

## Case Report

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# Management of Acute Angle-Closure Glaucoma in Nanophthalmos: A Case Report

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### Abstract

**Introduction:** Nanophthalmos is often associated with varying degrees of acute angle-closure glaucoma. The treatment has a high complication rate and a large number of reoperations occur.

**Methods:** We report a case of combined surgeries for bilateral nanophthalmos and the address for severe complications. The patient was successfully treated with primary posterior capsulectomy combined with IZHV or anterior vitrectomy, along with phacoemulsification and implantation of a posterior chamber IOL.

**Discussion:** The visual acuity was improved with no recurrence of the postoperative complications and the intraocular pressure in both eyes was well controlled without medication.

**Conclusions:** Combined surgery and treatment of postoperative complications including Nd: YAG laser and dexamethasone are safe and effective.

**Keywords:** Nanophthalmos; Irido-zonulo-hyaloido-vitrectomy; Combined surgery; Inflammatory membrane.

**Abbreviations:** IOP: Intraocular Pressure; IZHV: Irido-Zonulo-Hyaloido-Vitrectomy; AAC: Acute Angle-Closure; RE: Right Eye; VA: Visual Acuity; D: Diopter; Cyl: Cylinder; LE: Left Eye; ACD: Anterior Chamber Depth; RNFL: Retinal Nerve Fiber Layer; IOL: Intraocular Lens.

### Introduction

Nanophthalmos refers to an eyeball of short axial length, usually less than 20 mm which leads to acute angle-closure glaucoma in middle age due to the natural increase in the size of the lens which is already relatively too large for the small eye. Response to medical treatment is poor and miotics may even make the condition worse by producing relative pupillary block. Cataract surgery deepens and widens the anterior chamber angle in nanophthalmic

eyes and has beneficial effects on intraocular pressure (IOP), but is associated with a high rate of surgical risks and complications, such as serious retinal detachment and uveal effusion syndrome. We report a case of combined surgery for bilateral nanophthalmos. Phacoemulsification was performed for both eyes and posterior chamber intraocular lens were implanted, combined iridozonulo-hyaloido-vitrectomy (IZHV) for the more serious eye, and anterior vitrectomy for another.

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## Materials and methods

In this case study, a case of acute angle-closure (AAC) attack detected in a 50-year-old female patient was explored. The patient was referred to our hospital after a three-day history of severe visual loss and constant pain in her right eye (RE). Visual acuity (VA) was hand movements in her RE and 0.2 with high hyperopia (+15.0 Diopter (D), Cylinder (cyl)) in her left eye (LE). She had worn hypermetropic correction since she was five years old. No family history was mentioned. The IOP was 59.0 mmHg in RE and 17.5 mmHg in LE.

As acute angle-closure glaucoma with nanophthalmos was highly suspected in RE, axial scan and slit lamp were used to confirm the diagnosis. Ophthalmological examination revealed intense corneal edema and hyperemic conjunctival vessel of RE, very shallow anterior chamber of both eyes with mild cataract (the patient refused to take anterior segment pictures due to intense pain). The patient's eyes were small and the anterior chamber depth (ACD) /axial length of 1.49/14.80 mm in RE, and 1.54/15.17 mm in LE. A diagnosis of acute angle-closure glaucoma with bilateral nanophthalmos and high axial hyperopia was made.

Then abnormal retinal nerve fiber layer (RNFL) thickness had been observed in the patient which was 163 microns of RE which was higher than the mean global range reported in the literature [1]. B-scan ultrasonography of both eyes showed scleral thickening (Figure 1a-d). The patient received intravenous 20% mannitol, topical carteolol, brinzolamide, timolol maleate, and brimonidine for RE. Topical dexamethasone was added. But all these were temporarily effective and the IOP remained higher than 50 mmHg after a few hours. Anterior chamber paracentesis was performed by using a 15°stab knife (straight) to do the clear corneal incision for drainage of aqueous humor. After surgery, the IOP in RE was 20.7 mmHg. But five hours later, it increased uncontrollably and then we performed peripheral Nd: YAG laser iridotomy. Meantime, the IOP in LE was 32.8 mmHg. She received two kinds of antiglaucoma medications (i.e., brinzolamide, timolol maleate) for LE.

Three days later, the IOP fluctuations ranged from 28.7 to 37.2 mmHg in RE and 21.5 to 23.4 mmHg in LE. She was successfully treated with primary posterior capsulectomy combining with IZHV and phacoemulsification with implantation of a posterior chamber intraocular lens (IOL, +30.0D 6.0/Aspira-aAY, HOPA) and a capsular tension ring (275001G, OPHTEC BV).

One week after the surgery, the IOP fluctuations in RE ranged from 15.0 mmHg to 32.5 mmHg. The patient received two antiglaucoma medications (i.e., brinzolamide, timolol maleate) to control the IOP and two anti-inflammatory medications (i.e., Mydrin-P, Dexamethasone) to control anterior uveitis, combined with periocular injection of methylprednisolone sodium succinate (28mg/ml) every two days for one week. During this time, the IOP fluctuations in LE ranged from 15.2 to 24.5 mmHg.

