Nd-YAG laser hyaloidotomy for malignant glaucoma following one-piece 7 mm intraocular lens implantation

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Abstract

Three cases of malignant glaucoma following extracapsular cataract extraction with 7 mm one-piece posterior chamber intraocular lens implantation are presented. Nd-YAG laser hyaloidotomy was successfully performed in all eyes, but was difficult and required several sessions in two eyes. In the third eye, which had a sector iridectomy, laser hyaloidotomy applied over the edge of the lens optic through the iridectomy resulted in brisk deepening of the anterior chamber and reduction of intraocular pressure. We propose that the one-piece 7 mm optic posterior chamber intraocular lens may constitute an obstacle to successful hyaloidotomy, mainly owing to its large size, as it may block aqueous percolation from the vitreous into the anterior chamber. Eyes prone to develop malignant glaucoma after surgery should have a sector or large peripheral iridectomy to facilitate postoperative Nd-YAG laser hyaloidotomy if required.

The application of the Q-switched Nd-YAG laser for aphakic or pseudophakic malignant glaucoma has already been accepted as the surgical treatment of choice in cases where topical treatment with cycloplegic drops has failed. The treatment, as proposed by Epstein *et al*,¹⁻³ consists in cutting with the laser through the anterior hyaloid face (hyaloidotomy), with consequent release of aqueous trapped in the vitreous gel. This procedure is very effective in relieving the 'vitreous block', and aqueous diversion is reversed in both aphakic and pseudophakic eyes.⁴⁻⁹

In recent years the one piece 7 mm optic posterior chamber intraocular lens (PC-IOL) has become popular. This transition to 7 mm lenses was based on the belief that a larger lens would provide better optical centration, less glare, and fewer optical aberrations.

In this study we report on three cases in which malignant pseudophakic glaucoma followed the insertion of 7 mm one-piece IOLs. In two eyes, Nd-YAG laser hyaloidotomy was technically difficult, and the relief of the condition was slow. In the third case hyaloidotomy was easily and successfully done through a pre-prepared sector iridectomy. Possible reasons for such difficulties and some suggestions for minimising them will be discussed.

Case reports

In the last two years we have detected three eyes that developed malignant glaucoma following

extracapsular cataract extraction and insertion of a one-piece 7 mm posterior chamber intraocular lens (IOL).

CASE 1

A 75-year-old woman underwent uneventful extracapsular cataract extraction in the right eye with insertion of a one-piece 7 mm posterior chamber IOL. She was known to have suffered from chronic angle closure glaucoma in both eyes, and five years earlier bilateral laser iridotomies had been performed. Since then the intraocular pressure (IOP) had been controlled with drops of timolol 0.5% twice a day and pilocarpine 4% four times a day. Prior to surgery the visual acuity of the right eye was counting fingers at 3 feet (1 m), and there was a dense nuclear sclerosis and a moderate diffuse posterior subcapsular cataract. On the first postoperative day the anterior chamber was very shallow, the IOP was raised to 38 mm Hg, and the cornea was diffusely oedematous. Repeated applications of cycloplegic drops were unsuccessful in relieving the condition. Maximal antiglaucoma therapy, which included 0.5% timolol twice a day, 4% pilocarpine, four times a day, acetazolamide tablets 250 mg four times a day, and two doses of hyperosmotic agents (glycerol) were also ineffective. A diagnosis of malignant glaucoma was made, and Nd-YAG laser hyaloidotomy was performed after the cornea had been cleared with the application of glycerin drops. Completely successful hyaloidotomy required four sessions of laser treatment. The laser parameters at each session were: 15-22 pulses of 3-4.2 mJ each delivered through the pupil and the patent laser iridotomy. The aim of the laser treatment was to perforate the hyaloid membrane and allow aqueous, believed to be trapped in the vitreous, to flow into the anterior chamber. After the first three sessions the response was only temporary, with anterior chamber deepening and IOP reduction which lasted no more than 24 hours. Immediately after the fourth laser session the anterior chamber deepened and the IOP dropped to 10 mm Hg and persistently remained in the low teens. After 12 months of follow-up the IOP was 12 mm Hg with timolol 0.5% twice a day only, and best corrected visual acuity was 20/40.

CASE 2

A 68-year-old man underwent uneventful extracapsular cataract extraction with implantation of a one-piece 7 mm IOL in the right eye. He was known to be hyperopic in both eyes, with a visual acuity of 20/200 in the right

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and 20/50 in the left eye, best corrected with a +3.0 sphere and +2.25 sphere respectively. Three years prior to cataract surgery laser iridotomies had been successfully performed, based on a gonioscopic diagnosis of narrow, closeable angles with IOPs of 20 mm Hg in the right and 21 mm Hg in the left eye.

