CASE REPORT

Recurrence of aqueous misdirection following pars plana vitrectomy in pseudophakic eyes

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SUMMARY

We present a retrospective interventional case series of four patients with pseudophakic eye who developed recurrent aqueous misdirection following pars plana vitrectomy (PPV) for malignant glaucoma (MG). The patients were treated with neodymium: YAG (Yttrium Aluminum Garnet) laser hyaloidotomy/membranotomy through the patent peripheral iridectomy. The main outcome measure was resolution of MG. The intervention resulted in resolution of MG in all four cases. The cause for recurrence was an inflammatory membrane covering the hyaloidotomy opening in three eyes and the haptic of intraocular lens blocking the hyaloidotomy opening in one eye. Recurrence of aqueous misdirection even after vitrectomy may be related to obstruction of aqueous flow through the communication created, either by intraocular lens or fibrin. Treatment of this condition involves restoring aqueous flow to the anterior chamber from the anterior vitreous by treating the cause, and most often the YAG laser hyaloidotomy/membranotomy is successful in relieving the condition.

BACKGROUND

Classically, malignant glaucoma (MG) includes clinical situations having the following features: shallowing/flattening of the anterior chamber (AC), unresponsiveness or aggravation by miotics, with relief from cycloplegic-mydriatic therapy in the presence of a patent iridotomy, most often with markedly elevated intraocular pressure (IOP). Posterior segment pathology must be ruled out with the help of indirect ophthalmoscopy or ultrasound B-scan.¹ Several pathogenic mechanisms for MG have been described.² Shaffer described the posterior aqueous diversion and its accumulation behind a posterior vitreous detachment with subsequent forward movement of the iris lens diaphragm as the cause for MG.³ Chandler suggested that it is the laxity of the lens zonules coupled with the vitreous pressure that leads to the forward lens movement.⁴ Quigley *et al*⁵ recently proposed that the precipitating event that increases the vitreous pressure is choroidal expansion with a compensatory outflow of aqueous along the posteroanterior pressure gradient causing shallowing of AC and MG. Laser treatment in the form of Nd:YAG (Yttrium Aluminum Garnet) laser peripheral iridotomy with anterior hyaloidotomy may help in resolution of MG when medical therapy fails.^{6,7} The success of laser treatment depends on the disruption of the anterior hyaloid face, and creation of a communication between the vitreous and the AC.⁸ The most definitive surgical treatment for MG is pars plana

vitrectomy (PPV) with a complete anterior hyaloidotomy and peripheral iridectomy. DeBrouwere *et al*⁹ reported no recurrence after vitrectomy with zonullectomy and iridectomy. A MG-like syndrome has been reported after PPV in non-MG eyes due to pupillary block or blockade of the iridotomy/hyaloidotomy opening.¹⁰ However, the recurrence of MG in eyes treated by PPV with zonulohyaloidovitreotomy and iridectomy is rare but may be possible.

CASE PRESENTATION

Case 1

A 60-year-old man presented 10 days after an uneventful cataract surgery with a shallow AC and an IOP of 42 mm Hg, which failed to be controlled with YAG laser iridotomy with hyaloidotomy, and topical and oral antiglaucoma medications. With a diagnosis of MG, he was subjected to PPV with partial zonullectomy and peripheral iridectomy enlargement, which resulted in immediate deepening of the AC. On postoperative day 1, he had a shallow AC with an IOP of 40 mm Hg. On examination, there was pupillary optic capture superiorly, the inferior iridectomy was patent and the plate haptic of the posterior chamber intraocular lens (PCIOL) was seen blocking the inferior hyaloidotomy.

Case 2

A 64-year-old woman presented with decreased vision in the right eye following a trabeculectomy for medically uncontrolled primary angle closure glaucoma performed 3 months prior. Her IOP was 24 mm Hg with 360° closed angles on gonioscopy. She had grade 2 nuclear cataract and flat central and peripheral AC with a patent iridotomy, and a diffuse bleb. No such shallowing was seen in the other eye, which had a similar cataract, hence ruling out lens induced angle closure. She was diagnosed as having MG posttrabeculectomy and cataract. She underwent vitrectomy with parital zonullectomy and inferior iridectomy at 6 o'clock position combined with extracapsular cataract extraction and IOL implantation. Postoperatively, the IOP was 20 mm Hg in the right eye with a deep central AC and AC inflammation. The disc showed a 0.9 cup with a bipolar notch. The patient was put on postoperative topical steroids and cycloplegics. One week later, the IOP increased to 26 mm Hg with shallowing of the central AC. A fibrinous membrane was found covering the iridectomy (figure 1).

Case 3

A 44-year-old woman, a known case of angle closure glaucoma, with two previous failed filters

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Figure 1 Slit lamp photograph showing a recurrence of malignant glaucoma due to blockage of the hyaloidotomy opening by an inflammatory membrane.

