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CASE REPORT

Pseudophakic Malignant Glaucoma Treatment Assisted with Anterior Segment Optical Coherence Tomography: A Case Report

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PSEUDOPHAKIC malignant glaucoma is diagnosed based on the presence of a shallow or flat central and peripheral anterior chamber in the presence of patent iridectomy, with intraocular pressure (IOP) of 22 mm Hg or more after lens extraction and intraocular lens implantation.¹ Pseudophakic malignant glaucoma is one of the most challenging complications faced by surgeons. Initial medication includes topical cycloplegics, osmotic agents, and topical and systemic antiglaucoma medication, but only about 50% cases can be relieved.² Laser treatments such as neodymium-doped yttrium aluminium garnet (Nd:YAG) laser capsulotomy and hyaloidotomy are reported to relieve the situation sometimes and can be regarded as second-line therapy.^{3,4} Combined surgery consisting of partial pars plana vitrectomy, hyaloidozonulotomy, and peripheral iridectomy is effective in refractory cases but the potential risk exists.^{2,5,6} Studies showed that pseudophakic malignant glaucoma can be

managed by personalized therapy according to patients' conditions.⁷⁻⁹ An effective investigation evaluating and monitoring the treatment effect would be very helpful for surgeons managing pseudophakic malignant glaucoma.

We report a patient of unique eye with a history of primary angle closure glaucoma, who developed malignant glaucoma following cataract surgery. Anterior segment optical coherence tomography (AS-OCT), which appeared to be an objective assessment for therapeutic effects, was performed to confirm clinical diagnosis, and real-time record anterior segment structures after Nd:YAG laser hyaloidotomy and goniosynechialysis.

CASE DESCRIPTION

A 65-year-old woman had a past history of bilateral acute angle-closure and was treated with bilateral peripheral sector iridectomy in 1994. After the surgery, the left eye presented recurrent acute angle-closure attack and lost light perception in 2000. Cyclophotocoagulation was performed in 2012 to relief the pain of her left eye caused by high IOP. In recent 4 years she had recurrent episodes

of glaucoma attack in her right eye with IOP ranged from 40 to 60 mm Hg during attacks. Although IOP of the right eye could be controlled by medications, she is still worried about her precious residual eye. Thus the patient was referred to Peking Union Medical College Hospital in October 2013 for further treatment.

The right eye of this patient had a slight nuclear cataract and uncorrected visual acuity of 12/20. The anterior chamber depth (ACD) and axial length was 1.47 mm and 21.44 mm, respectively. Ultrasound biomicroscopy (UBM) showed 360° peripheral anterior synechia (PAS). Combined phacoemulsification with implantation of a posterior chamber intraocular lens and goniosynechialysis were performed in her right eye. Significant widened anterior chamber and normal IOP were observed on the next day of the surgery.

On the 4th day of follow-up, the patient complained of eye pain and blurred vision in her right eye for 24 hours. Slit lamp biomicroscopy revealed an extremely shallow anterior chamber with corneal edema and opacity (Fig. 1A, 1B). Visual acuity was 2/20 and cannot be corrected. IOP with Goldmann applanation tonometer was 34 mm Hg. AS-OCT revealed a flat anterior chamber with forward displacement of the iris-lens diaphragm and corneal edema with the cornea thickness of 590 μ m (Fig. 1C). This further confirmed the diagnosis of malignant glaucoma in this patient.

Treatment procedures and effect monitored by AS-OCT are shown as below:

D0: Because of the presence of sector iridectomy, initial therapy of Nd:YAG laser hyaloidotomy was made, during which a forward gush of aqueous together with simultaneous reshaping of the anterior chamber was observed (Fig. 1D, 1E). The ACD measured by AS-OCT was 1.72 mm (Fig. 1F) a few minutes after the procedure. However, extensive PAS was not separated and IOP did not decrease. Intravenous 250 ml 20% mannitol, topical steroids 8 times a day, carteolol bid, and brinzolamide tid were also given.

D2: IOP was decreased to 28 mm Hg, but AS-OCT showed anterior synechia was unrelieved and the anterior chamber was widened. Viscoelastics goniosynechialysis was performed to separate the PAS.

D3: AS-OCT showed the ACD was increased deepened to 1.94 mm (Fig. 2A) and IOP decreased to 18 mm Hg. PAS was relieved in all directions. Corrected visual acuity was 16/20 [−2.50 Diopter (D), Cylinder (cyl), −1.25 D, Axis (Ax) 125°]. Anti-glaucoma medications were terminated.

D5: AS-OCT showed the ACD slightly reduced to 1.83 mm (Fig. 2B). IOP was 19 mm Hg. The decrease of the ACD

implied that incomplete occlusion by vitreous may exist in the hole made by previous laser hyaloidotomy. A second Nd:YAG laser hyaloidotomy was performed to enlarge the hole. Several minutes after the laser, AS-OCT showed the ACD was increased to 2.01 mm (Fig. 2C).

D9: AS-OCT showed the ACD was 2.28 mm. PAS was not seen in any direction. IOP was 18 mm Hg without any medication. The corneal edema disappeared and the central corneal thickness decreased to 560 μ m (Fig. 2D).

