RETROLENTAL DECOMPRESSION FOR MALIGNANT GLAUCOMA*

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IN 1869 von Graefe described a complication following operations for glaucoma in which a shallow or absent anterior chamber was associated with severe intra-ocular pain and a greatly increased intra-ocular pressure. This condition carried with it an extremely poor visual prognosis due to its resistance to any form of treatment.

The passage of the years has done little to diminish the problem of malignant glaucoma. Indeed it has defied attempts at both prevention and cure with considerable success. Even the aetiology is far from certain, although it is now suspected that there may be certain predisposing factors which make a malignant course more likely to follow in the post-operative period. These are a shallow anterior chamber and a high ocular tension at the time of the operation (Chandler, 1950; Birge, 1957) and a lens relatively too large for the eye (Priestley Smith, 1879).

However, these qualities are undoubtedly present in many eyes that do not pass into malignant glaucoma (Tamler and Maumenee, 1955), and some other precipitating mechanism must be present in those that do so. At the onset of the condition there is a considerable forward movement of the lens iris diaphragm. It is thought that the relatively enlarged lens then blocks the angle since, because of its relative disparity in size with the rest of the eye, the circumlental space is not wide enough to allow seepage of aqueous round the equator. This forward movement may be due to a variety of causes.

Heerfordt (1915) suggested that uveal congestion was at fault, the engorged ciliary body forcing the lens forwards from behind. Chandler (1950) considered that this could be the cause in three of his six cases although he made the point that vasomotor instability was common in glaucoma, but malignant glaucoma occurred only in 2 per cent. of glaucoma operations; this mechanism was thus unlikely to be a potent cause in the majority of cases.

As an alternative, Shaffer (1954) postulated that aqueous did not flow forwards into the anterior chamber at the onset of the condition, but passed backwards, either directly into the vitreous, or behind it, detaching the

* Received for publication November 2, 1960.

vitreous from the retina. The vitreous was then pushed forwards carrying the lens iris diaphragm with it as the pressure in the posterior segment rose. Shaffer claimed that degeneration or even detachment of the vitreous was present in 50 per cent. of eyes in patients over 50 years old, and that this predisposed to such a posterior flow of aqueous. Furthermore, he implied that these vitreous changes occurred in an exceptionally high proportion of cases of glaucoma, especially after operation. This hypothesis suffers from the same weakness as the theory of uveal congestion, in that malignant glaucoma is fortunately rare whereas vitreous degeneration is said to be common.

A third mechanism which may be at fault could be complementary to those mentioned above. It is quite possible that, when the pressure in the anterior chamber is suddenly released at operation, the pressure of the contents of the posterior segment drives the lens iris diaphragm forwards against the cornea before the fall in ocular tension has had a chance to become equalized throughout the eye. Provided that the anatomical conditions are suitable, malignant glaucoma now follows from this moment. It is easy to see that a raised ocular tension at the time of operation would favour this sequence, and that this could also account for a malignant course setting in some time after the operation in cases with an excessively filtering or leaking wound (Barkan, 1954; Tamler and Maumenee, 1955). In these patients a more gradual forward movement of the lens would take place.

While the aetiology is thus far from certain, the treatment of the condition presents an even greater problem. As a rule conservative measures are useless, except in cases that are only partially developed, and operation is therefore called for.

The two main procedures employed in this dilemma are extraction of the lens and posterior sclerotomy. Extraction of the lens, first proposed by Pagenstecher (1877), has been practised ever since that time, usually with indifferent results.

To have the best chance of success the operation should be performed as soon as possible after the malignant course has set in. However, because of the technical hazards involved in surgery, a more conservative course is often adopted without success, and the most favourable period for operating passes. When the procedure is eventually undertaken the difficulties are still as great as ever, the eye remains hard even when the retrobulbar anaesthetic has been given, the absence of the anterior chamber makes a conventional section impossible, and vitreous loss is commonplace. By this time irreparable damage has usually been done to the eye, and blindness is almost invariably the outcome.

The decision to operate early becomes even harder to take when the eye in question is the only one with sight. In such a situation, in which the circumstances can hardly be described as favourable for major intra-ocular

surgery, the temptation to temporize is almost irresistible. Nevertheless, extraction of the lens is recommended as the treatment of choice by Chandler (1950), McDonald (1954), and others already noted.

