relevance to

future understanding of disease processes, diagnosis or treatment?

Partly

Is the case presented with sufficient detail to be useful for other practitioners?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Glaucoma surgical outcomes.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 29 May 2021

Carmen-Ecaterina Leferman, Saint Spiridon Emergency County Hospital, Iasi, Romania

We would like to thank you for your time, for taking an interest in our article, and for your constructive feedback. All your concerns were valid, pointing out areas in which our case reports needed improvement. We have carefully followed your recommendations and made the necessary improvements. We will provide answers to each of your comments illustrating the changes point by point.

- Can the authors elaborate on the cataract in the case presentation? Which type of cataract and which grade of cataract? It seems atypical for such a young patient to have a unilateral, visually significant cataract. Were other systemic illnesses ruled out? The authors include that the patient denies trauma but were there any other exam findings that suggest trauma? Could there be zonular insufficiency secondary to trauma which would explain the asymmetric narrow angle and the cataract?

Thank you for this constructive review and questions. Regarding lens opacities, the patient presented central anterior lens opacity changes and grade C3 cortical cataract according to LOCS III standardized chart. Other systemic illnesses were ruled out and there were no exam finding that suggested trauma. Other conditions causing lens related disorders- like ectopia lentis or zonula weakness- that cause secondary anterior chamber angle closure and which may be unilateral or bilateral were ruled out by ultrasound biomicroscopy.

- Did the authors obtain UBM to image the angle and to rule out other potential etiologies of asymmetric, unilateral narrow angles?

PACG and PAC tend to be bilateral. As such, the observation of a wide-open angle in the opposite eye suggests a diagnosis other than PACG. Using ultrasound biomicroscopy, we were able to rule out other unilateral or bilateral lens related disorders like ectopia lentis or zonula weakness that cause secondary anterior chamber angle closure (Table 1 in the new version).

- The first sentence in paragraph 6 in case presentation is missing information. Biometry and what were performed? Was the difference in axial length between the two eyes confirmed with A-scan?

The difference in axial length between the two eyes was confirmed with A-scan. A-scan ultrasound biometry and keratometry were performed for both eyes in order to plan

cataract surgery for the left eye. We added this information in the text.

- Can the authors elaborate on findings of the post-operative follow-up visits? Was formal glaucoma imaging with OCT RNFL, OCT GCC testing performed to evaluate for damage to the optic nerve?

We provide a table (Table 3 in the new version) to show the results of the eye examination representing visual acuity (VA), intraocular pressure (IOP), visual field (VF), optic disc evaluation of the left eye measured at different visits. VA remained unchanged compared to the 6 weeks postoperative follow-up. Regarding the IOP, the office hour IOP and diurnal variation test (DVT) were determined. Even if the office hour IOP was at target level, we repeated DVT to look for undetected IOP peaks or high fluctuations in the first year post-op. DVT was ≤ 5 mmHg. Changes in retinal nerve fiber layer (RNFL) and ganglion cell layer (GCL) thickness over the two years fall within the individual variability corresponding to age, sex, and ethnicity. There was also no pathological progression in cupping and no changes in the visual field.

- In the second to last paragraph in the discussion, the authors seem to suggest that the anterior capsular changes that occurred during her acute angle attack led to pupillary block from the lens. However, the lens thickness between the two eyes is minimal, much smaller than the difference in axial length between the two eyes. Can the authors elaborate?

We want to accentuate the positioning of the lens in angle closure affect eyes. It is located more anteriorly, thus hindering the passage of the aqueous humor between the lens and the iris as it moves towards the anterior chamber. Also, increasing thickness of the lens with existing opacities or the aging of a lens may also contribute to a progressive narrowing of the angle.

- Were the anterior capsular changes the only lenticular changes present? In this young patient who still has accommodation, removing her accommodation with cataract extraction seems to be a large risk when she may have done well with an LPI. I think this thought process and the authors rationale for their treatment choices is a very important part of this case. They seems to only mention that the presence of a cataract was their reasoning but it seems there are other points which should be addressed.

