In addition to this investigation of thirty-two cases, twenty-seven older slides were examined. Many of these were faded and had not been stained to bring out the bodies, but in eleven cases with signs of a raised tension these bodies were seen. In three cases they were not found when other histological evidence of glaucoma existed. I do not propose to publish this list of old cases in detail, but several interesting cases need comment. In a case of melanotic sarcoma of choroid and secondary glaucoma the bodies were absent, but the sarcoma was undergoing necrosis and possibly the tension had dropped to normal. In another case of iridocyclitis and secondary glaucoma they were absent but the cornea had undergone extensive ulceration. In an eye excised for glioma in a child of six a great many bodies were found.

Summary

(1) Structureless hemispherical bodies are found in Bowman's membrane in most eyes excised for glaucoma.

(2) The presence of such bodies is indicative that the raised tension is still present and is of at least three days standing.

(3) The bodies are often very faintly stained but are visible if carefully focused.

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EXFOLIATION OF THE LENS CAPSULE IN GLAUCOMA

BY

ALEXANDER GARROW

GLASGOW

THE subject of exfoliation of the lens capsule has not attracted much attention in the ophthalmological literature of this country. The first cases were published by Goulden, who described two at the Convention of English Speaking Ophthalmological Societies in London in July, 1925 (*Trans. Ophthalm. Soc. U.K.*, Vol. XLV, Part 2, 1925). In Goulden's cases the condition was associated with cataract and there was no glaucoma. His Fig. 1 is a very typical representation of the curling forwards of the edge of the exfoliated capsule.

In the *Brit. Jl. of Ophthalm.* of February, 1932, Dr. Mohamed Sobhy Bey of Cairo contributed a paper with a description of his pathological findings.

At a meeting of the North of England Ophthalmological Society in 1933 Foster, of Leeds, showed a case (*Trans. Ophthalm. Soc. U.K.*, 1933).

The condition has attracted more attention on the Continent since Vogt of Zürich first described it and published an account of his first 12 cases in 1925 in the *Klin. Monatsbl. f. Augenheilk.*, Vol. LXXV, 1925.

Nine of these cases had glaucoma. This paper is accompanied by nine beautifully executed plates and the reader is referred to them for a very clear representation of what may be seen in this condition. Vogt's paper was followed by others in the Continental literature. In Sobhy Bey's paper in the *Brit. Jl. of Ophthalm.* reference is made to many of these.

A paper by Hörven of Oslo appears in the *Acta Ophthalm.*, Vol. XIV, 1936, with an extensive list of the literature and papers on this subject and on others relevant to the discussion of it.

Hörven first aroused my attention to this subject. He read a paper and showed cases in Oslo in June of 1937 to the visiting Ophthalmic Surgeons from the North of England Ophthalmological Society and I was privileged to be one of that party and to see some of the cases. This paper has now been published in the *Brit. Jl. of Ophthalm.* for December, 1937.

Hörven found exfoliation of the lens capsule so frequently in glaucoma (in 80-90 per cent. of all the cases) that I was prompted to examine each case of glaucoma for this condition with the slit-lamp since my return from Oslo in June. Fifty-one cases have been investigated and in eight of them I have found exfoliation. These cases show such typical pictures that they are quite unmistakable and when one has become familiar with the appearances one is not likely to mistake the condition for any other.

Frequency.—The condition is found in diseases other than glaucoma, *e.g.*, cataract and sometimes in eyes which appear to be free from disease, but in a very small proportion of the cases examined. Although my investigation of the past six months has been more particularly directed to cases of glaucoma, I have looked for these capsule changes in the slit-lamp examination of all types of cases, such as one is likely to see in the ordinary routine of practice. I had not seen this disorder in any other condition than glaucoma until a month ago, since when I have found two cases.

The first was a man aged 68 years with very unhealthy eyes—high myopia with posterior staphyloma and choroidal atrophy, corneal opacity, irides atrophic and depigmented. The right eye

is blind from macular choroidal atrophy and showed no capsular change. The left eye is the seat of less extensive choroidal changes and showed a central film on the capsule with curled edge and specks of exfoliated lamella lying on it.

The second case was a well preserved and active man, aged 81 years, who had noticed defective vision of the right eye during the past few months. I found this to be due to incipient senile cataract. The other eye appeared to be normal and the retinal blood vessels were in good condition. Bluish white accumulations of exfoliated capsule were sticking to the margin of the pupils, and specks were lying on the lens capsule, and in the left eye there was a central pupillary film with a ragged curled-over edge.

