
PSEUDOPHAKIC MALIGNANT GLAUCOMA: Nd:YAG CAPSULOTOMY AS A PRIMARY TREATMENT

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SUMMARY

Malignant glaucoma is one of the most serious but rare complications of anterior segment surgery. It is best known following trabeculectomy but has been reported following a wide variety of anterior segment procedures including extracapsular cataract extraction with posterior chamber lens implantation. It is notoriously refractory to medical treatment alone and surgical intervention has had only limited success. An additional treatment option in pseudophakic eyes is that of peripheral Nd:YAG posterior capsulotomy, which is minimally invasive and can re-establish forward flow of posteriorly misdirected aqueous through into the drainage angle of the anterior chamber. We report our experience of seven cases of malignant glaucoma in pseudophakic eyes and of the successful use of Nd:YAG posterior capsulotomy in re-establishing pressure control in five of these eyes, thereby obviating the need for acute surgical intervention.

Von Graefe¹ introduced the term 'malignant glaucoma' in 1869 to describe raised intraocular pressure associated with a flat anterior chamber following uneventful surgery for angle closure glaucoma. It is now recognised to comprise the diagnostic triad of a diffusely flat anterior chamber, high intraocular pressure and aqueous pooling that is sometimes visible in or in front of the anterior vitreous.

Malignant glaucoma is distinctly rare, but remains one of the most serious complications of anterior segment surgery. It is notoriously difficult to treat and carries a generally poor prognosis for long-term control of intraocular pressure. It is most commonly seen following trabeculectomy but can occasionally complicate other kinds of anterior segment surgery including cataract extraction.² It has even been reported in unoperated eyes.³⁻⁵

One of its characteristic features is an unpredictable post-operative latency; it can present on the first post-operative day or its onset may be delayed for many months following surgery.⁶ It is thought to involve the mech-

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anisms of ciliolenticular block of aqueous flow leading to the misdirection of aqueous posteriorly into or in front of the vitreous gel leading to the characteristic diffuse shallowing of the anterior chamber accompanied by a precipitous rise in intraocular pressure. The mechanistic understanding of its pathogenesis has led to the use of the synonyms 'ciliolenticular block',⁷ 'ciliovitreal block', 'iridovitreal block',⁸ 'aqueous misdirection' and 'aqueous diversion syndrome'. Although probably more precise these are unlikely to succeed the original term 'malignant glaucoma', which more accurately evokes the fulminant nature of the condition as well as the justified anxiety associated with it. Medical treatment alone is rarely successful in establishing control of the intraocular pressure.^{2,8} Pars plana vitrectomy has been used in the surgical management of malignant glaucoma with some definite but limited success in phakic as well as pseudophakic eyes.^{9,10}

However, when malignant glaucoma develops in pseudophakic eyes (with posterior chamber intraocular lens implants) there exists an additional treatment option of Nd:YAG laser capsulotomy and/or vitreolysis.² This can be effective in arresting the spiralling rise in intraocular pressure by re-directing aqueous flow anteriorly, thereby avoiding the need for acute surgical intervention with its inevitably higher morbidity.

We describe 7 cases of malignant glaucoma occurring in pseudophakic eyes with posterior chamber intraocular lenses and assess the efficacy and 'surgery sparing' role of the Nd:YAG laser in its management.

METHODS

We undertook a retrospective study of the case notes of patients seen in the glaucoma unit of Moorfields Eye Hospital over the last 3 years with a diagnosis of pseudophakic malignant glaucoma.

RESULTS

Seven subjects were identified – a figure that reflects the rarity of the condition since over the 3-year study period in excess of 12,000 cataract extractions had been performed.

Six were female, and the mean age at presentation was 67 years (range 59–78 years). The mean follow-up was 9 months with only 1 patient seen for less than 6 months.