In the same year as that in which Pagenstecher advocated lens extraction, Weber (1877) suggested posterior sclerotomy. He combined this deliberate evacuation of vitreous with massage of the anterior chamber through the lid, attempting to force the lens backwards from the cornea. Priestley Smith (1879) also performed this operation, though with less success than that claimed by Weber. In his recent survey, Chandler supported the procedure and recommended the injection of air into the anterior chamber to restore its normal depth. The eventual outcome of his cases was mostly disappointing, but a recent paper by Cross (1959) has shown that brilliant results can be achieved by combining posterior sclerotomy with re-formation of the anterior chamber with air, provided that this is done soon enough.

Unfortunately, many operators are only slightly less reluctant to remove vitreous from an eye than they are to remove the lens. The present authors have evolved the technique described below in an attempt to provide a solution to the problem that involves neither of these unwelcome procedures.

TECHNIQUE OF RETROLENTAL DECOMPRESSION

A conjunctival flap is raised suitable for a cyclodialysis incision 4 mm. from the limbus. Surface diathermy is now lightly applied to the sclera to render avascular an area of some 2 mm. all round the proposed incision. A 4-mm. cyclodialysis incision is now made 4 mm. from and parallel to the limbus. A pre-placed scleral suture is inserted when a point is reached halfway through the sclera.

When the full thickness of the sclera is cut through, the lips of the wound are held apart by the suture. Because of the raised ocular tension, the pars plana now bulges outwards into the wound. Separating the lips of the wound as far as possible, the tip of the cautery is now applied to the pars plana.

As soon as this structure is perforated there is a dramatic decompression of the globe, with a sudden gush of *aqueous* out of the perforation (Figure, opposite). Sometimes a small bleb of vitreous precedes the aqueous, but if so the vitreous retracts back into the globe when the aqueous flow has ceased.

The eye is now soft, and a narrow cyclodialysis is easily performed. A cannula is inserted along the cyclodialysis track, and air is now injected into the anterior chamber until this is re-formed. The scleral suture is tied, and the conjunctiva is sutured as usual.

Case Reports

Case 1, a married woman aged 45, first attended Mr. A. Stewart Scott's Out-patient Clinic at the Manchester Royal Eye Hospital on June 17, 1959, complaining of attacks of headache, with which were associated blurred vision and haloes.

FIGURE.—Diagram to illustrate the condition of the eye immediately before perforation of the pars plana with the cautery. The aqueous is seen to be pooled in the retrolental space and the pars plana is bulging outwards between the lips of the wound due to the raised intra-ocular pressure.

Examination.—The visual acuity was 6/6 in both eyes, the anterior chambers were shallow, and there was glaucomatous cupping of both discs. Perimetry revealed defects typical of glaucoma in both eyes, the left visual field being severely constricted. The ocular tension was raised to 37 mm. Hg (Schiötz) on the right, and 42 mm. Hg (Schiötz) on the left. Gonioscopy showed narrow but open angles.

Diagnosis.—Chronic simple glaucoma, possibly associated with episodes of angle closure.

Therapy.—Medical treatment with pilocarpine was started.

Surgery.—These conservative measures completely failed to control the tension, and on July 17 an iris inclusion was performed on the left eye (V.H.S.), followed one week later by a similar operation on the right (V.H.S.).

Progress.—The patient made a satisfactory recovery from these procedures, and was discharged on August 1. It was noted at this time that the anterior chamber of the left eye was very shallow, but definitely present.

On August 13 she was re-admitted with bilateral malignant glaucoma. Both eyes were stony hard, and both anterior chambers were absent, with the lens and iris in contact with the posterior surface of the cornea. Intensive medical treatment was started, and after 24 hours the anterior chamber of the left eye had re-formed to some extent and the tension came within normal limits. The right eye, however, proved resistant to medical measures, and on August 17 a retrolental decompression (V.H.S.) was carried out on this side.

After this, the first performance of the operation, the tension fell but not to completely normal limits. On August 28 the visual acuity in the right eye could be corrected to 6/9, but that in the left could not be improved beyond counting fingers, and the left visual field was greatly reduced. It was felt that this loss of vision was directly due to the attack of malignant glaucoma, which had damaged the left eye more than the right because that eye had been more severely affected by the previous glaucomatous process.

