EQUATORIAL CATARACT AFTER CORNEO-SCLERAL TREPHINING*

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THE occurrence of cataract in association with glaucoma presents a therapeutic problem of some magnitude which has attracted a good deal of attention in recent years (Samuels, 1947; Sourdille, 1950; Chandler, 1949; François, 1947; Williamson-Noble, 1953). The difficulties of treatment are not made less by the uncertainty which still exists as to the role played by the glaucomatous process and its treatment in the genesis of the lens opacity.

Since the utility of corneo-scleral trephining was first established after its introduction by Elliot in the early 20th century, the cause of the cataract which may be seen post-operatively in some cases has been a subject of speculation. Elliot (1914) was not convinced that the cataract was due to the operative interference, and although, as experience with the operation has become world-wide, the contrary view has found its advocates, the general opinion appears still to be in agreement with his, provided that direct operative damage to the lens has not taken place (Duke-Elder, 1940; Spaeth, 1941; Arruga, 1952). The association of delayed reformation of the anterior chamber with post-trephine cataract is, however, generally familiar, and this post-operative complication has been assigned a major place in the causation of the lens opacity by Duke-Elder (1940) and by Williamson-Noble (1953).

The purpose of this paper is to present four cases which showed lens changes after trephining, and in which the clinical features can be fairly clearly interpreted in the light of the gonioscopic picture of the site of the operation. This distinguishes them as a type of post-trephine cataract not previously described, and permits the formulation of a possible hypothesis to account for them.

Case Reports

Case 1, female, aged 69, was admitted to Moorfields on April 27, 1939, with an acute attack of congestive glaucoma which responded in some degree to medical treatment; although the tension remained high, visual acuity was 6/9; the eye (left) was trephined on May 1, 1939, and the post-operative course appears to have been uneventful.

During the succeeding years vision in the left eye gradually failed, and, when she was first examined at the Institute of Ophthalmology on July 12, 1949, was 6/18 with a correction of $-1.0/-3.5$ axis 90° . Marked cupping of the disc was noted and the visual field showed peripheral constriction.

The gonioscopic appearance of the operation area at that time showed a basal iridectomy flanked by corneal peripheral anterior synechiae (Fig. 1, overleaf). The trephine was well-sited on the limbus; but was largely filled by a tube of opacifying lens capsule which could

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FIG. 1.—Case 1, 10½ years after operation (May 24, 1950).

FIG. 2.—Case 1, 3 years later (June 19, 1953).

be seen to be herniated from the equator of the lens opposite the trephine aperture.*

Since that time an equatorial lens opacity has been seen to form and to extend to the central area of the lens with a coincident reduction in vision to finger-counting (June 17, 1953). Examination with the gonioscope now shows the structures of the angle in the same relation to one another; but the tube of lens capsule seen in 1949 now appears to extend from the cataract into the trephine-hole as a flat, opaque, white band with a dense nodule of opacity at its base (Fig. 2) upon the equator of the lens.

Case 2, female, aged 61, was admitted to Moorfields with an acute attack of congestive glaucoma. The eye was trephined with complete iridectomy on March 6, 1944.

The immediate post-operative course called forth no comment; but the ocular tension was noted to be low. When she was first examined at the Institute on May 11, 1951, the trephine bleb was draining well, the tension was normal, the disc deeply cupped, and vision down to finger-counting with the field reduced to a minute paracentral island.

The gonioscopic appearance of the operation area showed a complete iridectomy with the trephine well-sited on the trabeculae. The trephine aperture, however, was seen to be behind a strand of lens capsule which was adherent to its anterior lip (Fig. 3).

When the patient was last examined (June 24, 1953) the gonioscopic appearances were substantially unaltered; but a small equatorial cataract was apparent beneath the capsule, and the opacity was evidently spreading towards the pupillary area.

Case 3, male, aged 75, was admitted to Moorfields after 2 years on miotics for minor congestive attacks of glaucoma and with a pre-operative tension of 41 mm. Hg Schiötz in both eyes. The right eye was trephined on May 11, 1951, and the left on June 27, 1951.

Post-operative examination at the first dressing showed a total hyphaema in the left eye, and when, during the next 2 weeks, it cleared, large choroidal detachments and irido-dialyses were visible. The detachments were seen to subside during the following 4 weeks.

*This case is referred to in the Discussion on Gonioscopy at the Royal Society of Medicine (Hobbs, 1950).