Examination of the ocular features of this group revealed that of the 7 eyes, 5 were already on treatment for glaucoma (2 for primary open angle glaucoma, 2 for chronic narrow angle glaucoma and 1 had had previous acute angle closure glaucoma) and had all undergone previous glaucoma surgery. One of the remaining 2 eyes had pseudoexfoliation and only 1 eye of the group could be described as normal.

The mean axial length of the 5 eyes for which the measurement was available was 21.1 mm; 4 of them were less than 21.0 mm. Four of the 7 eyes were 'only eyes', although none of the 4 affected fellow eyes had suffered from malignant glaucoma: 2 of them had suffered complications following cataract surgery, 1 had suffered permanent visual loss following an attack of acute angle closure glaucoma, and the fourth was phthisical from an unknown cause.

The surgical procedure that preceded the development of malignant glaucoma was extracapsular cataract extraction in 4 patients, glaucoma triple procedures in 2, and trabeculectomy in 1 whose eye was already pseudophakic. All had posterior chamber intraocular lenses.

The latency between surgery and onset of malignant glaucoma was variable. Four cases presented between 1 and 2 weeks post-operatively, 2 at 7 weeks and 1 was diagnosed at 7 months. The clinical courses of the 7 cases are summarised in Table I.

At presentation, a retrocapsular collection of aqueous was noted in 6 of the 7 cases and all 7 received full medical treatment to establish control of the acutely raised intraocular pressure. This consisted of intensive topical steroid, beta blocker, mydriatic and cycloplegic, systemic carbonic anhydrase inhibitor and oral hyperosmotic agents if required.

All 7 eyes received a Nd:YAG capsulotomy: in 3 cases

as a first procedure in 2 cases as a second procedure and in 2 cases as a third. In 5 of the 7 eyes which underwent laser capsulotomy the previously uncontrollable intraocular pressure was stabilised by the procedure. A forward gush of aqueous accompanied by simultaneous deepening of the anterior chamber was noted in 4 of these 5 cases.

Of the 3 eyes in which Nd:YAG capsulotomy was performed as a first procedure, 1 required no additional treatment (case 2). Further surgery was required to the other 2 eyes: trabeculectomy in 1 (case 7) and vitrectomy with surgical peripheral iridectomy, and ultimately Nd:YAG cyclothermal ablation, in the other (case 4).

Nd:YAG posterior capsulotomy was the definitive procedure in the 2 eyes in which it was performed as the second procedure: following Nd:YAG peripheral iridotomy in one (case 5) and pars plana vitrectomy in the other (case 3). The laser peripheral iridotomy which was performed after the laser posterior capsulotomy in case 5 was, in retrospect, performed inappropriately and consequently had no effect on the intraocular pressure, which remained at the stabilised level of 32 mmHg that had been previously attained by the posterior capsulotomy.

Nd:YAG posterior capsulotomy was also the definitive procedure in the remaining 2 eyes in which it was performed as the third procedure, following laser and surgical peripheral iridectomies in both (cases 1 and 6). Thus no further surgery was required to control intraocular pressure following Nd:YAG posterior capsulotomy in 5 of the 7 eyes.

There was a mean improvement in corrected visual acuity of three Snellen lines at final follow-up and no patient had worse acuity than pre-operatively. All 7 eyes corrected to 6/18 or better (3 to 6/18, 3 to 6/12 and 1 to 6/9).

The mean intraocular pressure was 20.1 mmHg. This average concealed an underlying bimodal distribution, with the intraocular pressure of 5 of the 7 eyes between 10 and 20 mmHg but the remaining 2 unsatisfactorily high at 30 and 32 mmHg.