Despite further intensive medical treatment, the tension in the right eye rose again in the days immediately following, until a typical picture of malignant glaucoma had once

more been established. On August 31 a further retrolental decompression (V.H.S.) was carried out on this eye, and this was followed by completely satisfactory results.

Two weeks later, on September 16, when the patient was on the point of discharge from hospital, the tension suddenly rose in the left eye and malignant glaucoma supervened. Retrolental decompression was now carried out on this side (V.H.S.) with a satisfactory result. The patient was discharged to the Out-patient Clinic on September 27, when perimetry showed gross reduction of the left visual field, and there was of course very little vision in this eye. The right visual field, however, showed very little deterioration from its original state.

A close watch was maintained in the glaucoma clinic during the next 2 months, during which the tension of the right eye was never higher than 25 mm. Hg (Schiötz), but the left eye repeatedly gave readings of 35 mm. Hg (Schiötz). At this stage it was felt that there was little to be gained by further surgical intervention as the eye was already severely damaged by glaucoma. A conservative policy was therefore maintained and an attempt was made to control the tension with pilocarpine. Unfortunately this was not successful, and the patient returned on December 9, with a recurrence of malignant glaucoma in the left eye, having had severe symptoms for 3 days.

In view of the past medical history of the eye, and the poor visual prognosis, relief from pain was regarded as the over-riding consideration. A left extracapsular extraction (V.H.S.) was therefore performed on the day of admission; there was no vitreous loss at this operation, she made a good recovery, and was discharged on December 23.

Result.—Since that day she has been followed up as an out-patient and there has been no further rise of tension in either eye. She was last seen on September 30, 1960, when the visual acuity in the right eye was 6/5 with correction, and in the left counting fingers. The ocular tension was 20 mm. Hg in the right eye, and 25 mm. Hg in the left. The right visual field showed an arcuate scotoma arching above the fixation spot and breaking through to the nasal periphery, and the left visual field was tubular when taken with a large white object.

Case 2, a married woman aged 43, first attended Mr. A. Stewart Scott's Out-patient Clinic at Birch Hill Hospital, Rochdale, on April 4, 1960, complaining of reduced vision in the left eye.

Examination.—The visual acuity could be corrected to 6/6 in both eyes. The anterior chambers were of normal depth. The left disc showed glaucomatous cupping, but the right disc was flat. Perimetry revealed a constricted visual field on the left side, but no defect was demonstrable on the right.

Diagnosis.—Chronic simple glaucoma.

Therapy.—Medical treatment with pilocarpine was started, but was abandoned on May 2, having failed to control the tension.

Operation.—An iris inclusion was performed on the left eye (A.S.S.). The patient made a good recovery, but before her discharge from hospital it was noted that the anterior chamber was shallow.

Progress.—5 days later she returned complaining of pain in the eye. The anterior chamber was even shallower than when seen in hospital, and the ocular tension was 44 mm. Hg (Schiötz). She was re-admitted and placed on intensive medical treatment, which was successful in that the tension fell to normal limits and there was some increase in the depth of the anterior chamber. She was once more discharged, with Pilocarpine as well as cortisone drops into the eye.

The ocular tension remained normal for a further month, but on July 6 she returned with undoubted malignant glaucoma in the left eye, and was transferred to the Manchester Royal Eye Hospital. Retrolental decompression (V.H.S.) was performed as an emergency on that date, and she made an excellent recovery, and was discharged on July 16.

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Result.—Since that date the tension has remained within normal limits in this eye, although 2 weeks after her discharge there was some circumciliary injection, and she was re-admitted for a few days while this mild attack of iritis settled rapidly on small doses of steroids.

Since this episode the clinical course has been uneventful. On October 7 her condition was satisfactory; the visual acuity in both eyes could be corrected to 6/6 and the ocular pressure in both eyes was 15 mm. Hg (Schiötz). The right visual field was normal and that on the left showed a slight further constriction compared with that taken at her first attendance.

Comment

For the sake of clarity most of the details of the medical treatment given to these cases have been omitted. Routine medical treatment for glaucoma consisted of pilocarpine drops in a strength of 1 or 2 per cent. instilled three times a day. For intensive medical treatment eserine was used in a strength of 1 per cent. frequently instilled, combined with hot bathings and Diamox. After the iris inclusion operations, homatropine drops were instilled in the operating theatre and cortisone drops were given subsequently. After retrolental decompression, in addition to this routine, small doses of systemic steroids were given for a month, starting with prednisolone 5 mg. three times a day and tailing off gradually. Immediately after the operation a short course of systemic antibiotics was also given.