Two days after surgery the IOP was 52 mm Hg in the right eye, the cornea was diffusely oedematous, and the anterior chamber was extremely shallow (less than one corneal thickness measured axially). The optic nerve head and the posterior pole appeared normal. Cycloplegic drops were applied at 10-minute intervals for one hour, with some deepening of the anterior chamber and reduction of the IOP to 40 mm Hg. Antiglaucoma medications were added, including 0.5% timolol twice a day, tablets of 50 mg neptazane three times a day, and two doses of an oral hyperosmotic agent (glycerol). As the IOP remained at 42 mm Hg the following day, Nd-YAG hyaloidotomy was performed through the pupil. Three treatment sessions were required to achieve a persistent functioning hyaloidotomy, with deepening of the anterior chamber and reduction of IOP to 14 mm Hg. The total number of laser applications was 41 pulses of 3.5–4.1 mJ each. After 15 months of follow-up the visual acuity was 20/30, the IOP was 16 mm Hg without medications, the cornea was clear, and the anterior chamber deep.

CASE 3

A 62-year-old man underwent uneventful extracapsular cataract extraction and 7 mm one-piece IOL implantation in the left eye. Sixteen years previously a superior sector iridectomy had been performed in this eye after an acute attack of angle closure glaucoma. A successful laser iridotomy was later done in the right eye, and the IOP was kept around 18–20 mm Hg without medical treatment and 22–23 mm Hg in the left eye with pilocarpine 2% four times a day. Prior to cataract surgery the visual acuity was 20/400 in the left eye, there were posterior synechiae, and a dense nuclear and anterior cortical cataract. Ophthalmoscopy revealed temporal pallor of the optic nerve head.

Immediately after surgery the anterior chamber was moderate (two corneal thicknesses measured axially), and the IOP was 17 mm Hg. Cycloplegic drops and steroid drops were started four times a day, with some deepening of the anterior chamber. Next day anterior chamber flattening was noted, with IOP elevation to 36 mm Hg. The superior edge of the lens optic was found to be tilted anteriorly with contact to the cornea, and there was adjacent localised stromal oedema of the cornea.

Nd-YAG laser hyaloidotomy was promptly done in the left eye, requiring only 12 pulses of 3.0 mJ each to achieve immediate relief. Treatment that was aimed at the hyaloid behind the lens was ineffective, while laser shots at the hyaloid over the edge of the optic and through the sector iridectomy resulted in immediate deepening of the anterior chamber, with subsequent reduction of the IOP to 10 mm Hg. After 10 months of follow-up the best corrected visual

acuity was 20/50, the IOP was 14 mm Hg with pilocarpine 2% four times a day, the anterior chamber was deep, and the IOL was centrally located with no corneal touch.

Discussion

Total obliteration of the posterior chamber by vitreous and a highly resistant hyaloid membrane have been suggested as a mechanism in aphakic or pseudophakic malignant glaucoma.^{6,10} According to this concept, aqueous is diverted into the vitreous cavity, accumulates there, and pushes the anterior vitreous and hyaloid forward, shallowing the anterior chamber.

Epstein *et al.*,¹¹ in experimental perfusion studies of normal, enucleated human and calf eyes, have provided support for Grant's speculation that in malignant glaucoma there may be a decrease in the permeability of the vitreous body or of the anterior hyaloid membrane to the anterior flow of aqueous humour, resulting in increased pressure in the space behind a posteriorly detached vitreous and a decrease in fluid movement through the vitreous gel. Therefore it is presumed that such eyes have a hyaloid membrane which is less permeable to aqueous. As the main pathology lies at the hyaloid and anterior vitreous level, laser iridotomy is usually insufficient to produce communication between the anterior chamber and the trapped intravitreal aqueous. Epstein *et al.*¹⁻³ recommended the use of the Nd-YAG laser for hyaloidotomy in three cases, and successful results reported by others have made this procedure the treatment of choice for aphakic or pseudophakic malignant glaucoma.^{1-3,9}

In this study we report on three eyes with pseudophakic malignant glaucoma in which Nd-YAG laser hyaloidotomy was performed but was very difficult and required several sessions in two of the eyes. We believe these difficulties are associated with the 7 mm one-piece PC-IOL. As the optic of this lens is larger and there are only two positional holes (compared with four holes in the 6 mm PC-IOLs), it is harder to aim at the hyaloid membrane and achieve a perforation. In addition, the 'spring-like' effect of the IOL may be greater in these lenses. Unlike the three-piece IOLs, which consist of prolene haptics with much elasticity, the relatively stiff plastic haptics of the one-piece lenses may provide more tension directed anteroposteriorly once implanted in the bag. This characteristic of the one-piece lens may result in more pressure against the hyaloid, with less room for trapped aqueous to pass through into the anterior chamber.

As most of the difficulties related to Nd-YAG laser hyaloidotomy in cases of one-piece 7 mm IOLs result from the size of the optic, we suggest that, when possible, laser treatment should be aimed at the hyaloid beyond the edges of the optic. This can be achieved best through a large peripheral or sector iridectomy, as was shown in the third reported case. We propose that in cases prone to develop malignant glaucoma (especially chronic angle closure glaucoma, hyperopia, or a fellow eye with a history of malignant glaucoma) such iridotomies should be performed during surgery, as is the acceptable

practice in cases of anterior chamber IOL implantation. Hyaloidotomy beyond the edge of the optic is easier, as the target is visualised properly; and, once the membrane is successfully cut, aqueous can freely percolate into the anterior chamber and deepen it. Moreover, placing the positional hole of the lens superiorly may result in a better view of the hyaloid through an iridectomy or even after pupillary dilatation.

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