DISCUSSION

Malignant glaucoma is thought to be a misdirection of aqueous humor flow backward into, or in front of, the vitreous cavity, causing by the forward movement of the lens-iris and iris-hyaloid diaphragm.¹⁰ The therapeutic goal is to allow aqueous humor to flow correctly into the anterior

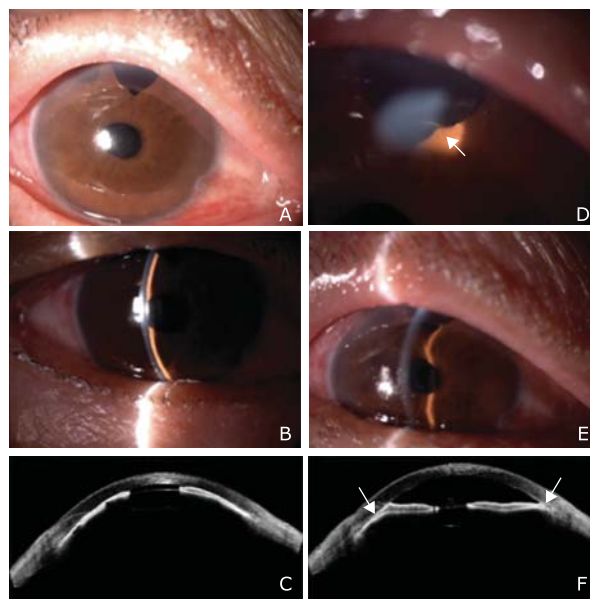


Figure 1. Patent peripheral iridectomy and intraocular lens were seen by slit lamp (A). The shallowing of ACA and peripheral iris-corneal touch during the acute phase of malignant glaucoma shown by simultaneous slit lamp (B) and AS-OCT examinations (C). A few minutes after the 1st Nd:YAG laser hyaloidotomy, deepening of the anterior chamber was detected by both slit lamp (E) and AS-OCT (F) (ACD 1.72 mm), but still with peripheral anterior synechia (arrows in F); the hyaloidotomy hole made by laser was also observed by slit lamp (arrow in D).

ACA: anterior chamber angle; AS-OCT: anterior segment optical coherence tomography; Nd:YAG: neodymium-doped yttrium aluminium garnet; ACD: anterior chamber depth.



Figure 2. AS-OCT showing peripheral anterior synechia was relieved at D3 following goniosynechialysis with viscoelastics (ACD 1.94 mm, ACA 24.8°) (arrows in A); both ACD and ACA decreased (ACD 1.83 mm, ACA 22.4°) (B); few minutes after the 2nd laser hyaloidotomy (ACD 2.01 mm, ACA 26.7°) (C); further deepening of the ACA at last follow-up (ACD 2.28 mm, ACA 27.2°) at D9 (D).

chamber. Medical treatment, Nd:YAG laser capsulotomy and hyaloidotomy,^{1, 3, 4, 11} and pars plana vitrectomy^{1, 12} are optional procedures. Individual treatment regimen should be arranged to manage this situation successfully and timely with least invasion and risk.

In this study we present the dynamic changes of anterior segment by Visante-OCT (Carl Zeiss Meditec; CA, USA) in a case of malignant glaucoma during treatments. AS-OCT provides a noncontact method to display the anterior segment of the eye with high-resolution. Hence, the relative positions of anterior segment structures in malignant glaucoma can be clearly visualized by AS-OCT.^{7, 13-15}

Previous study has demonstrated using UBM to show the configuration of anterior segment structures during malignant glaucoma process.^{16,17} Compared to UBM, AS-OCT is more valuable in postoperative eyes because it is noncontact and reduces the risk of potential infection and corneal abrasion. Besides, AS-OCT can provide quantitative analyses of the anterior chamber with faster scanning speed, and the measurements are more reproducible than UBM.¹⁸ On the other hand, AS-OCT is unable to explore structures beneath the iris because light is blocked by the pigmented layer.¹⁹ But UBM can delineate structures surrounding the posterior chamber, which makes it possible to detect existence of an abnormal anatomic relation between the ciliary processes, the lens or intraocular lens, and the anterior vitreous face in malignant glaucoma cases.²⁰

In this case, with the assist of AS-OCT, it was revealed that Nd:YAG laser hyaloidotomy can communicate the anterior chamber and vitreous cavity, and reshape the anterior chamber effectively. However, AS-OCT also showed PAS could not relief after reshaping of the anterior chamber sometimes. This may explain IOP is not decreased

after the laser capsulotomy or hyaloidotomy in some cases. The decision of goniosynechialysis was made. In later follow-up, AS-OCT quantitatively monitored the ACD and anterior chamber angle, helping us to identify the reduction of ACD on the fifth day after goniosynechialysis, implying the patency of the first capsulotomy might be partially obstructed. Therefore a second laser hyaloidotomy was performed to further deepen the anterior chamber. Without the precise measurement of ACD by AS-OCT, the previous treatment might be considered sufficient enough and the early sign of treatment failure could be ignored. During laser hyaloidotomy, incomplete occlusion by vitreous may happen so that follow-up examinations are necessary.

In summary, malignant glaucoma remains one of the most notoriously difficult problems after cataract surgery, especially in a unique eye with short ocular axis. Our case demonstrates that AS-OCT may not only help to confirm the diagnosis of malignant glaucoma, but also provide valuable guidance for further treatment.

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