Some other aspects of these cases call for further consideration:

Case 1

Right Eye.—Retrolental decompression was performed twice on this eye. The first occasion was our very first experience with the technique, and instead of penetrating the pars plana with a red hot cautery, as was done on subsequent occasions, we cut it through with a pair of scissors after preliminary surface diathermy had been applied. We feel that this incision may have healed up, thus re-establishing the conditions leading to malignant glaucoma. There has been no trouble since the second operation, which was performed according to the technique already described.

Left Eye.—By the time this eye came to operation it had been irretrievably damaged by the first attack of malignant glaucoma. Indeed it was debated whether retrolental decompression was justifiable in view of its experimental nature, or whether the lens should be removed purely as a pain-relieving procedure. In fact the former course was chosen, but we feel that we cannot offer any reasonable explanation for its failure. Depressing results are frequently encountered when eyes in an advanced state of glaucoma are subjected to operation, and it would seem that retrolental decompression is no exception in this respect.

Case 2.—This case went completely as planned except for a mild attack of post-operative iritis 2 weeks after discharge from hospital. This settled well on steroid treatment which, as might be expected, is an invaluable adjunct to a surgical procedure such as this. It is interesting that this is the only instance where there has been any sign of iritis, and in an operation involving a direct attack on the ciliary body thoughts of sympathetic ophthalmitis are naturally always present.

Discussion

The exact effect of the operation on the eye cannot as yet be described with any accuracy. It plainly has an action additional to that of simple decompression. Even when it is combined with injection of air into the anterior chamber, this would not alter the situation sufficiently to prevent the eye relapsing into malignant glaucoma once the decompression wound had healed and the air had been absorbed.

We suggest that some filtration of aqueous takes place through the hole in the pars plana into the suprachoroidal space, and possibly also through the scleral incision into the subconjunctival space, although no obvious drainage bleb has been visible at this site. This would prevent any build-up of aqueous in the retrolental space with the resulting forward movement of the lens iris diaphragm.

To support this theory of trans-planal filtration, we may recall the very first time the operation was performed, when the pars plana was cut through with scissors after the application of surface diathermy. As already stated we feel that this incision must have healed up with the reconstitution of the necessary anatomical factors for a malignant course to supervene. The original operation site was not re-explored to verify this assumption as it was felt that this would be unwise. We suggest, however, that it is significant that the eye has been normo-tensive since a much larger and perhaps more efficiently-draining hole has been burnt in the pars plana.

The operative findings also throw some light on the vexed question of the aetiology of the condition. It would seem that aqueous collected in the retrolental space in every eye on which we operated; thus anterior dislocation of the vitreous by aqueous passing back between it and the retina could not have occurred to any noticeable degree.

It is possible that the mechanism described by Shaffer may be operating in many cases, but as yet we cannot confirm this.

In both our patients some other explanation must be sought for the gross forward movement of the lens iris diaphragm that took place. All these iris inclusions showed good filtration, and it is possible that excessive drainage may have been a factor, perhaps combined with abnormal mobility of the lens. What part was played by hypersecretion of aqueous or ciliary congestion, either alone or in combination with these factors, we cannot say.

In attempting to assess the value of the procedure we are naturally hampered by lack of experience, and to some extent by the brevity of the follow-up period. We feel, however, that it offers a simple and not unattractive alternative to lens extraction or posterior sclerotomy in a condition where the results of surgical treatment (with notable exceptions) are depressing to a degree excelled only by those of more conservative measures.

Just as ophthalmologists shrink from the two standard operations, it is understandable that they might undertake deliberate surgery of the ciliary

body with some reluctance, although for some time the pars plana has been a favourite site for penetrating the globe when injecting substances into the vitreous, and indeed cataract extraction has also been carried out by this route (Young, 1957). In this connexion we would emphasize that only one eye showed any degree of post-operative iritis, and that this was easily controlled by steroids.

If, however, the operation stands the test of time, which at the moment it shows some signs of doing, we suggest that it may help in evolving a new approach to deliberate surgery of the ciliary body, perhaps also for other varieties of glaucoma.

We are grateful to the Department of Medical Illustration of the Manchester Royal Infirmary for their skill and co-operation in the production of the figure.

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