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COMMUNICATIONS

"ATYPICAL, INDIRECT, INCOMPLETE RUPTURE OF THE SCLERA"*

BY

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It will be remembered that indirect ruptures of the sclera occur most frequently on the inner and upper aspect of the globe (Müller, Wagenmann) and that ruptures in this region are termed typical. This typical localisation is interesting, but as theories explaining it are fully discussed elsewhere (*e.g.*, Wagenmann, Lister) they need not be repeated here. It will also be remembered that these ruptures originate in the neighbourhood of Schlemm's canal and that they continue backwards and outwards along Schlemm's venous plexus to reach the outer surface of the sclera some millimetres behind the corneo-scleral junction (E.Fuchs). In young subjects, on the other hand, the rupture may not pass backwards but directly outwards into the corneal limbus or even forwards into the cornea (E. Fuchs, 1905). This last type of rupture is usually small. Both varieties run parallel to the corneal limbus, a course influenced by Schlemm's canal and also perhaps by the direction of the scleral lamellae, which have been shown to split in a circular direction between the limbus and the insertions of the recti muscles (Kokott, 1935).

Although these typical and complete ruptures are fairly frequent one does not find many descriptions of either incomplete or

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atypical ruptures. A combination of both, *i.e.*, atypical, incomplete ruptures, has not yet been described in the literature.

FIRST CASE.—A.J.K., aged 17, stumbled and knocked his left eye against the corner of a wooden box. Six weeks later the globe was removed to relieve the patient of painful traumatic glaucoma.

Microscopical description. Superiorly the scleral fibres superficial to the pectinate ligament are pale and undulating. The area where this is observed runs backwards and outwards from Schlemm's canal along the venous plexus. Some of the scleral lamellae are interrupted and the interlamellar cell nuclei are pale and swollen. (*Partial, typical rupture of the sclera*, Fig. 1).

Also superiorly, but farther back, analogous changes are seen. These occupy an area between the pars plicata of the ciliary body on the one hand, and the insertions of the recti muscles on the other. The scleral fibres in this region are even more wavy than outside the pectinate ligament, they are paler and seem to have been broken in more places. The affected area begins in the inner layers of the sclera on the lateral aspect of the globe. Thence it passes medially and more superficially, and reaches the outer sclera in front of and behind the insertion of the medial rectus muscle. In this region the pathological changes occupy the whole thickness of the sclera and here the sclera is thinnest. In general the inner layers of the sclera have been principally affected. (*Atypical, partial rupture of the sclera*, Fig. 2).

The innermost layers of the sclera contain a few cells with long, slender nuclei here and there.

Inferiorly, just outside the point of entry of a vortex vein, the scleral fibres show similar changes. In addition, small round cells lie scattered between them. These changes are situated first on the outside, then on the inside of the vein, and are observed only in the inner third of the sclera. The same is seen around the ciliary vessels.

SECOND CASE.—Th. de L., aged 30 years, received a blow with a piece of wood on the left eye. The globe was removed eight weeks after the accident to relieve the patient of painful traumatic glaucoma.

Microscopical description.—The tissue spaces of the episclera are filled here and there with yellow pigment granules, especially around one of the vortex veins. Thence they can be traced into the spaces surrounding the vein in the sclera. They can also be traced backwards towards the posterior pole of the globe. These granules contain iron.

The sclera is thin in its anterior part and appears to have been stretched. Superiorly, but close to the equator, the outer scleral fibres are a little wavy and pale. These pathological changes are

FIG. 1.

Partial, typical rupture of the sclera running backwards and outwards from Schlemm's canal.

FIG. 2.

Partial, atypical rupture of the sclera. Above, the normal, darkly stained tendon of the rectus muscle is seen, contrasting with the abnormal paleness of the sclera.

FIG. 3.

Rupture of innermost layers of the sclera indicated by the presence of iron (the dark "smudges" outside the choroidal pigment).

FIG. 4.

Atypical, partial rupture of the sclera. Note the obvious scar-tissue formation in the sclera and the destruction of choroid and retina.

seen medially and laterally as far as the insertions of the recti muscles, but are most marked medially and above. A fairly large number of spindle cells with well-stained nuclei and a small number of round cells are interspersed between the scleral fibres. No iron can be demonstrated in this area. In its innermost layers, however, the sclera is found to contain a surprising amount of iron with special staining (Fig. 3) although with ordinary stains only a few spindle cells and a few pigment granules can be demonstrated.

Also superiorly, but more forward, the sclera is thin, and irregular in structure throughout its thickness. A large amount of haematogenous pigment is scattered through all this area. Superiorly and medially the inner layers of the sclera are markedly pale and contain a striking number of spindle cells with well stained nuclei. In this latter region retina and choroid have been completely destroyed (Fig. 4).

Summarizing, one may say that in this case pathological changes are found in both outer and inner layers of the sclera. In the outer layers no haematogenous pigment is found, and for this reason it seems unlikely that the findings in these layers are related to the accident. In the inner layers, and especially above and medially, haematogenous pigment is found in abundance as well as marked scar-tissue formation. Furthermore, the changes of the scleral fibres in this latter region are identical with those found in the first case. The second group of changes, therefore, must be related to the accident.