Thank you for your excellent point. As a result, we added a few lines in the text in order to highlight this important consideration. Indeed, a broader discussion of the risks and benefits of both LPI and lens extraction is necessary for patients with minimal cataractous changes. As we previously mentioned, anterior capsular changes are not the only lenticular changes (the patient presented central anterior lens opacities changes and cortical cataract C3 grade after LOCS III standardized chart in the left eye alone). Younger patients who are considering lens extraction as option should carefully ponder loss of accommodation. In the presented case, the age of the patient is at the point most people begin to notice the effect of presbyopia. The therapeutic role for lens removal was supported by the anatomy of the patient's left eye. Also, a progressing narrowing of the angle may also be attributed to an increase in lens thickness caused by aging of the lens and existing opacities. On the other hand, iridotomy may then have been a viable treatment, however most patients retain some iridotrabecular contact, so angle closure may progress regardless. Laser iridotomy widens the anterior chamber angle, however a more effective solution, when appropriate, may be removing the lens mass, which could reduce, or even eliminate the risk of blindness from an acute attack and chronic increase in IOP. Phacoemulsification has been shown

effective in some studies to prevent subsequent IOP elevations in PACG eyes presenting with IOP > 55mm Hg.

- The authors suggest that the patient is a case of PACG, however based on her lack of optic nerve cupping and mentioned normal testing - she would not qualify as PACG. Can the authors please address?

A diagnosis of primary angle chronic glaucoma was preferred, given the slight thinning of the neuro-retinal rim at the lower pole in the 6-clock hour sector, suggested by spectral domain optical coherence tomography.

Competing Interests: No competing interests were disclosed.

Reviewer Report 02 June 2020

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Lin Fu

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Yau Kei Chan

Department of Ophthalmology, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong, China

The authors presented an unusual but interesting case of APAC in a young female of 39 years old.

Major points:

- Since the cause of this type of APAC is important, an ultrasound biomicroscopy examination should be included to present the anterior segment structure especially the ciliary body, iris and anterior chamber angle. The difference of the AC between the affected eye and unaffected eye is relative large (2.62 vs 2.16), hence a differential diagnosis is needed in the discussion part, like the discussion on lens dislocation and zonula weakness.
- The authors should provide a table or relevant figures to show the results of the eye examination about of the VA, IOP, visual field, optic disc evaluation of the LE of different visits.

Minor points:

In the Abstract,

- Please delete "second only to cataract" in the first sentence, because the sentence structure gives a wrong impression that cataract is also a kind of irreversible blindness.
- Did the authors intend to stress how the presented case is so unusual as in the second sentence they mentioned PACG is usually bilateral but the presented case is unilateral?

- What does the “digital image” of the optic disc as mentioned in the 6th sentence in the second paragraph of the abstract stand for? Do you mean the fundus photo?

In the third paragraph of Introduction,

- Please elaborate more about the “process” mentioned in the last sentence in this paragraph.

In Table 1,

- What are the units of the measurements of the parameters in Table 1?

In the third paragraph of Discussion,

- Can the authors please name the parameters specifically that being mentioned in the second last sentence?

In the fifth paragraph of Discussion,

- Can the authors provide a value about the “increased risk of corneal edema after phacoemulsification”?

Is the background of the case’s history and progression described in sufficient detail?

Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?

Partly

Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?

Partly

Is the case presented with sufficient detail to be useful for other practitioners?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Ophthalmic surgical research, Ocular tissue engineering, Eye-on-a-chip.

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.

Author Response 29 May 2021

Carmen-Ecaterina Leferman, Saint Spiridon Emergency County Hospital, Iasi, Romania

We would like to thank you for your time, for taking an interest in our article, and for your constructive feedback. All your concerns were valid, pointing out areas in which our case report needed improvement. We are therefore grateful for your valuable contribution.

