CASE REPORT

MANAGEMENT OF SECONDARY ANGLE-CLOSURE GLAUCOMA IN ANTERIOR SEGMENT DYSGENESIS AND ANTERIOR MICROPHTHALMOS PATIENT

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ABSTRACT

Introduction: *The majority of cases of anterior segment dysgenesis (ASD) and anterior microphthalmia are known to be complicated by angle-closure glaucoma, which is also the primary cause of visual loss. Medical therapy of this secondary glaucoma is frequently ineffective, necessitating surgery. However, managing the surgery in an eye with a crowded anterior chamber is difficult. This study aimed to report the management of secondary angle-closure glaucoma in anterior segment dysgenesis and anterior micropthalmos patient.*

Case Report: : *A 39-year-old woman presented to Glaucoma unit with chief complaint of pain on the right eye. She also noted blurred vision, redness, and headache approximately seven months before presentation. The patient had a history of glaucoma since 5 years old, but hadn't regularly visit for a long time. The visual acuity was 1/60 and intraocular pressure (IOP) was 45. Anterior segment evaluation revealed scleral thinning with injection, microcornea, sclerocornea, hazy peripheral cornea, iridocorneal adhesion, shallow anterior chamber, iris transillumination defect and lens opacity. A-scan biometry showed normal axial length. She was diagnosed with secondary angle-closure glaucoma with anterior segment dysgenesis, anterior microphthalmia and presenile cataract of the right eye. The patient underwent combined phacotrabeculectomy, pars plana vitrectomy and intraocular lens implantation.*

Discussion: *Surgical procedure is indicated if pharmacological therapy cannot control IOP and glaucoma progressivity, including trabeculectomy combined with cataract extraction. However, cataract extraction is more difficult in shallow anterior eye chamber because the working field is narrower and the distance between the cornea and lens is closer. Some strategies to prevent this include pars plana vitrectomy (VPP).*

Conclusion: *Anterior segment dysgenesis, though rare, cause vision loss by glaucoma as complication. Treatment of secondary glaucoma aim to lowering IOP to halt its progression. Combined phacotrabeculectomy, pars plana vitrectomy and intraocular lens implantation was a safe procedure in this crowded anterior chamber eye.*

Keywords: *secondary angle-closure glaucoma, anterior segment dysgenesis, anterior microphthalmos, combined phacotrabeculectomy, pars plana vitrectomy*

INTRODUCTION

Angle-closure glaucoma can be found in patients with anterior segment dysgenesis (ASD), microcornea or microphthalmia. As many as 50% of patients with ASD will develop

glaucoma in the first or second decade. The incidence of glaucoma in anterior microphthalmia patients (corneal diameter less than 11 mm with an axial length of more than 20 mm) was as much as 77% in the fourth decade. Microphthalmia accompanied by microcorneas is a major risk factor for closed-angle glaucoma. Untreated closed-angle glaucoma can progressively damage the optic nerve and may cause blindness.[1-3]

In older ASD patients, medical treatment should be pursued before surgery. If medication is unable to control IOP and the rate of glaucoma progression, surgery is advised. Trabeculectomy with antimetabolites, trabeculectomy combined with trabeculotomy, implantation of a glaucoma drainage device (GDD), or transscleral cyclophotocoagulation (TSCPC) are all surgical choices. In glaucoma patients who also have cataracts and have advanced vision loss, or who have uncontrolled glaucoma despite taking medication to control it, trabeculectomy combined with cataract extraction is recommended. Lens extraction can deepen the anterior eye chamber, expand the angle, and lessen irido-trabecular contact in closed-angle glaucoma.[3-7]

In anterior microphthalmia cases, because of narrower working field and smaller distance between the cornea and lens in shallow anterior eye chambers, the approach for cataract extraction surgery is more challenging. It is necessary to combine other surgical methods to reduce the incidence of intraoperative complications in microphthalmia cases and increase the success rate. The removal of the lens can reduce the contents of the eyeball to deepen the anterior chamber. In addition, the vitrectomy can create enough space for the iris lens diaphragm to move backwards. Therefore, a combination of vitrectomy and lensectomy is considered a suitable method to solve this complicated situation.[5,6] The purpose of this case report is to point out the management of secondary closed-angle glaucoma in patients with anterior segment dysgenesis and anterior microphthalmia.