Hörven quotes statistics of the findings of a number of observers. They vary very much but no one records such a high percentage of positive cases in glaucoma as Hörven (*e.g.*, Hörven in 80-90 per cent., Vogt in 5 per cent.), and he remarks that it is difficult to give an explanation of that. He suggests that the most reasonable explanation is that the material dealt with is not quite the same. He says that the prevailing type in Oslo is glaucoma simplex, and that chronic inflammatory glaucoma is seldom met with. Hörven goes the length of saying that exfoliation offers a basis of classification of glaucoma; that it occurs in the simple type only and never in acute or chronic inflammatory.

It is difficult to attempt any definite classification of glaucoma because occasional congestive attacks do occur in cases of "simple" glaucoma met with in this country and two of the cases of my series (Cases 6 and 7) sought advice in the first instance during a congestive attack of considerable severity.

My positive findings represent a percentage of 16 (8 in 51 cases).

The percentage of positive cases must, however, depend upon the width of the pupil at the time of the examination because the changes are more extensive and more easily seen in the periphery than in the central area, and the peripheral changes cannot be seen unless the pupil is dilated and this cannot be done indiscriminately in glaucoma. The presence of a surgical coloboma displays the periphery for examination in some cases.

The width of the pupil at the time of the examination should be recorded, in order to make statistics comparable.

Fig. 2 of Case 1 exemplifies this point very clearly. I will return to that in the description of the case.

In order to compare its frequency in glaucoma and in non-glaucomatous cases, Hörven examined 67 non-glaucomatous old people in a Home for the Aged in Oslo. This investigation was carried out with the same apparatus and in the same place as the

glaucoma patients and in all the cases the pupils were dilated with homatropine and cocaine.

He found two cases and states that this corresponds very closely to the number found in a similar investigation by Rehsteiner in asylums for the aged in Zürich.

Hörven's positive findings in glaucoma were 85 per cent. in 150 patients who had been operated on for simple glaucoma, and 93 per cent. in 43 cases of simple glaucoma not yet operated on.

Hörven sums up his positive findings as follows: 89 per cent. in 183 cases of glaucoma, 3 per cent. in 67 old people without signs of glaucoma, 18 per cent. in 55 admitted for operation for mature cataract.

Description of the appearance.—A slit-lamp examination is necessary, although when well marked some of the appearances can be seen with a corneal loupe and hand lens. The low power (Oc2 Obj. F 55) discloses the condition in some cases but it is advisable to use the high power (Oc2 Obj. a 2).

Before describing the appearances seen it will simplify matters if one makes some remarks upon the condition which gives rise to the appearances.

It seems to be entirely a degenerative process affecting the capsule of the lens in its most superficial lamella. This gives it a milky appearance and the lamella is prone to tear, and the torn edges may curl, usually in a forward direction. This milky film is not homogeneous. It has a dotted or grained appearance and the graining may be fine or coarse. The fine graining is sometimes difficult to see but the coarse graining is easily detected particularly near the edge of a tear. Pieces of this loose lamella may break off and lie on the surface of the anterior capsule and some of them stick to the margin of the pupil giving rise to what is known as the felt masses.

Trantas does not think that even at the beginning of the degenerative process there is a formation of the film over the whole surface of the lens and both Trantas and Vogt think that when the superficial lamella has peeled off the process may affect the next layer.

Vogt published in the *Klin. Monatsbl. f. Augenheilk.*, Vol. LXXXIX, 1932, the results of a microscopic investigation of the lamella with numerous photomicrographs. Chapter 48 is devoted to a description of the normal lamella and chapter 59 to diseases of it. In the diseased lamella the outer layer has a spongy appearance with the formation of vacuoles. This results in peeling in flakes. His photomicrographs illustrate all these changes.

Sobhy Bey made a pathological examination of an eye in which he had observed the changes *in vivo*. He illustrated his paper

with photomicrographs which show laminated masses on the pupillary margins and on the posterior surface of the iris, thicker in the furrows and thinner on the ridges. He found that this material is highly refractile like lens capsule, and has the same histological characteristics. He found, too, that depigmentation of the iris goes hand in hand with exfoliation.