Figure 2 Slit lamp photograph 1 month postoperative showing a deep central anterior chamber and an inferior patent hyaloidotomy opening after laser membranotomy.

and pseudophakia, presented with decreased vision and pain in the left eye. On examination, her vision was 20/60 with an IOP of 32 mm Hg. She underwent an uneventful Ahmed glaucoma valve implantation for her refractory glaucoma in the left eye. One month later she developed a shallow central and peripheral AC with tube corneal touch and an IOP of 32 mm Hg, which did not respond to cycloplegics and antiglaucoma medications. With a diagnosis of MG, she underwent a PPV with a partial zonullectomy and inferior iridectomy following which the central AC deepened and IOP decreased to 16 mm Hg. Three weeks later, she again presented with shallow central AC and tube corneal touch. The inferior iridectomy was found to be covered with a thin inflammatory membrane.

Case 4

A 52-year-old man with primary angle closure glaucoma in both eyes underwent combined phacoemulsification and trabeculectomy in the right eye for uncontrolled pressures and cataract. One week later, he returned with a shallow central AC with IOP of 38 mm Hg. With a diagnosis of MG, he was put on cycloplegics and antiglaucoma medications to which he did not respond. He then underwent a PPV with a partial zonullectomy and inferior iridectomy following which the central AC deepened and IOP decreased to 14 mm Hg. After 1 month, he again developed a shallow central AC. The inferior iridectomy was covered with a thin inflammatory membrane.

INVESTIGATIONS

An ultrasound B-scan was performed to rule out posterior segment pathology where a fundus examination was not possible due to media haze.

TREATMENT

We performed Nd:YAG laser hyaloidotomy superiorly beyond the optic of the PCIOL in case 1. For the other three cases we performed an Nd:YAG laser membranotomy to restore the anteroposterior communication.

OUTCOME AND FOLLOW-UP

Case 1

The AC deepened immediately with the IOP dropping to 8 mm Hg, which was maintained with an improvement in vision to 20/20 until the last follow-up at 2 years.

Case 2

The AC deepened and the IOP decreased to 12 mm Hg (figure 2). The IOP was maintained at 14 mm Hg at 18 months of follow-up with the vision stabilised at 20/60.

Case 3

The AC deepened and the final IOP in the left eye was 18 mm Hg with a best corrected visual acuity of 20/20 at 24 months of follow-up.

Case 4

Nd:YAG laser treatment resulted in deepening of the central AC. The final IOP in the right eye was 16 mm Hg with a best corrected visual acuity of 20/80 at 12 months of follow-up.

DISCUSSION

MG is a rare complication after intraocular surgery especially in patients with pre-existing angle closure glaucoma. The definition of resolution along with the outcomes of MG management and our treatment algorithm are detailed in our previous publication.¹¹ Recurrence was defined as the re-shallowing of the central AC after the initial deepening with IOP $\geq$ 21 mm Hg. Classically, MG is described to occur following a trabeculectomy or cataract surgery, with increased postoperative inflammation.¹² This predisposition was seen in all the patients in the current series.

In pseudophakic eyes, complete removal of the anterior hyaloid is possible and is hence associated with fewer recurrences as compared with phakic eyes.^{6 13 14} Residual capsular material and lens zonular fibres behind the iridectomy opening are other causes leading to recurrences in pseudophakic eyes.⁶ Interestingly, in our series, recurrence was seen even though utmost care was taken to disrupt the anterior hyaloid during vitrectomy combined with a zonullectomy and iridectomy in the pseudophakic eyes. The recurrence of MG was not due to the persistence of the anterior hyaloid, but due to the hyaloidotomy opening blocked by the plate haptic of the IOL in case 1 and inflammatory membrane blocking the posteroanterior communication in cases 2, 3 and 4. There is little information in the literature regarding the management of recurrence of MG following PPV. Massicotte *et al*¹⁰ described two cases of recurrence following PPV. In one, fibrin was noted to be occluding the iridectomy site 1 week postoperatively; the patient was treated by intracameral tissue plasminogen activator (tPA). The other patient received a surgical peripheral iridectomy through the pars plana. Although use of intracameral tPA is an option to treat inflammatory membranes, it necessitates entry into the AC and is more invasive and expensive compared with

laser membranotomy. Moreover, laser is easily accessible to most ophthalmologists and can be easily performed. Since three of four cases in our series had an inflammatory membrane as a cause for the recurrence of MG, it is also important to control the postlaser inflammation aggressively to avoid further recurrence of this serious complication and its sequela. Any delay in intervention may also result in further thickening and rigidity of the inflammatory membrane, which may not be amenable to treatment by laser membranotomy and will therefore require surgical intervention. A similar inability of the Nd:YAG laser membranotomy to be effective in a different clinical scenario (for a descemet membrane remnant) following prolonged withholding of treatment has been described.¹⁵ The increased thickness of the membrane with time was described as the possible cause. Hence, the timing of Nd:YAG laser treatment is also important and the treatment should be given as early as possible.

The use of a non-invasive modality such as Nd:YAG laser to treat this recurrent complication has not been previously described. Also, recurrence of MG in postvitrectomised eyes due to the blockade of the hyaloidotomy opening with IOL haptic has not been reported.

Learning points

- Definitive treatment of malignant glaucoma is pars plana vitrectomy with partial zonulectomy and iridectomy.
- Complete removal of anterior hyaloid is necessary to avoid recurrences.
- Hyaloidotomy opening can be blocked by an inflammatory membrane or by the plate haptic of the intraocular lens.
- Use of YAG (Yttrium Aluminum Garnet) laser to disrupt the inflammatory membrane or to make another opening beyond the site of blockage is an effective measure to treat recurrence.

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