about once in six months, and last about an hour. At the end of attack, patient feels exhausted and goes to sleep. Said to be still during the attacks. Has had five attacks in two years. Has been exceedingly well since the beginning of last summer.

N.B.—Since writing this report I have seen the patient several times. L.V. was 6/9 on August 8, 1933. She started internal medication and as she began to get better she took ill, and had to stop it. On October 9, 1933, L.V. was 6/12. On October 25, she noted that the L.E. went suddenly worse. On November 2, a detachment of the retina at the lower periphery was evident in the L.E. On November 9, it was seen to be more extensive.

Owing to the pathological condition of the L.E., and the useful R. eye, as well as her very unsatisfactory general condition, it has not been considered advisable to operate for the detachment.

NEW VESSEL FORMATION IN THE VITREOUS

BY

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LEBER¹ has described new vessel formation in the vitreous, the vessels arising from the retina as well as from the disc. The formation of new vessels, usually small capillaries, frequently follows inflammatory processes of the retina and particularly of the disc, but these are so minute that they can hardly be observed as such, and merely give the appearance of a somewhat hyperaemic disc. When their calibre is larger they appear on the disc as fine radial vessels.

New vessels which are visible ophthalmoscopically arise most frequently from deep and chronic inflammatory processes, resulting in localized disturbance or interruption of the circulation. Into the exudates which are formed, the new vessels grow.

They have also been observed in cardiovascular disturbances, particularly when associated with vascular disease of the retinal vessels.

In such cases there is often developed a system of collateral vessels, which take over the nutrition of the retina. This type of new vessel formation is not infrequently seen in arterio-sclerosis which has ended in an obliteration of the arteries.

Less often it is seen after thrombosis of the central vein or its

branches, or during the course of a retinitis haemorrhagica. Cases are also recorded of glaucomatous eyes in which very tortuous new vessels have developed on the disc—these being distinguishable from the tortuous retinal vessels so often seen. All these vessels run more or less in or on the retina. Not infrequently they leave the retina and extend into the vitreous, especially in cases of haemorrhage and trauma, in retinitis proliferans, in inflammatory tumours of tuberculous or luetic nature, and also in encapsulated abscesses of the vitreous. As a partial detachment so often results, whereby the retinal vessels are displaced forwards, it is often difficult, especially when the media are turbid, to distinguish between new-formed vitreous vessels and pre-existing retinal vessels. The former however usually form a much closer network of vessels of about the same calibre, and are much finer than the retinal vessels.

A much rarer form of new vessel formation is the type in which new vessels grow out from the disc into the vitreous. This form has been described in the literature and cases have been recorded in which the vessels are said to have grown from the disc into an apparently clear vitreous. But more usually some vitreous opacity or haemorrhage into the vitreous has been the cause of the new vessel formation. Marple² described this form of new vessel formation as a particular form of retinitis proliferans.

These vessels may extend forward deep into the vitreous as single vessels or more complicated anastomosing masses, but in some cases a fine, delicate, close network of vessels is formed which floats like a veil in front of the retina.

If there is no recurrence of the vitreous haemorrhage or if the retinitis subsides, these vessels may, over a long period of years, gradually recede and even disappear.

During 1932 and 1933 the following four cases presented themselves at the out-patient department of the First Eye Clinic of Professor Meller in Vienna, and they are recorded as illustrating some points in the aetiology and course of new vessel formation in the vitreous.

Case I

Leopold H., aged 22 years, entered the Clinic in April, 1927, with a complaint of having been struck in the left eye 14 days previously, from which time his vision had begun to fail. Family history and past history essentially negative.

General examination showed a left anterior adhesive apical pleurisy and a mitral stenosis and insufficiency. Blood Wassermann strongly positive on repeated examination. Intradermal tests with old tuberculin and tebeprotein were strongly positive in dilutions of 1/100 mg. and 1/10 mg.

Examination of eyes:—Left eye—vision 6/9, not improved, J.1. There was marked ciliary injection, with some bedewing of the corneal epithelium, and many precipitates on the posterior surface of the cornea. The anterior chamber was deep and aqueous cloudy. Iris very hyperaemic, pupil round and dilated (atropine). There was slight opacity of the vitreous, through which the fundus was somewhat dimly seen, but the disc was sharp in outline, the vessels normal, and there was no macular change.