These then are the changes which form the basis of the pictures seen, which may be conveniently described as they occur in three zones of the pupil:—

- (1) Central zone.
- (2) Peripheral zone.
- (3) Intermediate zone.

The width of the pupil naturally determines which of these zones are displayed for examination.

If the pupil is dilated all three zones may be examined at one sitting, but in the case with undilated pupil the central zone only will be seen and perhaps also the central part of the intermediate zone.

A single case may show so many of the signs of the condition that even in the small group which I have examined I have seen most of the appearances figured in Vogt's plates and described in the text of his paper.

(1) *Central Zone.* (2-3 mm. pupil).—(a) *The Central Film.* The characteristic appearance here is a milky film which is homogeneous and not dotted as in the other zones. It is sometimes seen with great difficulty and in some cases it is very difficult to be sure of it, particularly if the smallness of the pupil prevents one from seeing its edge. The importance of seeing the edge of the film is that one appreciates a difference in the hue of the part covered by the film and the part not so covered and if an edge can be seen on it it is almost certainly a case of this degenerative change. If any part of that edge shows a curl it is certainly a case of it.

The film is more or less circular in outline and may have sticking on its surface bluish white felt masses which have broken loose. If these are present it confirms the case.

Trantas says that one sometimes sees a delicate curved white line on the capsule which makes one think that it may be the outline of a disc in formation, and that this may be confirmed later by finding a disc with that white line as its margin; he further says that these are not to be confounded with specks of pupillary membrane which never progress.

It is sometimes the delicate white margin which leads one to recognise the film itself.

Trantas points out that it is very difficult to see the central film in fully formed cataract for want of a dark background.

In one case I was misled in thinking I saw a milky film with an edge on it. By manipulation of the beam of light I found that the appearance of the edge was in reality a shadow effect of the margin of the iris cast upon the surface of the lens capsule.

(b) The surface of the lens should then be examined all round the margin of the pupil. In some cases milky patches may be seen coming into view from under the iris (see Plate II and Fig. 2). When the pupil is dilated these patches are found to be projections from the periphery. They are sometimes flat topped and sometimes tongue like, and either V or U shaped. On their surface the fine or coarse graining may be seen. The edge is often a delicate white line and a curling forwards makes a most characteristic picture when peeling has begun. With a small pupil it is only the tip of such a tongue which is seen; more of it, and perhaps other and shorter tongues, are seen with cocaine dilatation; while with full dilatation a series of similar tongues and flat topped processes may be seen all round the pupil. When a series of V-shaped processes is continuous the edge has a jagged appearance. Some of Vogt's plates show this edge to be rounded and quite irregular.

These conditions are quite unlike the films which may remain on the capsule after iritis.

(c) The bluish white masses may also be included in this description of the central zone because their detection does not depend upon the size of the pupil. They are as easily seen with a small as with a large pupil. These have been named felt masses but that term does not quite suit as a description of the slit-lamp appearances of the cases I have seen. The particles appear loosely packed and resemble in arrangement and in hue the superficial particles of tobacco ash on the end of a cigarette. They are accumulations of loose particles of exfoliated lamella. Vogt considers that they stick to the margin of the pupil because of the latter's fine corrugation. Plate III illustrates the appearance. In this case many of the particles were sticking on their ends on the iris stroma some little distance from the pupillary margin like minute hairs. Where one of the indentations on the iris margin is completely filled with these masses some stick on the stroma just peripheral to the indentation. This is evidently unusual because Hörven, who has seen so much of this condition, says that these particles are never seen on the iris stroma.

The arrangement of these masses is quite unlike that of organised exudate often found round the margin of the pupil after iritis.

Peripheral Zone. (4.5 mm. and more).—The peripheral zone can be seen only when the pupil is dilated. When the central zone is free of change a negative case may become positive when examined with a dilated pupil. A coloboma affords an opportunity of examining a part of this area without pupillary dilatation unless a large filtration bleb intervenes.

With a wide pupil a great variety of changes may be seen (see Plate 1 and Fig. 2). There is sometimes a continuous milky zone, more or less all round, and from this zone projections may be seen jutting in towards the centre of the pupil. These are sometimes rounded and sometimes pointed, giving a jagged appearance. From the peripheral border of this zone projections pass outwards. These projections have a radial appearance, and between the projections there are V-shaped spaces of normal hue. The axial edges of the projections may have curls and tears. Curls are usually in a forward direction. This jagged edge has a pattern which fits in to some extent to the edge of the film in the intermediate zone, suggesting that it has broken away from it there. The surface of this peripheral changed capsule has a white dotted appearance, the dots sometimes being fairly large giving a coarse grained appearance and sometimes they are very small giving a fine grained appearance. This graining is usually most marked near the edges. A characteristic feature of the edges is a fine white line on them.