FIG. 3.—Case 2, 7 years after operation (May 11, 1951).

FIG. 4.—Case 4 (August 31, 1953).

Reformation of the anterior chamber in the right eye was slow, and a large choroidal detachment was early apparent which subsided during the first post-operative month.

When the patient was first examined at the Institute (April 10, 1953), the right bleb indicated good drainage, but vision in this eye was reduced to finger-counting; in the left eye it was 4/60, and in both there were extensive central and peripheral field loss. Tension in the right eye was 20 mm. and in the left 30 mm. Hg Schiötz.

The gonioscopic appearance of the operation areas showed, in the right eye, the trephine well-sited on the trabeculae and patent. Into it there passed a strip of transparent tissue (? zonule) which was attached to the equator of the lens. In the left eye, also, the trephine was well-sited on the trabeculae, and was patent, but partly obscured by an adhesion of the lens capsule to its antero-nasal edge.

Case 4, male, aged 72, was admitted to Moorfields with a history of visual deterioration in the left eye for 2 months, and showed signs of typical chronic simple glaucoma without congestive attacks. The tension (digitally) was "full". The eye was trephined on May 29, 1945.

The post-operative course was uneventful; but a week after operation the anterior chamber remained shallow. Subsequently the vision in this eye gradually deteriorated so that when the patient was examined at the Institute of Ophthalmology (August 31, 1953), it was reduced to finger-counting. The trephine at this time was draining well; but a maturing cataract obscured any view of the fundus.

The gonioscopic appearance of the operation area (Fig. 4) showed the trephine hole anterior to the ciliary body, but with a prolapsed ciliary process passing into it. An opaque strand of lens capsule was seen to adhere to the antero-nasal edge of the fistula.

Discussion

The common features of these four cases which we should like to emphasize are, first, the capsular adhesion to the operation site; second, the presence

of a history of congestive attacks, amounting to an attack of acute congestive glaucoma which immediately preceded operation in two of them; third, the occurrence of delayed reformation of the anterior chamber with choroidal detachments in one of them.

Capsular Adhesion.—Adhesions of this sort were first noted by Sugar (1941); but no cataract had been seen at the time of his report. The occurrence of a localized equatorial cataract in the first two cases might, at first sight, be taken to indicate that the condition was the result of direct operative trauma to the lens; but the fact that the opacities have formed slowly (over a period of some 10 years in Case 1, and 9 years in Case 2) suggests to us that they are less likely to have arisen in this way than to have resulted from the prolonged tension on the lens capsule. Very little opacity was present in Case 1 10 years after operation, and none in Case 2 after 7 years, although in both an equatorial cataract has been seen to develop subsequently during the period of observation, and has spread in the first case to involve the central part of the lens. In Case 4 no equatorial opacity has been seen; but the cataract, 8 years after operation, remains immature and is denser in its upper part. In Case 3, operated upon more recently, the lens remains clear. Such opacities are in marked contrast with the rapidly-forming traumatic cataract which is generally accepted to be the result of direct injury of the lens—a process which is said to be exaggerated when the eye is glaucomatous (Samuels, 1947) and occasionally to present an acute post-operative disaster. Indeed, Verhoeff (1918) reported that the majority of eyes for which enucleation was necessary as the result of complications following trephining had suffered injury to the lens.

The cause of the capsular adhesion hence becomes of considerable importance; and it may be recalled that one of us (H.E.H.), in a reference to Case I in 1950, suggested that the appearances might be interpreted as resulting primarily from prolapse into the trephine-hole of ciliary processes, which subsequently, by tension on the suspensory ligament, drew a tent of lens capsule after them. Such prolapse of the ciliary processes is a not uncommon finding with the gonioscope after trephining (Sugar, 1942; Troncoso, 1948), but it usually occurs when the trephine aperture is to some extent retroplaced. In all of our cases the trephine-hole is sited anteriorly over the trabeculae, and, since, in the only one of them in which a prolapsed ciliary process is seen (Case 4), this is quite separate from the lens capsule, the proffered explanation must remain entirely hypothetical. On the other hand, it is noteworthy that, in the three last cases the lens capsule does not pass through the trephine-hole, but is adherent to its *anterior* lip. This, it seems to us, suggests that the lens itself must at some time, and most probably at the time of operation, have become subluxated upward and tilted forward toward the new aqueous exit at the trephine aperture. The tendency for forward displacement of the lens to occur in congestive glaucoma is well known, and has been responsible, after iridectomy during an acute attack, for the severe and intractable recurrence of hypertension, to which von Graefe gave the name of “malignant glaucoma”. This condition has recently been reviewed by Chandler (1950).

