

## PRODROMAL MALIGNANT GLAUCOMA\*

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FAILURES in the surgical management of malignant glaucoma (von Graefe, 1869; Smith, 1891; Chandler, 1950; McDonald, 1954) call attention to the syndrome of prodromal malignant glaucoma in which success has been reported (Birge, 1956). Based on a new and possibly radical operation performed before the devastating complications which give rise to malignant glaucoma can occur (Birge, 1952, 1953, 1956; Hughes, 1955; Wenaas and Stertzbach, 1955), this new concept of an old problem offers some hope to the otherwise hopeless individual afflicted with malignant glaucoma.

Von Graefe (1869) described malignant glaucoma as "a new and acute glaucomatous process brought about by surgery, which is unusual only in the continued failure of the anterior chamber to form". The increasing intra-ocular tension which followed this series of events was usually treated by surgical procedures on the lens, sometimes with less than desired success (Pagenstecher, 1877; Rheindorf, 1887; Smith, 1891; Zeeman, 1935).

Prodromal cases can be defined pre-operatively as those in which the likelihood of lenticular complication is greater. The majority can be specifically diagnosed before surgery.

### Signs and Symptoms of Prodromal Malignant Glaucoma

Each case of chronic non-congestive glaucoma in which any of the following additional findings occur is in danger of developing malignant glaucoma after surgery.

Prodromal malignant glaucoma occurs when the eye is too small as in microcornea (Smith, 1891), or when the lens is too large as in acquired myopia after surgery or cataract formation (Chandler, 1950), extreme hyperopia, extreme age, and usually, although not always, in narrow angle glaucoma (Vail, 1956).

When the syndrome of prodromal malignant glaucoma is diagnosed, the importance of any lens factors is recognized, and with proper treatment the "new and acute glaucomatous process" specified by von Graefe can be avoided.

The importance of recognizing an over-large lens before surgery is undertaken cannot be underestimated if malignant glaucoma is to be prevented. The diagnosis must be arrived at in the prodromal stage if preventive measures are to be successful.

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The prodromal stage of malignant glaucoma usually exists for many months before the lens is displaced forward by the surgical procedures designed to alleviate the chronic glaucoma. Ample time for study and reflection before glaucoma surgery is available to the surgeon in most cases. Despite the difficulty of measuring the size of the lens, there are several methods which serve adequately, if only the surgeon will consider the behaviour of the lens as well as the problem of glaucoma.

In the usual course of events, malignant glaucoma occurs in both eyes, frequently at different times. After the loss of the first eye from malignant glaucoma, the prodromal stage should easily be recognized in the second eye.

The recognition of the prodromal stage of malignant glaucoma in the first eye offers gratifying possibilities, in that the loss of the first eye may be avoided, and treatment of the second eye is often thereby facilitated (De Voe, 1950).

### Management of Prodromal Malignant Glaucoma

Simultaneous consideration of the two aetiological processes which join to produce malignant glaucoma can most profitably be accomplished in the prodromal stage.

While glaucoma can be controlled it can be managed medically, but as soon as surgical measures are indicated, the importance of the lens becomes paramount.

Removal of the lens before it becomes jammed into the narrow anterior chamber through forward displacement is the method most likely to be successful, both theoretically and practically, for the prevention of malignant glaucoma.

At the time of lens removal, glaucoma surgery, such as sclerectomy or iridencleisis, can easily be added to the lens extraction (Birge, 1952, 1956; Hughes, 1955; Wenaas and Stertzbach, 1955). Glaucoma surgery can be done at a later time, when multiple operations are not contraindicated, although it is more advantageous to do all the surgery at one time. Surgical treatment aims at producing simultaneous relief of both the factors which lead to malignant glaucoma, namely chronic non-congestive glaucoma and the dangerously enlarged lens.

The presence of cataractous changes is of prime importance only in cases that do not belong to the category of prodromal malignant glaucoma.

In prodromal malignant glaucoma the clarity of the lens is a minor consideration. The increased size of the lens in relation to the eye or the anterior chamber determines the indication for lens removal.

A large clear lens can produce malignant glaucoma and therefore must be removed in the prodromal stage. Fortunately, most clear lenses, in my experience, have, upon removal, given clinical evidence of cataractous changes, even though these were not visible ophthalmoscopically through the miotic pupil.

**Case Reports**

The first case illustrates the cure of prodromal malignant glaucoma and the benign effect on the second eye of a double operation on the first eye.

**Case 1, a 70-year-old man**, came to us in 1946 with complaints concerning his right eye. Refraction showed that he had developed acquired myopia of -1 D in the right eye and that the left eye remained +1.5 D hyperopic. A slight elevation of ocular tension (35 mm. Hg) was controlled by 1 per cent. pilocarpine twice a day for 8 months, and then the dosage had to be increased to four times a day. Faint lens changes were noted in 1947, but visual acuity was 20/20 in each eye with glasses.