The radial arrangement of this zone is a very striking feature and the reason for it is a matter of doubt. Vogt thinks that it is due to the rubbing of the ridges of the iris on the diseased capsule in the to and fro movements of the iris. A study of Vogt's illustrations of the normal lamella and of Plate I of this series suggests, I think, that there may be an anatomical basis for it and that it is caused by radial traction acting from the periphery. The common situation of the tears and the direction taken by the curling edge suggest this. These curling torn edges are usually on the tongue-like or flat topped axial projections of the peripheral zone and the direction of the curl is forwards and then backwards. In Plate I almost every axial projection has a curl. Vogt's plates show this too, while no curl is shown on the edge of a film in the intermediate zones, where such is present.

Trantas does not think that one can conclude that there has been a separation of the peripheral film from that in the intermediate zone. But some of the cases suggest this very strongly. The peripheral edge of the intermediate zone is usually very indefinite but its pattern often appears to fit in with the gaps and the prominences of the central margin of the peripheral zone as if they had at one time been continuous and had parted (? by the action of radial traction acting from the periphery).

PLATE I.

PLATE II.

PLATE III.

Furthermore, in Case 1 (see Plate I) the V-shaped spaces which are devoid of film are not opposite iris ridges but opposite similarly V-shaped parts of the iris. Manipulation of the beam brings this out clearly and the artist has succeeded very well in depicting it. If the rubbing of the iris ridges is the cause of the radial arrangement one would expect that the film free spaces would be opposite a ridge and not opposite a furrow. The question is, however, difficult to determine because Sobhy Bey's microphotograph shows more of the laminated exfoliation deposited in the furrows than on the ridges, but that is what one would expect because there is more room in the furrows for the accumulations of debris.

(3) *Intermediate Zone.* (3 to 4.5 mm. pupil).—This lies between the pupillary film and the peripheral zone and consists of indefinite grained areas arranged concentrically round the zone. It is the least striking part of the picture and was not present in the cases from which the accompanying plates were made. It is figured as a complete band all round the pupil in only two of Vogt's eleven plates, with a band of normal hue between it and the central film on the one hand and between it and the peripheral band of film on the other hand.

The peripheral edge of it is usually indefinite and has an outline more or less corresponding to the central edge of the peripheral zone and suggesting that it has at one time been in contact with the latter. In this zone the edges do not show a curl in any of my cases; the film merges gradually into normal capsule. One uses the word "normal" for convenience. The capsule is almost certainly not normal in the parts which are not milky but have the normal dark hue.

Sometimes one or more bridges of film connect one zone with another, across the zone of normal hue.

Hörven states that it is difficult to explain the peculiar division of the changes in the capsule into a central disc and peripheral and intermediate bands and he does not think that it is due to the movements of the iris. If this were so, he says, it should follow that the central disc would be present just as often as the peripheral band; but in 10 per cent. of his cases he was unable to detect a central film.

The Coloboma.—A coloboma sometimes affords an opportunity of seeing a peripheral zone of exfoliation. In my eight cases there were seven eyes with colobomata in four of which the exfoliation was seen. In three its lower edge was in line with the margin of the pupil and was peeling, giving a fringed or frilled appearance, and in the other there was a reticulate arrangement. In one of these with a frilled edge there was a tongue-like prolongation towards the centre of the pupil.

All the changes above described are not seen in every case. Thus Trantas in 42 cases found all the changes in 23, *i.e.*, peripheral band, central film and the felt masses. In 12 there was just a peripheral band, sometimes associated with felt masses, but with no central film. In four there was just a central film with no peripheral change, and in three just specks on the capsule like those found in eyes which show all the changes.

In my own eight cases exfoliation was found in eleven eyes. In one of these the central film, the peripheral band and the felt masses were found, in four the central film and the peripheral film, in three the peripheral film only and in two the felt masses only, and in one a central film and felt masses.