Pressure in the vitreous chamber, uncompensated in the anterior chamber, has appeared to be the most likely explanation of this condition, and has been attributed to swelling of the vitreous (Reese, 1950), or uveal congestion (Chandler, 1950). Whatever the immediate cause, however, the end-result is the same, namely, a

great and rapidly produced disparity between the pressures in the anterior and vitreous chambers, with a tendency for the lens-zonule diaphragm to be forced forward towards the point of reduced pressure at the site of the incision.

The adhesion of lens capsule at the operation site in the cases described above, suggests that as well as this forward movement, there is a subluxation upward which brings the lens into contact with the trephine aperture. Such a movement would presumably be determined by the aqueous escaping as the surgical fistula is made, and a similar mechanism, in a more pronounced degree, has apparently been active in a case of malignant glaucoma recently seen by one of us (R.S.), of which a section of the subsequently excised eye is shown in Fig. 5.

Congestive Background.—In at least two of these four cases, therefore, the congestive background appears to be rather more than coincidental, and it seems likely that,

whether or not the measurable tension was severely raised at the time of operation, a considerable forward thrust must have been exerted upon the lens diaphragm in order to bring the equator of the lens as far forward as the anterior lip of an anteriorly placed trephine. The congestion in the uveal tract behind the lens in an acute congestive attack is an obvious source of such pressure, and it seems reasonable to hold it responsible in the two cases in which an acute attack immediately preceded operation.

It seems likely from these considerations, therefore, that this complication arises from a relative excess of pressure in the vitreous chamber over that in the anterior chamber. Pre-operative uveal congestion may, of course, have been present as the primary cause of the ocular hypertension, and may have been accentuated by the fall in anterior chamber pressure when aqueous was allowed to escape through the wound; or the escape of aqueous alone, if sufficiently rapid, may have been responsible for the disproportion.

Delayed Re-Formation of the Anterior Chamber and Choroidal Detachment.—The association of post-trephine cataract with delayed reformation of the anterior chamber has already been referred to above, and, although no satisfactory explanation of it has yet been offered, the fact that, in Case 3, choroidal detachments were also present is of additional and relevant interest. After cataract extraction or trephining, such detachments are well known to be associated with hypotony and with a shallow anterior chamber, and although the mechanism by which they

FIG. 5.—Sagittal section of eye enucleated on account of malignant glaucoma.

arise may differ somewhat in the two types of case, it seems certain that they can only appear when, in the presence of lowered ocular tension, fluid passes into the subchoroidal space. Such a condition, in this case, by adding to the retrolenticular volume, could provide in the vitreous chamber the thrust needed to retain the lens diaphragm in its forward position during the early post-operative period, and so to facilitate the formation of the capsular adhesion seen.

Conclusion

One form of post-trephine cataract arises as an equatorial opacity which spreads centrally to involve the pupillary area of the lens. An adhesion of the lens capsule to the trephine aperture, which is best demonstrated gonioscopically, appears to be its immediate determining cause. Of the four cases reported in which such an adhesion is present, the cataract has developed in three, the fourth having been operated on comparatively recently.

The adhesion probably forms at, or shortly after, operation, when, through the emptying of the anterior chamber, the forward thrust of the pressure behind the lens is unopposed. Pre-operative congestion and post-operative choroidal detachment with delayed reformation of the anterior chamber are, therefore, likely to play a part in causing, and maintaining, the displacement of the lens.

It seems desirable, therefore, that when a fistulizing operation is contemplated in the presence of high tension, appropriate measures should be taken to minimize the abruptness of the decompression. Some of these measures will concern the actual operative technique; but such medical measures as retrobulbar injection of novocaine or intravenous injection of sorbitol, or alternatively preliminary posterior sclerotomy, should tend to diminish the strain on the lens-zonule-diaphragm at operation by reducing the ocular tension as a whole. The findings in trephined eyes first prompted this suggestion, but it seems likely that the same considerations apply to such other decompression operations as iris inclusion and cyclodialysis, which are by no means free from the complication of post-operative cataract.

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