Right eye—vision 6/5 J.1, entirely normal. Anti-luetic treatment (neosalvarsan) was immediately instituted, and shortly afterwards treatment with tebeprotein.

The condition of the left eye became worse, and a few days later deep vessels were seen growing into the cornea, an interstitial keratitis gradually forming, which, however, never affected the whole cornea, the vascularization occurring only in certain localized areas, and not spreading. A severe iritis remained the predominant feature, with increasing precipitates on the posterior corneal surface, and a hypopyon. The vitreous became progressively more opaque.

In June, 1927, the right eye became painful and on examination showed marked ciliary injection, slight clouding of the corneal epithelium, many fine precipitates, and a very turbid aqueous. In July of the same year, the condition of this eye had progressed to a point very similar to that of the left eye. The vision at this time was—right eye, 6/18 J.1; left eye, 6/60 J.9. The patient was discharged from the hospital at this time for personal reasons, having received 3 grams neosalvarsan. and tebeprotein up to 3.3/1000 mg.

In November, 1927, the patient was re-admitted and examination showed: blood Wassermann reaction negative, spinal fluid Wassermann positive. Intradermal tests with tebeprotein were repeated, and the patient reacted so sharply to 1/100 mg., that his temperature rose to 102°F. Right eye—vision 6/18 J.2. Slit-lamp examination showed slight scars in the deep corneal stroma, and almost obliterated vessels. A few large precipitates were seen, and in the lower part of the anterior chamber were masses of organized exudates. There were a number of small sharply outlined nodules in the iris stroma, and many delicate posterior synechiae were still present. The lens was normal, but the vitreous was very cloudy.

The disc was seen only indistinctly. It was hyperaemic, slightly prominent, with large veins and normal arteries. Haemorrhages were present around the disc, most of them along the course of the enlarged veins, and one of these seemed to project forward into the vitreous. This haemorrhage showed a definite tissue of new-formed vessels about it, which, a few days later, began to spread downwards, taking a wing-shaped form, fastened at the disc and projecting into the vitreous. It consisted of a delicate membranous framework in which the blood vessels ran radially, forming a thick anastomosis at the edge.

In addition, at the temporal free edge of the disc was seen another structure, spur-shaped, rising in front of the disc and swaying in the vitreous in which the arrangement of the new-formed vessels could be seen particularly well. Left eye—vision 6/24 J.3, presents a similar picture except for the absence of haemorrhages. Both eyes showed a large central scotoma for colours, but normal peripheral fields.

In August, 1932, the patient returned for a third time having had no symptoms for several years. Vision—Right eye, 6/9 J.1; Left eye, 6/12 J.1. Examination showed no ciliary injection. There was some organized exudate on the posterior corneal surface in the lower quarter, but no precipitates, and the aqueous was clear. The lenses were normal. In the right eye the vitreous was normal with no opacities, and the disc was of normal colour with sharply defined edges. From the disc the remains of the new vessel formation extended vertically in the form of a gray strand which branched as it came forward. In the left eye, the vitreous was normally transparent, the disc sharp in outline and normal in colour.

Comments

It will seem, at first glance, that the aetiological factor in this case is fairly clear, but upon closer study such is not the case and although, in all probability, it will be generally agreed upon that this patient's eye disease was luetic in nature, we wish to call attention to the following facts.

1. That the condition in both eyes started as a very acute and severe iridocyclitis and that throughout the course of the disease this iridocyclitis remained the predominant feature of the picture.
2. That the keratitis described above, although an "interstitial" one, in that it was the deep layers of the corneal stroma which were involved, was not in any sense the classical luetic interstitial keratitis, but rather seemed to be the result of and secondary to the violent iridocyclitis.
3. That the condition of the eyes became progressively worse in spite of anti-luetic treatment.
4. That the patient reacted unusually strongly to tuberculin.

On the other hand, though the fundus findings were consistent with a tuberculosis of the eye, this finding of new-formed vessels is more common as a syphilitic lesion. In short, the findings in the anterior segment of the eye speak strongly for tuberculosis while those in the posterior position are of the type more often seen in lues.

The question of arterio-sclerosis and diabetes, both of which have been mentioned as a possible aetiology in this condition, played no part in this case.

Case II

Theodora N., aged 56 years, entered the Eye Clinic in October, 1927, with a complaint that she had first noticed a violet cloud over the right eye in 1925, continuing up to the present time. Early in 1927 this cloud became suddenly thicker and vision was almost completely lost in the right eye. Family history and past history essentially normal.