There seems to be a difference of opinion as to whether or not the extreme periphery may be affected by these changes. Trantas says that it is not, whereas Hörven says that it is so constantly. He says that in excised eyes, where exfoliation is present, the changes are never wanting, and that they are always found *in vivo* if the suspensory ligament is at all visible. He finds that the suspensory ligament is densely covered with white scurf-like particles of the same appearance as the flakes on the pupillary border; but that one does not yet know if these are secondary, like the flakes on the pupillary border, or a degenerative change in the fibres, analogous to the affection of the capsule.

The Cause of the Condition.—It is almost certainly degenerative. Vogt discusses the point as to whether it is the cause of glaucoma, or glaucoma the cause of it. He decides that the latter is the more likely. But is it not more probable that glaucoma and exfoliation are not related to each other in the way of cause and effect, but that each is an expression within the eye of degeneration of tissue?

Trantas does not think that the syndrome depends upon glaucoma because in his 42 cases of it he found glaucoma in only 14. He was impressed by its association with other evidence of degeneration of ocular tissue such as cataract, vitreous opacities, depigmentation and presumably degenerative changes in the aqueous drainage passages, rendering such eyes prone to glaucoma.

There can be no doubt, however, about its association with glaucoma. In my own search for it over a short period of six months I found it in three cases in the first month in the glaucoma group, and I had to wait until the sixth month before finding it in a non-glaucomatous case, although during that period I had examined many more non-glaucomatous eyes than glaucomatous.

The question naturally arises: is this change of the capsular lamella of any practical importance?

(1) *Does it help diagnosis?*—I have not had an opportunity of

testing this in early cases. All the cases investigated for the purpose of this paper were well established. I understand that at Oslo it has been detected in some cases which ultimately became glaucomatous.

In this connection I will follow up at least two of my cases with interest. In Case 1 of the series the right eye is glaucomatous and the left eye has satisfactorily passed every test as being free of glaucoma although it is the site of wide-spread capsule changes (see Plates I and II and Fig. 2).

The non-glaucomatous patient, aged 81 years, already referred to, in whom I found felt masses all round the pupillary border of both eyes and a central film in one eye, is a medical man and I will therefore have an opportunity of examining his eyes as often as I may wish.

(2) *Does it affect prognosis?*—It has been suggested that this exfoliation once established is likely to aggravate glaucoma by blocking the filtration angle by debris. More histological examination is needed to decide this by finding deposits of the lamella in the angle. In Sobhy Bey's case which was histologically examined a mass was found crossing the angle from the pectinate ligament to the iris, but it was not highly refractile like the deposits on the back of the iris. He described the mass as homogeneous whereas the deposits of lamellae on the iris were laminated and his reference to it suggests that he did not consider it to be an accumulation of exfoliated capsule.

Sobhy Bey quotes Vogt as stating that the operative prognosis is not so good in cases with capsule changes as in those without them. This can scarcely apply to the Oslo cases in which Hörven has found the capsule changes in from 80 to 90 per cent. of all cases.

My own series is too small to enable one to form a comparison.

The point can only be settled by the examination of a large series of cases and in order to be certain of the classification one would have to examine all the cases with fully dilated pupils and therein lies the difficulty in such a disease as glaucoma.

Cases of Glaucoma Showing Exfoliation

CASE 1. D.M., Aged 65 years.

First seen on April 8, 1937, complaining of defective vision of the right eye of six months' duration. No symptoms suggestive of congestive attacks.

R.E. T., 43. Glaucomatous cupping. Iridencleisis on June 16, 1937. September, 1937, T, 19 but lens becoming cataractous.

L.E. Apparently normal, although, as will be seen below, it is the seat of much more widespread capsule changes than the glaucomatous eye. Its tension has always been normal on repeated examinations with the tonometer. There is just a little concentric contraction of the peripheral field of vision, and examination on the screen with 1/2000 does not reveal any abnormality such as bareing of the blind spot, described by Traquair as the earliest field sign of glaucoma.

CAPSULE.

R.E. See Fig. 1. Peripheral film seen in coloboma with frilled lower edge; graining all over it, especially near a vertical split in the film. No central film, but in the central area of the pupil are a number of specks of exfoliated lamella and one rolled piece lying on the capsule.

FIG. 1. R.E. of Case 1.

The triangular shaded area represents a patch of subcapsular opacity in the lens.

FIG. 2. L.E. of Case 1.