CASE ILUSTRATION

A 39-year-old woman came to Glaucoma unit with a complaint of pain of the right eye since 7 months ago. Complaints are accompanied by an increasing blurry vision, eye redness, and headaches. Complaints of nausea are sometimes felt, but vomiting is denied. There is a history of glaucoma since she was 5 years old, and the left eye was the same as the right eye previously. Both eyes felt blurry and seemed to twitch since childhood. The patient had been treated at Cicendo Eye Hospital but lost to follow-up for a long time. In 2005, the left eye suddenly ached and bled. The patient underwent removal of the left eyeball and implanted a prosthesis. There is no history of recurrent eye redness, trauma, nor long-term use of glasses

and steroid drugs. There are abnormalities in the teeth and weak left limbs since childhood. There is neither hearing loss nor mental delay. There is no history of heart disease, hypertension, diabetes mellitus, asthma nor kidney disease. The patient is an only child, premature, spontaneous, and immediately cry. The length and birth weight are unknown to the patient. The history of infection at the time the patient was conceived is unknown. No abnormality of growth and development. Complete basic immunization history. No similar complaints in the family.

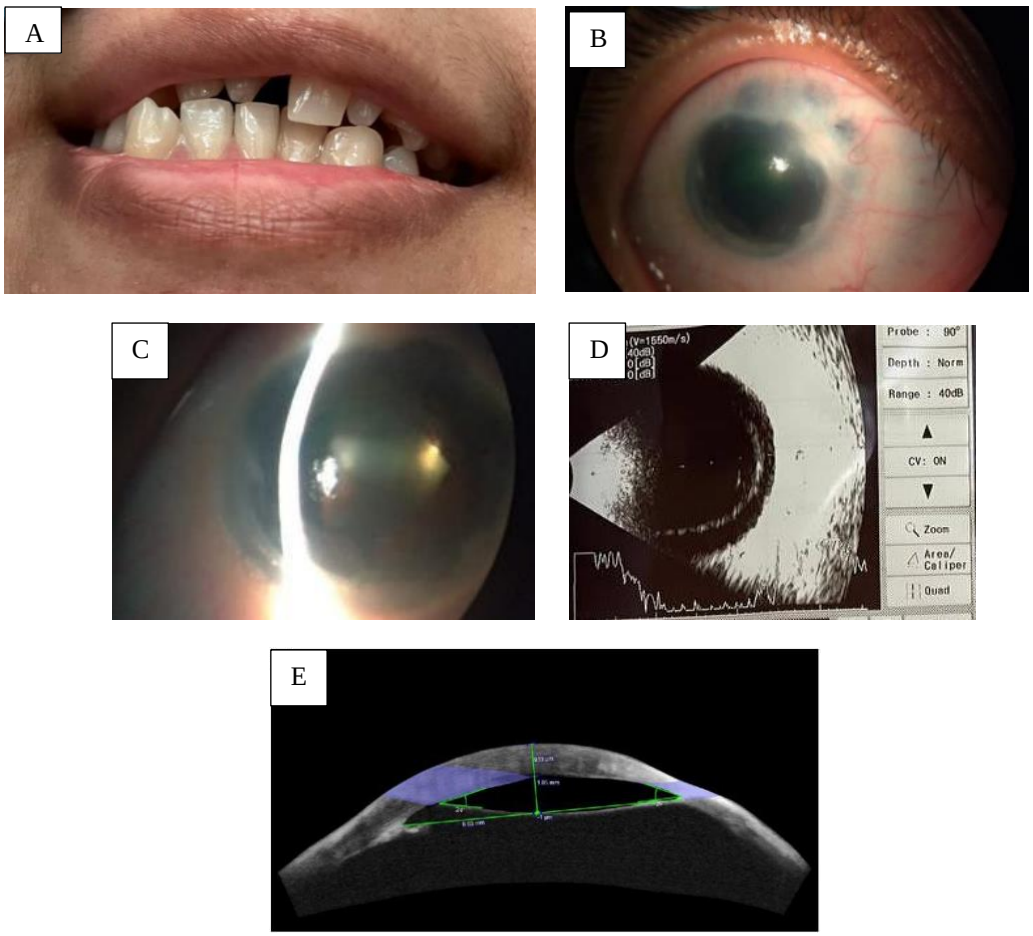

Figure 1. The clinical manifestation. (A) Microdontia. (B) Microcornea, sclerocornea, synechia, and cloudy lens. (C) Shallow anterior chamber. (D) B-Scan USG showed complete posterior vitreous detachment. (E) AS-OCT showed thick CCT and shallow anterior eye chamber.