Discussion

In these cases pathological changes were observed in the inner layers of the sclera. There are two possible ways in which they may have arisen, (*a.*) through the raised intra-ocular pressure causing a staphyloma of the sclera, and (*b.*) through a partial rupture of the sclera. When a staphyloma is being formed however, the sclera contains many cells and many young vessels, (Elschnig 1928); this is a reason for thinking ruptures of the scleral fibres more likely. But there are other reasons even more convincing. The changes are found on the upper, inner aspect of the globe, a localisation typical for indirect ruptures of the sclera. Also, the changes occur mainly in the inner layers of the sclera and this again is typical for incomplete ruptures. Finally, the presence of haematogenous pigment in the inner layers of the sclera can only be explained by previous haemorrhage. Therefore we may safely assume that the microscopical findings in these two cases are based on partial rupture of the sclera. Two different types of rupture were found, *viz.*, a typical rupture near the corneal limbus

in the first case, and an equatorial (*i.e.*, atypical) rupture in both cases. The latter type of rupture appears to be very rare indeed.

Atypical ruptures have not often been noticed. The equatorial are very rarely encountered in civil practice. Wagenmann (1915) mentions cases by Wadsworth, Montagnon, Ask, Nuel, Purtscher, Weeks, Oeller and Axenfeld. More recently cases have been described by B. Schaefer (1926) and Casanovas (1933). According to von Szily (1918) and Lister (1924) they are much more frequently found in military practice.

Typical, incomplete ruptures have also been infrequently described. Although a certain number of them are found in the literature it must be admitted that in many cases the diagnosis is open to suspicion. It must not be forgotten that for a sure diagnosis a microscopical examination is indispensable (Müller; Wagenmann; E. Fuchs, 1926). If, therefore, one insists on this for a correct diagnosis all the following cases that are based on clinical examination must be disregarded: Von Arlt (near the corneal limbus; quoted by Müller and by E. Fuchs), Müller (near limbus), Bertram (near limbus), E. Fuchs (1905, near limbus), Purtscher (quoted by Wagenmann), E. Fuchs (1911, one case near limbus and another case 7 mm. behind the limbus).

Even some of the cases that have been examined microscopically cannot be accepted with certainty. H. Schäfer has omitted to state whether the whole rupture has been examined in his case. Inasmuch as a considerable hypertrophy of episcleral tissue is mentioned in the description, one is led to think of connective tissue formation at the end of a complete rupture of which the author may have examined only one end. Buchanan's description is too brief to be convincing.

One may state therefore that only von Szily's, Fuchs's and Burk's cases are described in sufficient detail to warrant a sure diagnosis. All three cases constitute typical, incomplete ruptures of the sclera. Burk's case differs from the other two, however, as it belongs to the group of small ruptures described by E. Fuchs in 1905. To this small number of incomplete, typical ruptures the anterior rupture in the first case of my article may be added, bringing the total up to four. Inasmuch as atypical, incomplete ruptures have not yet been recorded, the two instances of incomplete, equatorial rupture are new. In both cases it was mainly the inner layers of the sclera that were affected. This agrees with what is known of ruptures in general, although Müller in his monograph expressed the (often misquoted) opinion that the sclera may tear from without inwards just as well as the reverse. However, Müller's theory has been disproved by the findings in cases of incomplete rupture and in cases where the rupture, although complete, was very small (*e.g.*, Wintersteiner).

In every case the inner parts of the sclera were more extensively torn than the outer.

The only description of an incomplete equatorial rupture that I could find in the literature was published by Axenfeld (1899). Probably, however, this must be regarded as a direct rupture, as the patient, a lunatic, had torn out his own eye. The globe was not examined microscopically, but macroscopically the inner layers at the equator were torn.

Although the literature yields no other cases of this type I believe that it is not so rare as this would suggest. Garnier (1891), for instance, gives a detailed description of traumatic glaucoma in a young boy whose eye had to be removed two weeks after the accident. Within this short period a staphyloma had developed superiorly and medially at the equator. Unfortunately the sclera was not described microscopically with the other parts of the eye, but if glaucoma had been the cause of distension of the sclera one would expect the sclera to distend generally, as in cases of buphthalmos. Inasmuch as in Garnier's case a staphyloma developed within two weeks after a blow, it is reasonable to suspect a traumatic lesion to the sclera. Moreover, the staphyloma developed superiorly and medially; and it will be remembered that in both my own cases pathological changes were most marked in the same region, and that the majority of scleral ruptures occur upwards and inwards.

The interesting changes in other parts of the two globes discussed above will be described in two separate articles, one on rupture of the lamina cribrosa¹⁷ and a second on traumatic glaucoma.

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VASCULARISATION OF IRIS AND CORNEA IN DIABETES

BY

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VASCULAR eye changes are frequent in diabetes, especially in elderly, long-standing cases, and are usually confined to the posterior segment of the eye, especially the retina. Much less frequently are found oedema of the posterior layer of the iris with ectopia uvae and occasional vascularisation of the iris, a condition of affairs which makes the eye unusually prone to iridocyclitis and glaucoma.

Vascularisation of the iris and cornea, such as we record, must be extremely rare and is not mentioned in the previous literature.

Diabetic History and Condition

Diabetes was diagnosed in 1923 in a slightly obese man, aged 49 years, home on leave from India. He had had no previous illness of any importance and no family history of diabetes. The hyperglycaemia and glycosuria were easily controlled by diet and no diabetic complications or organic abnormalities were present. There is no doubt that diet was not strictly followed and when next seen in 1926, heavy glycosuria, some ketonuria and a blood-sugar of 0.425 per cent. were found. Insulin was advised, but taken very irregularly and the patient was not seen again for eight years (May 1934). Fair general health had been maintained during that time although without doubt the diabetes had seldom been properly controlled. In 1933 the patient nearly died in India from a huge carbuncle, and in February 1934 from lobar pneumonia and empyema, when acute cystitis also developed. At this