Shows how the size of the pupil regulates the visibility of the changes. The inner circle represents the 2 mm. pupil, the middle circle the 3.5 mm. pupil and the outer circle the 5 mm. pupil. With the 2 mm. pupil this case would be classified as negative. For details see the description of the capsule in L.E. of Case 1.

L.E. See Plates I and II and Fig. 2. The condition in the right eye just described above was found on July 1, 1937. On that date I noted the left eye as negative, but at that examination the pupillary diameter was only 2 mm. Subsequent examination with a pupil of 5 mm. showed a complete peripheral band of film.

On September 10, 1937, I made drawings of the condition seen in three degrees of dilatation of the pupil. I examined firstly with a 2 mm. pupil and found no change, then with a 3.5 mm. pupil and found three tongue-like prolongations, with curling of the edges, jutting out from below the iris from 1 to 3, then the pupil was further dilated to 5 mm. when it was found that these three tongues were just the longest of many others all round the periphery.

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Three drawings were made and these have been combined to make Fig. 2. The inner circle represents the 2 mm. pupil, the middle circle is the 3.5 mm. pupil and the outer circle is the 5 mm. pupil. The figure shows how much a negative or a positive finding may depend upon the size of the pupil.

Plates I and II were made from drawings of this eye on November 10.

Fig. 2 and Plate I show the varieties of the shapes taken by the projections from the peripheral film towards the centre of the pupil—round topped, flat topped, and sharp pointed, already referred to in the description of the peripheral film; while the outer border shows the radial arrangement of the granular prolongations towards the periphery, separated by the V-shaped spaces of normal hue.

When examining an eye with a medium pupil one must look all round its margin in the search for grained tongues as seen in Plate I and Fig. 2. Their recognition requires careful focusing and manipulation of the beam of light, and one's attention to them is sometimes first attracted by the delicate white line of their edges. It has already been said that Vogt considers the sequence to be first glaucoma and then exfoliation. In this patient's left eye this sequence is reversed. Wide spread lamella degeneration is already present, but so far there are no signs of glaucoma.

Some changes in the film have been noted in the past two months. The tongues from 1 to 7 are not now so long as they were. Their ends are more curled over giving them a more flat topped appearance. In September a small oval hole was easily seen in the tongue at 3 (See Fig. 2). In November this hole was almost completely hidden by the curled over end of the tongue (see Plates I and II). A curved roll of lamella is sticking on the edge of the tongue at 4. The edge of the film is curled over forwards almost all round.

CASE 2. A.M., Aged 74 years.

Seen on July 29, 1937, complaining of defective vision of 5 months' duration. No history of congestive attacks.

R. and L. Glaucomatous cupping and atrophy, R.E. the worse. T.R. 60. T.L. 50. V.R. 3/60. V.L. 6/9 (pt.) Extreme contraction of field of vision L.E.

CAPSULE.

R.E. Felt masses all round margin of iris. No central film and no peripheral film when examined with 5 mm. pupil.

L.E. See Fig. 3. Felt masses all round. Faint central film with many bluish specks on it when examined with 3 mm. pupil. No peripheral film.

FIG. 3. L.E. of Case 2. Pupil 1.5 mm.

Particles of exfoliated capsule sticking to edge of iris and to each other.

This is the case from which Plate III was drawn.

The felt masses show a great variety of arrangement. The corrugations of the margin of the iris are packed with them. Some pieces stick by their ends on the margin of the iris, some pointing forwards, some towards the centre of the pupil and some outwards towards the iris stroma. Some are rod-like (? rolls of lamella) and where these stick to each other there is a branched effect. At one part a great number of extremely fine rods are sticking on their ends on the iris stroma like minute hairs. Depigmentation of iris.

R.E. which has no central film shows normal lens shagreen.

L.E. which has a faint central film shows no lens shagreen.

CASE 3. A.G., Aged 65 years.

L.E. Simple glaucoma when first seen in 1928. Not seen again until 1931. Trephined 1931. Lens now cataractous.

R.E. Now glaucomatous. T. 35. Cupping of O.D. V=6/9.

CAPSULE.

L.E. See Fig. 4. Coloboma 6 mm. in width, covered with peripheral film with frilled edge, rolled back in some places, in line with the margin of the pupil. Peripheral film all round pupil. A few specks and rolls lying on a central film which has several spots on it of normal hue, suggesting that the film has peeled off in these places.

FIG. 4. L.E. of Case 3.