Vital signs were within normal limits. General examination showed a protruding lower lip, microdontia, and several cone-shaped teeth, as seen in figure 1. Motoric neurological status of the upper and lower right extremities was 5, and the upper and lower left extremities was 4. Ophthalmological examination obtained the visual acuity of the right eye (VOD) 1/60, while the visual acuity of the left eye (VOS) could not be assessed. IOP measured with applanation tonometry (ATN) of the right eye was 45 mmHg. There was nystagmus, and the movement of the right eyeball was limited to superior. The anterior segment of the right eye in figure 1,

showed superior scleral injection, choroid shadow in superior and superonasal, ciliary injection, cornea had a diameter of 8 mm, sclerocornea in the direction of 12 to 3 o'clock and turbidity in the peripheral 360 degrees, anterior chamber was Van Herrick grade I flare/cell (f/c) -/-, irregular pupil, iris transillumination defect (+), posterior synechia in the direction of 4 to 9 o'clock, peripheral anterior synechia in the direction of 11 to 4 o'clock, and slightly cloudy lenses. Gonioscopy examination obtained peripheral anterior synechia in superior and nasal side of the lens, and Schwalbe line in temporal and inferior. The posterior segment of the right eye appeared to have a well defined papil, cup/disc ratio was 0.9, and thinning of the superior and inferior part of neural rims. The results of Ultrasonography (ultrasound) B- scan of the right eye in figure 2 shows complete posterior vitreous detachment (PVD), with scleral thickness in area of posterior pole was 0.98 mm. The patient was examined with biometric A-scan with axial length result of 25.24 mm. The anterior segment optical computed tomography (AS-OCT) showed thick central corneal thickness and shallow anterior chamber.

The patient was diagnosed with secondary closed-angle glaucoma, dysgenesis of the anterior segment suspect Axenfeld-Rieger syndrome, anterior microphthalmia, microcornea and presenile cataract of the right eye, as well as anophthalmia of the left eye. The patient was given betaxolol 0.5% 2x1 drop of the right eye, acetazolamide 3x250 mg peroral and potassium 1x1 tablet peroral. The combined phacotrabeculectomy, implantation of intraocular lens (IOL) and vitrectomy pars plana (VPP) of the right eye was performed in general anesthesia.

The surgical technique was performed as seen in fugure 2. Corneal traction and peritomy were performed in the superotemporal. Bleeding was controlled by cauter. The flap of the sclera was made rectangular in shape with a size of 4x3 mm. Grooving using a stab knife with a half depth of the sclera, then tunnelling was done using a crescent knife. Corneal diameter was 10 mm, measured by caliper.

Three 23G trocars were installed 3.5 mm from limbus. Pars plana vitrectomy was performed in the vitreous core and vitreous base. The incision was done with 2.75 mm keratome on the same side as the flap sclera. Viscoelastic fluid was injected to form the anterior eye chamber. Synechiolysis was performed to release posterior and anterior synechia. Trypan blue was injected to color the anterior capsule lens, then rinsed with a balanced saline solution. Viscoelastic fluid was injected before continuous curvilinear capsulorrhexis. Hydrodissection and hydrodelineation were performed, then perpendicular paracentesis of the main port. Lens extraction was performed by phacoemulsification, followed by aspiration of the cortex. Viscoelastic injection was performed prior to IOL implantation in the lens sac. The IOL used was Asphina 404 measuring +14.50D, single piece shape, made of hydrophilic acrylic with an

optical diameter of 6 mm and a total length of 11 mm. Simple interrupted suture was performed on the main port using ethylon 10.0 thread. Stromal hydration was performed to seal the incision.

A 2x2 mm sclerotomy was done using a stab knife. Peripheral iridectomy was not done. Sclera flaps were sutured on both sides with a simple interrupted suture using ethylon 10.0 thread. The conjunctiva was also sutured. After re-evaluation of the posterior segment and no complication was found, the trocar was released. Postoperative therapy given was levofloxacin 6x1 drop, prednisolone acetate 6x1 drop, chloramphenicol ointment and hydrocortisone acetate 3x1, ciprofloxacin 2x500 mg peroral (po), paracetamol 3x500 mg po, methylprednisolone 1x48 mg po, and lansoprazole 1x30 mg po.