Then she received phacoemulsification with implantation of the same IOL and capsular tension ring as RE. Anterior vitrectomy, lens posterior capsulotomy, and vitreous anterior membranectomy were performed, using a 25-gauge vitrectomy system.

One month after surgeries of RE, the IOP was 19.6 mmHg controlled with brinzolamide, and the ACD was 2.64 mm. The IOP in LE was 16.5 mmHg without medication, and the ACD was 2.73

mm (Figure 2 a-b).

But, the IOP was 28.0 mmHg in RE six weeks after surgeries and we observed an inflammatory membrane forming completely across the zonulo-hyaloidotomy incision after intraocular surgery (Figure 3). The inflammatory membrane was removed with Nd: YAG laser and the IOP was reduced to 17.6 mmHg. Post-procedural management included hourly dexamethasone eye drops for 1 week.

## Results

Three months after surgeries, there was no recurrence in the inflammatory membrane and the IOP in both eyes was well controlled without medication (Figure 4 a-b). The patient showed good adherence which improved the effectiveness of interventions. Her VA was 0.4 ×+15.0 D, cyl, +1.50 D, Axis (Ax) 80° in RE and 0.4 ×+13.0 D, cyl +1.75 D, Ax 90° in LE.

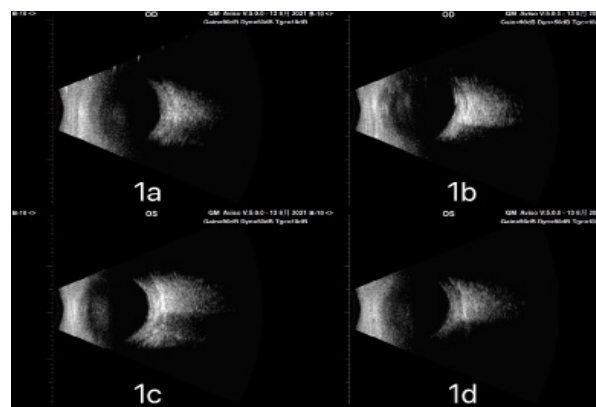


Figure 1: B-scan ultrasonography of RE (2a, 2b) and LE (2c, 2d) with scleral thickening.

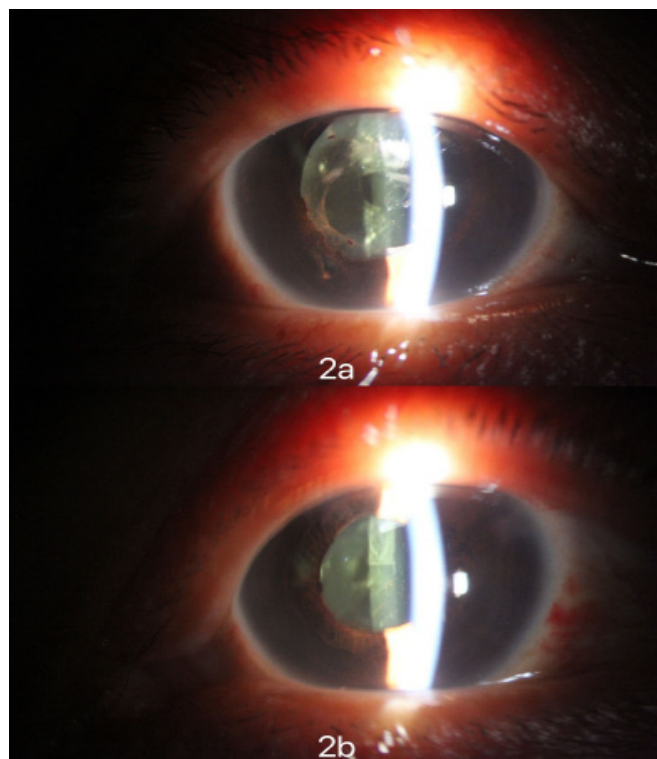
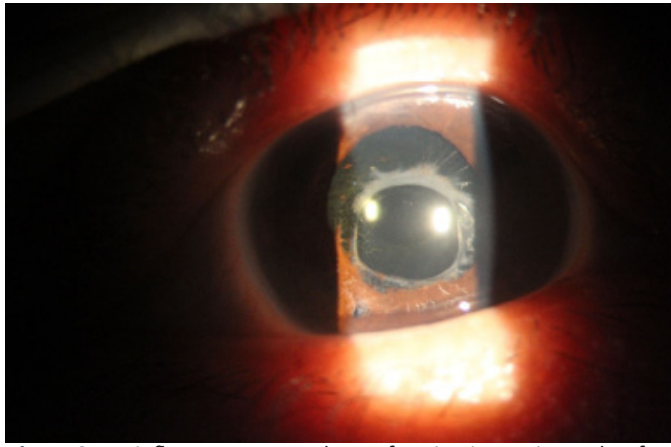
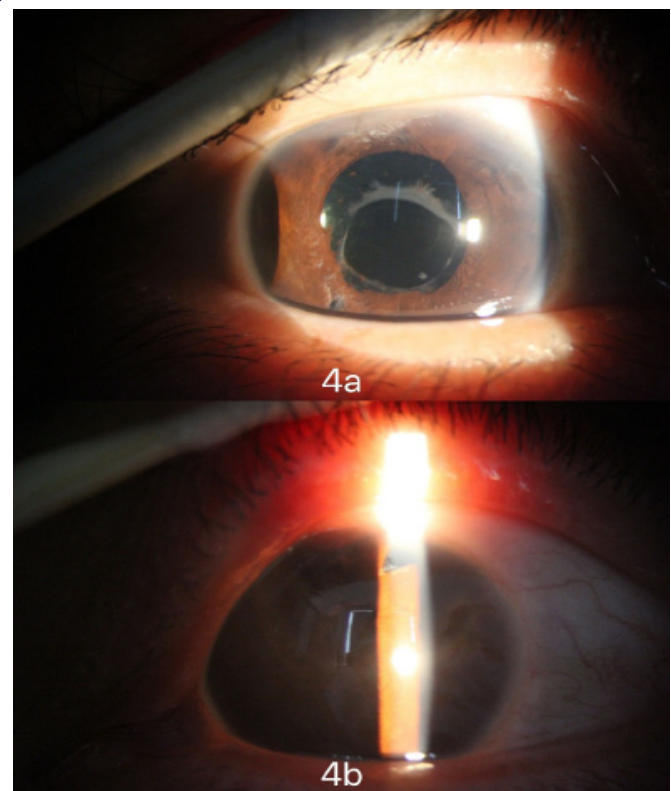