Central film with exfoliated particles lying on it. Film in coloboma with frilled edge, curled forwards in places. Complete peripheral band.

R.E. (a) 2 mm. pupil—central film with specks on it. Some of these have branched effect.

(b) 7 mm. pupil—shows, in addition, a coarse-grained peripheral film from 4 to 8 o'clock. Also two felt masses in the upper quadrant. (See Fig. 5.)

FIG. 5. R.E. of Case 3. Pupil 7 mm.

Central film with loose particles on it. Peripheral film from 4 to 8. Felt mass at 10. The line at 11 represents a loose particle sticking at each end to the margin of the iris.

CASE 4. Miss H., Aged 75 years.

First seen in 1933. Both O.D.s cupped. Many vitreous floaters R.E. T.R. 25. T.L. 42. Both eyes trephined 1934.

CAPSULE.

R.E. Posterior synechiae 8-12. Depigmentation. Anterior capsule sprinkled with iris pigment. No pupil film and no exfoliation.

L.E. See Fig. 6. Long piece of rolled lamella jutting out from below the iris at 11. Peripheral film showing below from 5 to 7. No changes seen in small peripheral coloboma.

FIG. 6 L.E. of Case 4.

Partial peripheral band below. Long piece of rolled lamella adherent above to the iris margin.

CASE 5. A.R., Aged 73 years.

First seen in 1925. L.E. had been trephined elsewhere in 1924 but was blind from optic atrophy, and R.E. was trephined by me in 1935. Both eyes are now practically blind, R.E. from cataract and L.E. from optic atrophy. He has been in receipt of pension as a blind man since 1931.

CAPSULE.

R.E. See Fig. 7. Exfoliation seen in coloboma; they appear as irregular greyish areas with crenated margins. A few delicate processes extend from the coloboma down towards the centre of the pupil. Pupil is fixed by posterior synechiae and there are fluffy wisps of organized exudate between the iris and the lens.

FIG. 7. R.E. of Case 5.

Film in coloboma with crenated edge. Narrow radially arranged patches in the intermediate zone above.

L.E. Iris atrophic. Pupil fixed at a diameter of 5 mm. covered with thin layer of organized exudate, sprinkled with pigment.

CASE 6. Mrs. M., Aged 66 years.

Seen in 1936 with retinal hæmorrhage L.E. associated with kidney disease and high blood pressure. Seen for the second time on July 13, 1937, on account of an attack of congestive glaucoma L.E.

L.E. Corneal oedema T. + 3. No perception of light.

R.E. Retinal arteriosclerosis. O.D. appeared normal.

Seen for the third and last time on July 20, 1937, after a week on eserine. Cornea of the left eye had cleared and tension was normal.

CAPSULE.

R.E. Felt masses all round the pupillary margin of iris. No central film. Periphery not seen owing to small pupil.

L.E. No changes.

CASE 7. W.R., Aged 43 years.

First seen on June 15, 1935, on account of pain and defective vision R.E. of one week's duration. He was quite certain that he had never before had eye trouble.

On June 15, 1935, the condition was congestive glaucoma. R.E. with T. 105, corneal oedema. No K.P. Vision almost nil.

L.E. appeared normal, with V.A. = 6/6.

R.E. Iridectomy on June 21, 1935, A week later, cornea being clear, it was found that the lens was hazy, especially posteriorly. A year later lens more cataractous, and in February, 1937, it was noted as completely cataractous and T. 29.

L.E. has appeared to be normal throughout, but on February 4, 1937, T.L. was 25 and in July he spoke of coloured rings round the lights with L.E. He had never before complained of this eye and at the time he was disputing his fitness for work.

CAPSULE.

R.E. See Fig. 8: One posterior synechia from 4 to 5. Central film from which processes radiate outwards giving a rosette shape to it. A piece of peeled lamella sticks at one end to the lower end of the pillar of the coloboma and at the other end to the capsule, and on the latter there is a small space of normal hue from which the peeled piece of lamella had come. Reticulate peripheral film in coloboma.

L.E. No changes seen.

FIG. 8. R.E. of Case 7.

Reticulate film in the coloboma. Central film with short rounded projections from it. The upper triangle represents a piece of lamella which appears to have become peeled off the unshaded space below it. Its base sticks to a spur of iris at the lower end of the pillar of the coloboma. The unshaded spot below represents another place where a piece of lamella has been peeled off.

CASE 8. J. J., Aged 62 years.