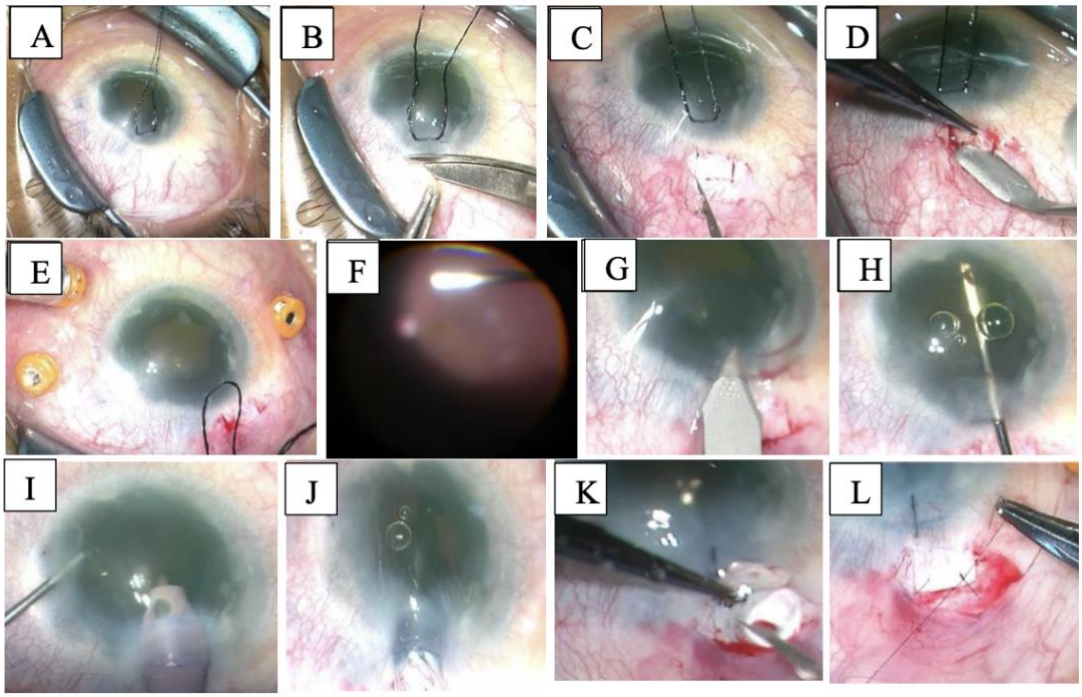

Figure 2. Scleral flap procedure (A-D), followed by vitrectomy pars plana (E-F). Then synechiolysis, phacoemulsification, and IOL implantation were done (G-J). Then sclerotomy dan hecting (K-L).

Examination 1 day after surgery obtained VOD 1/300. The IOP was 26 mmHg. The anterior segment of the right eye in figure 3 showed sclera injection in superior, choroid shadow in superonasal, subconjunctival hemorrhage, blebs formed, intact suture, microcornea, sclerocornea at 12 to 3 o'clock, turbidity in the peripheral 360 degrees, and corneal edema. Anterior eye chamber depth was Van Herrick grade I-II, f/c was difficult to assess, irregular pupil, iris transillumination defect (+), anterior synechia (+), and posterior chamber intraocular lens (PC IOL) was in place. However, visual acuity remained unchanged and IOP was increased to 40 mmHg after 2 months following the surgery. The patient underwent transscleral

cyclophotocoagulation of the right eye. Pain of the right eye decreased despite the IOP was 38 mmHg after 2 years following the surgery.

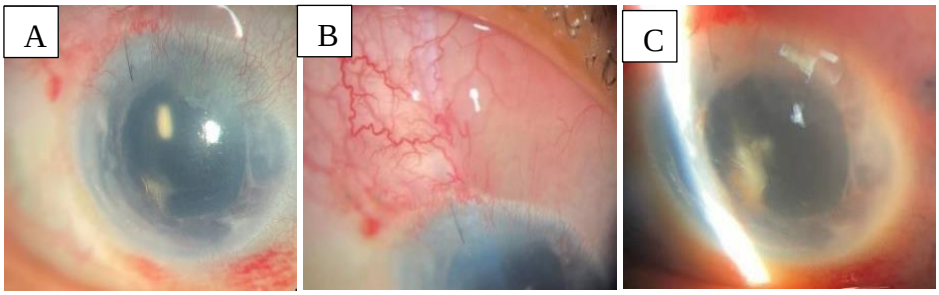

Figure 3. Ocular examination 1 day post surgery. (A) subconjunctival bleeding. (B) Bleb was formed. (C) Shallow anterior eye chamber.