Kindly note our response in line with the provided comments:

- Since the cause of this type of APAC is important, an ultrasound biomicroscopy examination should be included to present the anterior segment structure especially

the ciliary body, iris and anterior chamber angle. The difference of the AC between the affected eye and unaffected eye is relative large (2.62 vs 2.16), hence a differential diagnosis is needed in the discussion part, like the discussion on lens dislocation and zonula weakness.

Thank you for your observation. Indeed, because PACG and PAC tend to be bilateral, the observation of a wide-open angle in the fellow eye suggests a diagnosis other than PAC. Ultrasound biomicroscopy ruled out other conditions which may be unilateral or bilateral, such as lens related disorders like ectopia lentis or zonula weakness that cause secondary anterior chamber angle closure. Also, we added ultrasound biomicroscopy parameters measured for both eyes at admission (Table 1 in the new version). Variation in accommodation was minimized by fixation of the contralateral eye on a standard distance target on the ceiling.

- The authors should provide a table or relevant figures to show the results of the eye examination about of the VA, IOP, visual field, optic disc evaluation of the LE of different visits.

We provide a table (Table 3 in the new version) to show the results of the eye examination representing visual acuity (VA), intraocular pressure (IOP), visual field (VF), optic disc evaluation of the affected eye measured at different visits. VA remained unchanged compared to the 6 weeks postoperative follow-up. Regarding the IOP, the office hour IOP and diurnal variation test (DVT) were determined. Even if the office hour IOP was at target level, we repeated DVT to look for undetected IOP peaks or high fluctuations in the first year post-op. DVT was ≤ 5 mmHg. Changes in retinal nerve fiber layer (RNFL) and ganglion cell layer (GCL) thickness over the two years fall within the individual variability corresponding to age, sex, and ethnicity.

- Please delete “second only to cataract” in the first sentence, because the sentence structure gives a wrong impression that cataract is also a kind of irreversible blindness.

We deleted “second only to cataract” in the first sentence.

- Did the authors intend to stress how the presented case is so unusual as in the second sentence they mentioned PACG is usually bilateral but the presented case is unilateral?

Thank you for your comment. PACG and PAC tend to be bilateral. As such, the observation of a wide-open angle in the opposite eye suggests a diagnosis other than PACG. Using ultrasound biomicroscopy, we were able to rule out other unilateral and bilateral lens related disorders like ectopia lentis or zonula weakness that cause secondary anterior chamber angle closure. We added a new paragraph regarding this topic in the discussion section (second paragraph in the new version).

- What does the “digital image” of the optic disc as mentioned in the 6th sentence in the second paragraph of the abstract stand for? Do you mean the fundus photo?

As an imaging strategy, we used the spectral domain optical coherence tomography in order to acquire retinal nerve fiber layer (RNFL) and ganglion cell layer (GCL) measurements and analyze cup-disc ratio.

- In the third paragraph of Introduction, please elaborate more about the “process” mentioned in the last sentence in this paragraph.

Phacoemulsification can reverse structural impairment of aqueous humor drainage via the trabecular meshwork, thereby decreasing the volume of the capsular sac, increasing the size of the iridocorneal angle and, making it a viable situation for both conditions. We added

this information in the text.

- In table 1, what are the units of the measurements of the parameters?

All values in the Table 1 (Table 2 in the new version) are in mm.

- In the third paragraph of discussion, can the authors please name the parameters specifically that being mentioned in the second last sentence?

The parameters refer to the la axial length and the lens thickness. We added them in the text.

- In the fifth paragraph of discussion, can the authors provide a value about the "increased risk of corneal edema after phacoemulsification"?

The occurrence and severity of corneal edema after phacoemulsification depends on the associated preoperative, intraoperative and postoperative risk factors which makes it difficult to provide a single a value about the "increased risk of corneal edema after phacoemulsification". In our case in particular, the risk refers more to the anatomical features suggested by the biometric parameters, that may increase the risk of corneal endothelial damage during phacoemulsification, plus endothelial damage caused by recent increased intraocular pressures reported at the time of surgery.

Competing Interests: No competing interests were disclosed.

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