General examination showed no definite evidence of any heart, lung, or circulatory disease and the Wassermann reaction was repeatedly negative on blood and spinal fluid.

Examination of eyes:—Left eye—vision 6/6, J.1, entirely normal; right eye—vision hand movements. Field shows a lower nasal quadrant defect. The anterior segment of the eye is essentially negative.

At the first examination large vitreous haemorrhages blocked the view so that details of the fundus were seen with difficulty—but there were no gross changes at the disc and certainly no new vessel formation.

In February, 1928, vision was improved to counting fingers at $2\frac{1}{2}$ metres and the vitreous opacity had cleared sufficiently to give a clear view of the fundus, and during the next few days, with further

FIG. 1.

clearing, it was possible to distinguish a full development of new-formed vessels at the disc, the convoluted net extending far forward into the vitreous. (See Fig. 1.)

As time went on the vitreous cleared completely and with its clearing the new vessel formation became less and less distinct and more and more delicate until it had practically disappeared.

Comments

Here the aetiological factor was even less clear than in the first case. The anterior segment of the eye was at no time involved and there was no evidence of either tuberculosis or syphilis, by general or serological examination. Diabetes and arterio-sclerosis of any marked degree were excluded as before.

The marked similarity, however, between the two cases is found in the manner of appearance and especially of regression of the new vessel formation. In each case these new vessels were made visible by the relatively rapid absorption of massive vitreous haemorrhages followed by the gradual regression of the vessels themselves when their reparatory work was done; for we are forced to look upon them as reparatory agents whose function was solely the removal of the extraneous "foreign matter" in the vitreous.

Case III

Otto F., aged 55 years, entered the Clinic in October, 1929, with a history of having been previously admitted in 1928, on account of pre-retinal haemorrhage in the left eye. At that time the right eye was normal with a vision of 6/6 and J.1. The haemorrhage ended in an extensive retinitis proliferans, and a complete detachment of the retina.

Three days before the present entry he had noticed bright lights before the right eye and a diminution of vision. Family and past history were essentially negative.

General examination showed the presence of an active tuberculous lung process, and the cutaneous reaction to tebeoprotein was positive to 1/100,000 mg. Wassermann reaction was negative.

Examination of eyes:—Left eye—blind, with complete detachment of the retina. Right eye—Vision, fingers at 5 metres. The anterior segment of the eye was essentially normal. There was extensive haemorrhage from the retina with haemorrhage into the vitreous.

For the first six to eight months there was little apparent progress, after which new vessels began to be seen running from the disc and from the neighbourhood of some of the retinal veins from which the bleeding had occurred.

The massive vitreous haemorrhage became surrounded by delicate endothelial channels, and in a short time the resorbing action of these new-formed vessels was quite evident, so that marked clearing of the vitreous took place, and the vision improved to 6/12 and J.3, while the vessels themselves began gradually to regress.

During all this time the patient had been confined to bed and given treatment with tebeprotein so that he gained in weight, and his general condition improved.

Comments

In this case the aetiology is obvious as a tuberculous retinal periphlebitis with resulting vitreous haemorrhages. What part the tuberculin treatment played in its cure is more difficult of assessment, but that the new vessel formation was of a definitely reparative nature, there can be even less doubt than in the two preceding cases.

Case IV

Ludwig R., aged 52 years, came to the Eye Clinic with a history of having had diminution of vision in the left eye for several days. Family history essentially negative. Past history:—In 1905 patient had a luetic infection. He received two mercury injections and two courses of neosalvarsan and two years ago treatment with malaria. Later he had intramuscular injections—nature unknown.

General examination showed a luetic mesaortitis and considerable cardiac dilatation with moderate emphysema of the lungs. The serum and spinal fluid Wassermann was negative. Luetin test was positive. Intra-cutaneous tuberculin test positive to 1/10,000 mg.

Examination of eyes:—Both eyes showed a normal anterior segment except that the pupillary reactions were sluggish to light. Right eye—otherwise normal throughout observation—vision 6/6 and J.1; left eye—vision 6/18 and J.1.

The disc was somewhat pale and at its lower temporal pole there was a small pre-retinal haemorrhage extending into the vitreous. Below and on the temporal side there was a large crescent-shaped haemorrhage about 3 to 4 disc diameters in length and forked so as to enclose the macula. Above this were several small haemorrhages extending as far as the macula.