The ocular tension in the right eye gradually required increasing doses of pilocarpine to 4 per cent. four times and then six times a day. The anterior chambers were quite narrow. The tension in the left eye never required more than 2 per cent. pilocarpine three times a day to stay controlled.

Operation on the right eye was performed for the swollen lens and narrow angle glaucoma on March 18, 1952, an extracapsular extraction being obtained and an iridencleisis being performed at the same time. No miotic has since been required in the right eye, and the visual acuity is now 20/20 with correction. The bleb is atrophic.

The left eye is still under control with 2 per cent. pilocarpine five times a day (ocular tension 23 mm. Hg and visual acuity 20/25). No acquired myopia has yet occurred in the left eye, but the anterior chamber is less than 1 mm. deep.

The second case illustrates the restoration of vision and normal ocular tension in the second eye with prodromal malignant glaucoma, after the loss of the first eye with malignant glaucoma.

**Case 2, an 82-year-old female**, had had narrow angle glaucoma for 12 years. Her right eye had been operated on for acute glaucoma, an iridectomy having been performed in 1948. A mature cataract was present in the right eye in 1954. This eye was controlled by 2 per cent. pilocarpine three times a day with 0.25 per cent. eserine at night. There was poor light projection.

The visual acuity in the left eye was counting fingers only. Every morning she looked for the light in her bedroom to see whether it was there and whether she could still see. She was under care for blindness, using talking books and having people read to her.

The ocular tension in the left eye remained controlled with pilocarpine and eserine until an automobile accident in December, 1954. Thereafter, even with pilocarpine 4 per cent. five times a day, the ocular tension in the left eye rose to 48 mm. Hg, while that in the right eye was 40 mm. Hg.

In spite of her age an operation was performed, and the cataract removed from the left eye, with iridencleisis, so that 18 months later the visual acuity was 20/30, though the visual field was only 10°. Our diagnosis was chronic narrow angle glaucoma with mature cataract or malignant glaucoma.

She required no further miotic therapy and maintains a good bleb.

The third case illustrates the effect of multiple operations in bilateral chronic narrow angle glaucoma with a clear lens, microphthalmos, and prodromal malignant glaucoma.

**Case 3, a 65-year-old female**, with chronic narrow angle glaucoma in eyes with a corneal diameter of 10 mm. and hyperopia of plus 3.00, plus .50 × 90, O. U., had visual acuity of 20/20 in each eye. She had had glaucoma since 1951 and was using 2 per cent. pilocarpine five times a day in each eye to keep the tension moderately controlled (right

23 mm. Hg and left 27 mm. Hg). The lenses were clear. She had psychiatric consultation for her anxiety, but no additional help was available since her fear of blindness was based on organic disease.

When her tension rose to 50 mm. Hg in the left eye and remained elevated from March 23 to April 18, 1955, an iridencleisis with sclerectomy was performed on the left eye. This resulted in a 1-cm. bleb and controlled the tension in the left eye in spite of synechia and iritis, but a cataract developed. This was removed in June, 1956, and was followed by discission. Visual acuity in the left eye in December, 1956, is 20/70, and in the right 20/20. The right eye is still under therapy with 8 per cent. pilocarpine every 2 hours.

The removal of a clear lens in the first eye would have been advisable and would have saved her from multiple operations. That procedure will be followed in the near future on the second eye.

The fourth case illustrates malignant glaucoma over a 13-year period.

**Case 4, a 60-year-old female**, was first seen by us in March, 1953, when her left eye had been blind since glaucoma surgery elsewhere in 1943. She reported that she had seen ten doctors at that time and that the vision was severely impaired before diagnosis and surgery were undertaken. The left eye now shows a mature cataract, old iridectomy, and synechia. She shows a mild chronic anxiety state.

Visual acuity in the right eye is 20/25 with +3.5 D sph. The corneal diameter is 9 mm. The visual right field is still good but shows a nasal loss. There is a large glaucomatous excavation in the nervehead and the patient sees haloes and has frontal headache at intervals.

She was still receiving medical treatment in November, 1956 (Table), but surgery is expected in the near future.