DISCUSSION

Secondary glaucoma can be associated with ocular abnormalities, such as dysgenesis of the anterior segment. Dysgenesis of the anterior segment is a broad spectrum of conditions that include developmental abnormalities of the cornea, iris, angle of the anterior eye chamber and trabeculae tissue. One of the anomalies of the development of the anterior segment is Axenfeld-Rieger syndrome (ARS). ARS cases occur in 1of 200,000 births. ARS is caused by PITX2 or FOXC1 mutations that can be passed down predominantly autosomal or occur sporadically. Most cases occur bilaterally with a median age of 6.3 years. There is no gender predilection in ARS cases. Clinical manifestations in the form of posterior embryotoxone of the cornea, characterized by a prominent and shifted Schwalbe line to the anterior. Other manifestations are the adhesion of the iris to the Schwalbe line, hypoplasia of the iris, atrophy of the iris in the presence of hole in the iris, correctopia, polychoria, uvea ectropion, megalocornea or microcornea. Other rare ocular manifestations include strabismus, cataracts, retinal detachment, macular degeneration, optic nervus hypoplasia, and chorioretina coloboma. Systemic manifestations include hypodentia, microdentia, malar hypoplasia, hypertelorism, protruding periumbilical bark, hypospadias, heart valve abnormalities, pituitary gland abnormalities, neurological disorders, mental deficiencies, hearing loss and short stature. As many as 50% of cases are related to glaucoma which generally occurs since the first or second decade. Increased intraocular pressure (IOP) is caused by iridogoniodisgenesis and adhesion of the iris to the angular structure of the anterior eye chamber.[6-9] This patient was diagnosed with glaucoma from the age of 5 years. In this case, iris adhesion to the cornea, hypoplasia of the iris, and microcornea were found. Systemic manifestations are also apparent in this patient, namely anomalies in dental and neurological disorders.

Microcornea is characterized by corneal diameter of 10 mm or less after the age of 2 years. Microcornea is an autosomal dominant defect and can be a component of ocular malformations such as microphthalmia, nanophthalmos, Rieger anomalies, and congenital rubella syndrome. Microphthalmia is characterized by eyeballs measuring less than 2 standard deviations at normal age, hyperopia and microcorneas. Microphthalmias are divided into simple and complex microphthalmia. Simple microphthalmia is not accompanied by other ocular malformations, while complex microphthalmia accompanied by ocular or systemic malformations. Shortened axial length of the anterior segment can occur in relative anterior microphthalmia. Shallow anterior eye chamber and narrow angle in microphthalmia may cause a closed-angle glaucoma.[10-12] In this case, the diameter of the cornea was 10 mm. The depth of the anterior eye chamber of the anterior segment OCT examination was 0.83 mm, while the axial length of the A-scan biometric examination was 25.24 mm. The manifestations indicated the presence of relative anterior microphthalmia.

Pharmacological therapy should be the first choice before surgery in older ARS patients. Surgical action is indicated if pharmacological therapy cannot control IOP and glaucoma progressivity. Surgical options include trabeculectomy with antimetabolites, a combination of trabeculectomy and trabeculotomy, Glaucoma Drainage Device (GDD) implantation, or transscleral cyclophotocoagulation (TSCPC). Some considerations before implanting GDD include visual acuity, corneal condition, eyeball motion, conjunctival status, sclera health, peripheral anterior synechia location and vitreous status. GDD implantation can be considered if the patient still has visual potential. It is not safe to implant GDD on a thin sclera.[9,10,13] In this case, the patient came with an advanced glaucoma condition, so surgery was recommended. GDD implantation could not be performed due to thin sclera.