Observation over a number of months showed no great change in spite of continued anti-luetic and tebeprotein treatment, except that the larger forked haemorrhage was mostly absorbed, but its place was taken by a long, narrow, extensive crescent-shaped haemorrhage below the macula, while at the extremities of the larger vessels above the macula there were numerous

small punctate haemorrhages hanging in some cases like grapes from the smaller capillaries. (See Fig. 2).

The vision gradually improved to 6/9 and J.1.

The patient was discharged and ordered to report for further examination.

In the course of a long observation we were able to establish that the pre-retinal haemorrhages had not spontaneously resorbed. On

FIG. 2.

the contrary they broke through in several places into the vitreous and lay in the form of thick vitreous clouds in front of the original haemorrhagic areas.

About a year later new-formed vessels sprouted out from the damaged retina into the vitreous chamber and surrounded the blood masses located there, thereby presenting in due time the typical picture of new vessel formation in the vitreous.

An indication of this new vessel formation is to be seen in the previously mentioned figure (Fig. 2).

FIG. 3.

One of us saw this case at a still later date (January, 1933) when the new-formed capillary network had brought a great part of the vitreous opacities to resorption and afterwards with the continued clearing of the vitreous, the vessels themselves regressed. (See Fig. 3.)

Comments

The findings in this case are closely reminiscent of those reported in the literature under the heading of new vessel formation in the retina. In as much as the first development of these new vessels was presumably, on the retina, we must think of them as formed for the purpose of absorbing the massive retinal haemorrhages.

When, however, these large haemorrhages broke through into the vitreous as described above, the new vessels "followed" them and, as in the preceding cases, when their work of absorption was done they regressed.

As to the aetiological factor here, we are forced to consider it as luetic, as, indeed, are most of the cases reported in the literature.

As has been mentioned the most common aetiological factors in this condition are lues, tuberculosis, diabetes and arterio-sclerosis. Of these, Case I is probably luetic, Case II is unknown, Case III is

tuberculous, and Case IV luetic. In each case regardless of the aetiology, the primary factor was vascular disease, and in each, the course and ultimate outcome were the same.

We are indebted to Prof. Dr. Meller for his permission to publish these cases and to Dozent Dr. Urbanek for his helpful co-operation.

BIBLIOGRAPHY

1. Leber.—v. Graefe-Saemisch. *H. d. ges. Augenheilk.*, Vol. VII, ii, p. 127.
2. Marple.—Contribution to the Pathology of Vascular Growth into the Vitreous. *Trans. Amer. Ophthal. Soc.*, Vol. IX, p. 254.

LEAD POISONING IN THE FIRST CENTURY

BY

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ONE of Martial's Epigrams¹ suggests the possibility that we have an allusion to a contemporary case of lead poisoning with optic neuritis.² The poet, a debauched and scurrilous Spaniard from Aragon, lived in the days of Nero and Domitian and died somewhere near the year 104 A.D. when over 60 years of age, so the case in question can be roughly dated as occurring in the first century of our era. The epigram is to the effect that a chronic soaker of the name of Phryx had lost the sight of one eye, and was going blind in the other as well. His doctor Heras warned him that the effect of continuing his drinking would be total blindness; at which the patient laughed defiantly and, saying "Good bye" to his remaining eye, ordered cup after cup of his forbidden tippie. "Do you ask the result? While Phryx drank wine his eye drank poison."

The two ingredients of spirituous and other liquors capable of giving rise to optic neuritis are methyl alcohol (or its concomitant impurities) and lead. Methyl alcohol is a dope whose presence in potable liquors is the result of ignorant sophistication with an industrial spirit; lead was a common ingredient of wines and cyders into comparatively recent times, and in lead poisoning there is a substantial danger of optic neuritis and atrophy. Wines and cyder which contain acids quickly become contaminated in contact with lead. It was the frequency of colic in certain of the cyder districts of Devonshire which gave the name of Devonshire colic, as the frequency of it in Poitou gave the name *cólica Pictonum*.³ In another of his Epigrams⁴ Martial quite definitely alludes to the presence of lead as a contamination in wine, the special variety indicated by him being new (and so probably crude and highly acid) Sabine wine. Alcohol itself may lead to visual hallucinations, such