TABLE

Date	Visual Acuity		Ocular Tension (mm. Hg)		Treatment	
	Right	Left	Right	Left	Right	Left
Mar. 18-53	20/25	Blind	29	22	pilo 1% twice daily	None
Apr. 8-53	20/25 with glasses	Blind	25	22	pilo 1% twice daily	None
May 7-53	20/25 with glasses	Blind	29	20	pilo 1% three times a day	None
June 5-53	20/25 with glasses	Blind	26	20	pilo 2% 6-hrly	None
June 19-53	20/25 with glasses	Blind	30	22	pilo 2% 3-hrly	None
Sept. 9-53	20/25 with glasses	Blind	25	20	pilo 2% 3-hrly	None
Dec. 14-53	20/25 with glasses	Blind	25-27	20	pilo 2% 3-hrly	None
Feb. 24-54	20/25	Blind	27-29	20	pilo 2% six times a day	None
May 18-54	20/25 with glasses	Blind	22	20	pilo 2% six times a day	None
Dec. 24-54	20/25 with glasses	Blind	27-30	20	pilo 2% six times a day	None
Sept. 7-54	20/30 with glasses	Blind	25-27	15	pilo 2% six times a day	None
Jan. 26-55	20/25 with glasses	Blind	20-23	17	pilo 2% six times a day	None
Apr. 27-55	20/25 with glasses	Blind	23	Soft	pilo 2% six times a day	None
Aug. 3-55	20/25 with glasses	Blind	24-27	17	pilo 3% six times a day	None
Dec. 15-55	20/25 with glasses	Blind	37-40	20	pilo 4% 2-hrly	Pheno- barbitone
Feb. 23-56	20/25 with glasses	Blind	27	23	pilo 4% 2-hrly	Pheno- barbitone
Apr. 25-56	20/25	Blind	22	Soft	pilo 4% 2-hrly	Pheno- barbitone
Aug. 15-56	20/25	Blind	27	Soft	1 D acquired myopia	
Nov. 21-56	20/20	Blind	27	Soft	Same—nervous over holidays	

This is certainly prodromal malignant glaucoma in the second eye. The tension variations are glaucomatous. Lens factors are beginning to occur; there is acquired myopia but no cataract.

In a microphthalmic one-eyed 60-year-old with prodromal malignant glaucoma the operation of choice is lens extraction with a filtering operation

The fifth case illustrates prodromal malignant glaucoma in a large eye, from 1949 to 1956, complicated by hypertension, cardiac failure, and allergy to all glaucoma medication. Eventually an operation restored vision and normal tension.

**Case 5, a nervous woman aged 75**, when first seen on September 7, 1949, had the left eye blind from undiagnosed glaucoma. The ocular tension in the right eye was 25 mm. Hg and in the left 65 mm. Hg. The patient refused surgery because of fear and the necessity to care for her ailing husband.

She was treated with 1 per cent. pilocarpine twice daily in the right eye (visual acuity 20/25) and 4 per cent. pilocarpine with Furchthide 10 per cent. at frequent intervals in the left eye until she developed a local dermatitis in August, 1950. A change of medication to prostigmine benefited her until April, 1952, when she was put on eserine. This worked until February, 1953, when she went back to pilocarpine in the right eye 2 per cent. 3 times daily and in the left eye 6 per cent. every 3 hrs. In June, 1953, the pilocarpine in the right eye had to be increased to 4 per cent. every 3 hrs. and she had nearly constant chronic lid allergy, in spite of anti-histaminic drugs and changes in medication.

The visual acuity in the right eye gradually failed to 20/50 by mid-1955. She refused operation, even though the tension occasionally registered 34 to 40 mm. Hg. There were a few hypertensive retinal haemorrhages seen from time to time, and she survived one spell of cardiac decompensation in 1954.

By March, 1956, the right eye had almost no anterior chamber, and an immature cataract, and was frequently red from the allergic conjunctivitis; Diamox kept the ocular tension fairly well controlled until operation on October 23, 1956.

She now has a restoration of vision to 20/30 or 20/40 without medication, and for the first time in years has clear skin and a white eye. The bleb is small and draining well. The left eye will, of course, have to be removed when it becomes painful.

The sixth case illustrates an explosive type of prodromal malignant glaucoma in a man with microcornea; surgery brought about restoration of vision and ocular tension and ability to return to work 5 weeks later.

**Case 6, a 61-year-old man**, noted that his glasses were not comfortable on March 2, 1956. At this time the ocular tension was 65 mm. Hg. in the right eye and 48 mm. Hg. in the left. The visual acuity was 20/40 in the right eye and 20/20 in the left. He was placed on 2 per cent. pilocarpine without much improvement.

4 per cent. pilocarpine kept the tension under control until September, 1956; 6 per cent. pilocarpine was prescribed on September 24, 1956, but the ocular tension in the right eye was never reduced below 30 mm. Hg. The ocular tension in the left eye was 25 mm. Hg. on 8 per cent. pilocarpine six times a day with two Diamox tablets in addition.

After consultation, the patient returned for surgery which was performed on October 9, 1956. The lens was removed from the right eye and a sclerectomy with iridencleisis was performed.

Five weeks after operation the vision was restored with an aphakic glass to 20/30 without any medication.

The left eye is being maintained on 8 per cent. pilocarpine every three hours without Diamox.

There was no opacity of the lens in this case, but the lens was quite yellowish in colour, the anterior chamber was less than 1 mm., and the corneal diameter was 8.5 mm.

Sometime in the near future an operation will have to be performed on the left eye.

### Summary

The operation of choice in prodromal malignant glaucoma is lens extraction combined with a filtration procedure, performed at one operation to avoid multiple surgery.

The operation is indicated when the intra-ocular pressure begins to be uncontrollable, as for instance, when pilocarpine of more than 4 per cent. solution is required at 2-hour intervals or less.

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