Research by Zepeda et al. showed trabeculectomy in ARS patients has a 50% success rate in the first year, 33% by the 15th year and 7% by the 25th year. The success rate of trabeculectomy with antimetabolites is higher, namely 78% in the first year, 65% in the 10th year and 43% by the 30th year. Some conditions that decrease the success rate of trabeculectomy are iridis rubeosis, active anterior uveitis, extensive conjunctival wounds or thin sclera because it increases the risk of scarring. Administration of antimetabolites can increase the success and survival rate of trabeculectomy by reducing the risk of scarring. Nevertheless, antimetabolites may increase the risk of hypotonic maculopathy and infection. The risk of occurrence of such complications is higher in patients with conjunctiva or thin sclera.[7,9,10,14] In this case, patients were not given antimetabolites due to thin sclera.

Trabeculectomy combined with cataract extraction can prevent premature increase of intraocular pressure after surgery and accelerate visual rehabilitation. These procedures are indicated in glaucoma patients accompanied by cataract with advanced vision loss, or uncontrolled glaucoma with pharmacological treatment. In closed-angle glaucoma, lens extraction can open the angle, deepen anterior eye chamber, and reduce irido-trabecular contact. The success rate of these combined procedures in lowering intraocular pressure without pharmacological treatment is 66-95%. Phacotrabeculectomy incisions can done on one side or on both sides.[9,14,15] In this case cataract extraction was expected to deepen the anterior eye chamber, in addition to clear the visual axis. The incision of phacotrabeculectomy was done on one side because the other side has a thin sclera, hazy cornea, as well as anterior synechia. The patient's IOP was reduced from 45 mmHg before surgery to 26 mmHg 1 day after surgery. Antiglaucoma drugs reduced from 3 drugs before surgery to only 1 after surgery.

Cataract extraction surgery technique is more difficult in shallow anterior eye chamber because the working field is narrower and the distance between the cornea and lens is closer. Microphthalmos patients have a higher risk of complications with worse visual outcomes. Complications that can occur are posterior capsule rupture, uveal effusion, corneal decompensation, retinal detachment, choroid or vitreous hemorrhage and aqueous misdirection. Some strategies to prevent this include preoperative mannitol infusion, intraoperative use of viscoelastic fluid, pars plana vitrectomy (PPV) or vitreous pars plana aspiration. Previous studies have shown that vitreous tap or PPV successfully maintains the depth of anterior eye chamber, sufficient for the phacoemulsification process and increases the depth of BMD after surgery with a complication incidence rate of 0-5.5%.[16-19] In this case, preoperative mannitol administration, injection intraoperative viscoelastic and pars plana vitrectomy (VPP) were done. When surgery was done, the depth of anterior eye chamber could still be maintained.

Intraocular (IOL) implantation in posterior eye chamber in patients with microcornea cannot be performed if the diameter of the cornea is less than 9.5 mm. Possible complications of IOL implantation in microphthalmia or microcorneas are secondary glaucoma and retinal detachment. Chirapapaisan et al. used single foldable IOL in the sulcus and the lens remained stable for up to 6 months of monitoring. Kumar et al. managed to maintain the stability of the IOL with a 3-piece IOL, haptic cutting, and sclera fixation using glue. Anterior chamber IOL is not recommended in cases of shallow anterior eye chamber due to the risk of endothelial damage. Acrylic IOL material has good biocompatibility, while polymethyl methacrylate (PMMA) lens material prolongs inflammatory response.[14,20,21] In this case, the IOL used was a

foldable single piece made of acrylic with a total length of 11 mm. After surgery, there was no change of visus, related to the condition of corneal edema and advance optic nerve damage. Examination of the anterior segment after surgery showed a stable IOL position.

The prognosis depends on several factors such as age, glaucoma severity, previous retinal conditions, the presence of amblyopia, previous nystagmus, choroidal coloboma, and corneal opacity.[21,22] The presence of a history of congenital anomalies and extensive iris adhesions that may cause the angle of the eye chambers to close again can increase the IOP again and worse the prognosis. TSCPC has been used to lower IOP in cases of refractory glaucoma.

CONCLUSION

Anterior segment dysgenesis, although rare, can cause closed-angle glaucoma. The goal of therapy is to reduce IOP so as to reduce the progressivity of the disease. A combination of phachotrabeculectomy, IOL implantation, and pars plana vitrectomy can be performed on patients with glaucoma that was caused by anterior segment dysgenesis and anterior microphthalmia, to lower IOP and clear the visual axis with a relatively safe procedure.

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