Table I. Case summaries of pseudophakic malignant glaucoma

	Case no.						
	1	2	3	4	5	6	7
Operation	E/C	Trab	Triple	E/C	Triple	E/C	E/C
Presenting IOP	47	44	35	36	51	32	48
Full medical therapy	+	+	+	+	+	+	+
1st procedure (IOP)	YAG-PI (24)	YAG-PC (22)	Vity (30)	YAG-PC (15)	YAG-PI (32)	YAG-PI (32)	YAG-PC (22)
2nd procedure (IOP)	Sx-PI (27)	–	YAG-PC (10)	Vity (40)	YAG-PC (21)	Sx-PI (40)	Trab (42)
3rd procedure (IOP)	YAG-PC (18)	–	–	Cyc-YAG (18)	YAG-PI (32)	YAG-PC (14)	Revn (42)
Final IOP	16	12	15	18	32	18	30
Final therapy							
Beta blocker	+	+	–	+	+	+	+
Pilocarpine	–	–	–	–	+	–	–
Acetazolamide	–	+	–	+	+	–	+
IOP stabilised by YAG-PC?	Yes	Yes	Yes	No	Yes	Yes	No

E/C, extracapsular cataract extraction + intraocular lens; Trab, trabeculectomy; Triple, combined E/C + Trab; YAG-PC, YAG laser posterior capsulotomy; YAG-PI, YAG laser peripheral iridotomy; Sx-PI, surgical peripheral iridectomy; Vity, vitrectomy; Revn, revision; Cyc-YAG, YAG laser cyclothermal ablation; IOP, intraocular pressure (mmHg).

Assessment of change in requirement for medical anti-glaucoma treatment between the pre-operative situation and final follow-up revealed that the 2 patients who were on no treatment pre-operatively required continuing anti-glaucoma treatment at final follow-up, but that 1 patient who was on pre-operative anti-glaucoma treatment had this successfully withdrawn by final follow-up. At final follow-up, 1 additional patient required acetazolamide than pre-operatively (4 vs. 3), 1 additional patient required topical anti-glaucoma treatment than pre-operatively (6 vs. 5) and 1 fewer patient was on no anti-glaucoma medication (1 vs. 2). We feel that these figures show no overall significant change in the pre- and post-operative requirements for anti-glaucoma medication.

DISCUSSION

The diagnosis of malignant glaucoma has been recognised as a source of confusion to many ophthalmologists. Confidently differentiating it from pupil block is especially difficult,¹¹ particularly since pupil block is the commonest cause of angle closure following cataract extraction¹² and pseudophakic malignant glaucoma as a cause of acute pressure rise post-operatively is distinctly rare.

Theoretically, pupil block should be distinguishable by the presence of iris bombe which causes peripheral shallowing of the anterior chamber. In malignant glaucoma the anterior chamber should be diffusely flat as the entire iris-lens diaphragm is pushed forwards by the accumulation of aqueous in the vitreous cavity. In practice such a distinction may not be obvious. If pupil block is suspected, and a laser peripheral iridotomy is successfully performed without effect, then it is unlikely that further iridotomy will be helpful.

Another diagnostic feature of malignant glaucoma is that there is sometimes visible an optically clear zone of sequestered aqueous either retrocapsularly or within the anterior vitreous. Aqueous misdirection into the anterior vitreous in such cases has been successfully reversed in phakic and pseudophakic eyes with Nd:YAG laser vitreolysis.^{2,13,14}

When aqueous accumulates in front of the anterior hyaloid face in eyes with an intact posterior capsule following cataract surgery then a Nd:YAG posterior capsulotomy can effectively redirect aqueous flow anteriorly.¹⁵ We suggest that it is preferable to position the capsulotomy peripheral to the lens optic, if possible, since if positioned centrally there is a risk of subsequent blockage of aqueous flow by the juxtaposed optic. In our experience a capsulo-

tomy has been successfully performed through the dialling hole of the lens optic, which is a viable alternative if a more peripheral site is inaccessible.

We found that Nd:YAG laser posterior capsulotomy is an effective treatment in pseudophakic malignant glaucoma and was successful in stabilising the intraocular pressure in 5 of the 7 eyes so treated. We recommend it as a first-line treatment for this condition as it is an effective and minimally invasive procedure that can delay and sometimes obviate the need for acute surgical intervention.

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