This case is a good example of how much the relegation of a case into the positive or the negative group depends upon the size of the pupil. In July last with a 2-3 mm. pupil it was entered in the negative group. In January, with a 7 mm. pupil, the changes were found.

This patient was seen in February, 1930, with the complaint of D.V.L. of one month's duration, with haloes. The cornea was dull, T. was 85, and there was deep glaucomatous cupping.

R.E. appeared to be normal and its tension was 18.

L.E. was trephined and he ceased attendance in September of the same year. New blood vessels on the surface of the iris were noted then.

He was not seen again until May 17, 1937, when he came to the Out-patient Department, suffering from a severe attack of congestive glaucoma. L.E. The iris was atrophic and completely adherent to the lens and the eye was quite blind. Enucleation advised and refused. Eserine, pilocarpine and dionine prescribed and the attack passed off.

On that date R.E. appeared normal and there had been no symptoms referable to it.

On June 17, 1937, both eyes were examined with the Slit Lamp for the capsule changes and none were found, and his name was included in the negative group of my series. At this examination the pupil of R.E. was small, about 2-3 mm.

EXFOLIATION OF THE LENS CAPSULE IN GLAUCOMA 229

The patient was not seen again until January 17, 1938. He stated that the vision of his good eye had been gradually failing in the past month, and rapidly in the past week. No symptoms of congestion. The pupil was found to be dilated, 7 mm., and reacted very sluggishly to light, and the tension was 42.

(See Fig. 9.) An opportunity was immediately taken to examine the eye with the 7 mm. pupil with the Slit Lamp. A prolonged search failed to discover any of the capsule changes and one had almost decided to retain the case in the negative group when suddenly one perceived a few tongue-like milky

FIG. 9. R.E. of Case 8.

Central film with exfoliated particles on it. Peripheral band with jagged edge. A row of exfoliated particles are sticking to the edge of a projection at 2. Three radii in the intermediate zone above. Localised oedema of the cornea obscured the outer part of the capsule.

projections appearing from behind the margin of the iris. Careful focusing and manipulation of the beam so that the light was projected through the anterior chamber at a high angle displayed an almost complete peripheral band with sharp-pointed prolongations towards the centre, some of the prolongations were curled and one edge had a few bluish white specks on it. Part of the temporal margin of the pupil could not be seen distinctly on account of some localized oedema of the cornea there.

A faint but quite unmistakable central pupillary film was then seen with crenated margins and a few bluish white specks on its surface. This central film was not detected in July because the smallness of the pupil had prevented one from seeing the edge and thus one was denied the benefit of contrast between the central film and the surrounding area of normal hue.

A few narrow milky radii crossed the intermediate zone from the peripheral band to the central film in the region of 12 o'clock.

L.E. Iris densely adherent. Organized exudate and sprinkling of iritic pigment on the lens capsule. Lens partially cataractous.

Negative Cases

In this group there are 43 patients of whom 20 had had one or more congestive attacks. In 31 the glaucoma affected both eyes.

So far as this series of cases, positive and negative, is concerned, I can so far offer no explanation of the presence of exfoliation in the one group and its absence in the other. In the matter of age and the ordinary stigmata of degeneration, either in the eye or in the general bodily condition, there appears to be nothing to distinguish the one group from the other.

The duration of the glaucoma cannot be a factor because quite a number in the negative group have, to my knowledge, had glaucoma for ten years or more, and in the positive group the glaucoma had developed in the past year in three of the patients.

It must be borne in mind, however, that these exfoliation changes are more extensive and more frequent in the peripheral parts of the capsule than in the centre and that a case cannot be definitely pronounced to be negative until the periphery is examined, and that has not been systematically done in this series of cases.

Summary

Fifty-one glaucomatous patients have been examined for exfoliation of the capsule. In eight patients this has been found. Two of these had a congestive attack when they first came under observation.

No record has been kept of the number of non-glaucomatous patients examined by the slit-lamp during the period of this investigation, but in these it has been found only twice.

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ANNOTATION

The Remuneration of Medical Staffs of Voluntary Hospitals

IN 1932 a committee presided over by Lord Linlithgow and the Voluntary Hospitals Commission unanimously agreed "that the time has come to recognise the claim of visiting medical staffs to some share in the moneys raised for the treatment of patients in hospitals other than those provided by voluntary subscription or donation for the treatment of free patients."