Figure 2: Deep anterior chamber observed one month after surgeries in RE (a) and two weeks after surgery in LE (b).



**Figure 3:** An inflammatory membrane forming in RE six weeks after surgeries.



**Figure 4:** Three months after surgeries, there was no recurrence in the inflammatory membrane and the IOP in RE (5a) and LE (5b) were well controlled without medication.

LE: Left eye, RE: Right eye

### Discussion

Due to the special and complex structure of nanophthalmos, the disorder is often associated with many complications, including malignant glaucoma, uveal effusion syndrome with or without exudative retinal detachment, and acute angle-closure glaucoma [2]. The patient fully understood the difficulty of the treatment process and had patience cooperating with treatment.

In this case, we performed anterior chamber paracentesis and Nd: YAG laser peripheral iridotomy to temporarily control the IOP. Our further intervention aimed at directly communicating between the anterior chamber and the vitreous cavity to disrupt

the mechanism of aqueous misdirection. Both eyes underwent phacoemulsification with goniosynechialysis and anterior vitrectomy. Additional lens posterior capsulotomy and vitreous anterior membranectomy to disrupt the blockage site at the ciliary-hyaloid interface.

Combining vitrectomy with phacoemulsification has been suggested as a strategy to reduce the risks during operations, especially when the anterior chamber is shallow [3]. IZHV, is a simple, safe, and effective procedure that can be adopted by all ophthalmologists who are involved in glaucoma management and are not comfortable with the pars plana vitrectomy approach [4].

Jung KI calculated the predicted postoperative refraction error and found that in nanophthalmic eyes, the Holladay 1 produced better refractive results. The refractive predictability and postoperative outcome were poorer in nanophthalmic eyes than in eyes without refractive error [5]. In this case, we calculated IOL power for emmetropia with different formulas ranging from +50.50 to +55.50 D for the right eye and from +49.00 to +54.50 D for the left eye. The IOL power selection was based on the average value from four formulas (Holladay 1, Holladay 2, Hoffer Q, and SRK/T) with the target refraction of emmetropia. High-power customized IOLs may allow complete correction of hyperopia, but the highest available power of IOLs at our institution was +30.00 D.

A piggyback IOL system comprises a posterior chamber IOL and a separate, exchangeable optic [6]. Piggyback IOL implantation was an effective refractive procedure in nanophthalmic eyes [7]. However, the primary piggyback IOL can lead to possible complications of under-correction and lens opacity. Single aspheric IOLs had better optical performance than piggybacking lower-power aspheric IOLs, providing the highest contrast sensitivity among all of the analyzed settings [8] Phacoemulsification was considered necessary to deal with the cataract, but additional surgical maneuvers such as laser, IZHV, or anterior vitrectomy were required to avoid intraoperative and postoperative complications of nanophthalmic patients with acute angle-closure glaucoma[9].

What we should pay more attention to is that the inflammatory membrane forming after intraocular surgery may be inevitable. Our patient presented a chronic inflammatory process that generated an inflammatory membrane, causing posterior misdirection of the aqueous humor and finally, increased IOP in RE. The membrane was removed with Nd: YAG laser and the IOP was reduced and management of dexamethasone eye drop was used to prevent the recurrence.

### Conclusion

Our case showed that acute angle-closure glaucoma is a common complication of nanophthalmic eyes. The IOL power selection was difficult and high-power customized IOLs were hard to achieve. Combined surgery and treatment of postoperative complications including Nd: YAG laser and dexamethasone are safe and effective to control the IOP without antiglaucoma medications.

### Declarations

**Patient consent statement:** Written informed consent was obtained from the patient. The article has not been presented in a meeting.

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