I wish to express my thanks to Dr. Sinclair, for his kindness in personally demonstrating his operation to me; to my colleagues of the honorary staff of the Manchester Royal Eye Hospital, for permission to operate on many of their cases and to Mr. S. B. Smith, for his assistance in the compilation of the records. Particularly do I wish to thank Dr. T. M. Bride and Dr. H. H. McNabb for their collaboration and helpful criticism of this work.

REFERENCES

A CASE OF PERIVASCULITIS RETINAE ASSOCIATED WITH SYMPTOMS OF CEREBRAL DISEASE

BY

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The case is one of vascular disease in the retina, with recurrent retinal and vitreous haemorrhage, in a young man; differing from the usual cases of this group in the rapid evolution of the vessel changes, and presenting an interesting but somewhat unusual feature in the occurrence of symptoms pointing to disease of the central nervous system.

The man, whose age was 30 years, was seen on December 2, 1935, complaining of dimness of vision in the left eye. Vision in the right eye was 6/6 and in the left eye 6/24. Ophthalmoscopic examination in the right eye showed some widening of the inferior temporal vein which was constricted by the over-lying artery. Otherwise the fundus was normal. In the left eye there were some haemorrhages in the vitreous. The veins showed, in some parts, parallel sheathing, and elsewhere there were sections accompanied by white lines. There were many retinal haemorrhages. The changes were most marked in peripheral parts of the fundus.

A fortnight later the left eye had a large vitreous haemorrhage, and the right eye showed exudates accompanying and concealing the veins, and some retinal haemorrhages. In this eye the exudate.
CASE OF PERIVASCULITIS RETINÆ... 23

appeared to advance from the neighbourhood of the disc to the periphery. The fundus changes progressed rapidly. The exudate was most marked where two veins were confluent. Haemorrhages, both superficial and deep, increased. Here and there the veins were accompanied and concealed by broad areas of white exudate, and at some points both artery and vein were buried in exudate. Branching, narrow, white lines were seen vaguely here and there, apparently representing occluded blood vessels, but the origin of these, whether venous or arterial, could not be traced. The whole retina in both eyes was oedematous. The nasal vessels became affected later than the temporal ones. A *rete mirabile* appeared on the left optic disc and later, on the right; and the latter extended along the course of the superior temporal vessels. The veins became dilated and in some parts tortuous and beaded. The haemorrhages were not definitely associated with the visible vessels, and vascular changes appeared to be entirely confined to the veins. Diagram I shows the general appearance of the right fundus as it was seen on January 27, 1936.

The iris in both eyes, but more markedly in the left, showed prominent varicose vessels in the pupillary zone, and the straight vessels of the iris were visibly injected. In the left eye a few fine precipitates were visible. Diagram II shows the slit-lamp appearance of the left iris.

Vision varied from time to time, with the onset and clearing of vitreous haemorrhage, but on February 10, 1936, vision in the left eye was reduced to hand movements. Secondary glaucoma had occurred, and the eye was excised on the 14th. It is interesting to note that the visual acuity of the right eye improved on the day following the enucleation from 1/60 to 6/18. This improvement was, however, temporary.

General examination, which included the condition of the cardiovascular, pulmonary, urinary and nervous systems was, for the most part, negative. Blood showed a slight preponderance of lymphocytes; blood sedimentation and blood coagulation time were normal. Cerebro-spinal fluid was drawn off under excessive pressure, but was normal in its composition. There was no evidence of pulmonary disease, either on physical examination or in the X-ray photograph. The Wassermann reaction in both blood and cerebro-spinal fluid was negative, but the von Pirquet test was positive to human and bovine tuberculin.

The history showed that for eight years he had been having fits once in two months or so; before each attack his face twitches and everything becomes black. The attack is followed by sleepiness, but this is common at all times, and he has even fallen asleep at his work. There is a tendency to katatonia.
Sections of the left eye, which was removed on account of secondary glaucoma, show the following changes:

Many of the veins show a greater or less degree of cellular infiltration which, while involving the vein wall only at one part in the early stages, goes on to a complete annular infiltration of the vessel wall. In only a few instances, however, does the exudate extend beyond the perivascular space. Some exudate which appeared to do so could be seen on closer examination to

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**SECTION E.**

**SECTION F.**

**SECTION G.**

**SECTION H.**
be enclosed within the stretched fibres of the vessel wall. Sections A, B, C, and D show the progressive stages of the infiltration. Section B, which is a typical appearance for most of the veins, shows the freedom of the perivascular space from infiltration. The later stage as represented in section D is a most infrequent appearance. The tendency for the exudate to gather at the bifurcation of the veins as already noted is well seen in section E. In places the exudate is invading the vessel lumen and occluding it.
An early stage of this is seen in section F. In other places the exudate has brought about a closure of the lumen of the vessel without apparently interrupting the endothelium. (Section G). The vessel is evidently finally converted into a fibrous knot as
CASE OF PERIVASCULITIS RETINAE

seen in Section H. The earlier stages of this progressive involvement of the veins are seen next to the disc while the later ones are near the equator of the globe. In the latter region haemorrhages were abundant. Blood was found not only in the nerve fibre and ganglion cell layers but also throughout the other layers as far back as the external limiting membrane. It was doubtful if haemorrhage occurred among the elements of the rod and cone layer. Blood was also found immediately under the anterior limiting membrane and in the vitreous as far forwards as the ora serrata.

The exudate is chiefly composed of lymphocytic cells. This is seen in sections I and J. Similar cells are to be seen in the blood stream, and in section J three cells are apparently about to leave the blood stream through a breach in the endothelial lining. There is, however, in several veins a proliferation of the endothelial cells. This is seen in section K.

In a few instances the arteries show a similar infiltration of their walls. Early and later stages of this are seen in sections L and M. Both show that the infiltration is at the outset well away from the endothelial lining and yet well confined by the perivascular space.

Sections were made of the optic nerve both transversely, immediately behind the globe, and longitudinally somewhat further back. At one point in the former sections, some cellular infiltration of venous walls was found in the perineurium (section N), while in the longitudinal section, the vein at one point shows a massive infiltration of its walls with narrowing of the lumen (sections O and P, low and high powers).

The histological findings confirm the ophthalmoscopic appearances in that they suggest that the earliest changes are in the periphery of the fundus and the more recent ones nearer the disc. The phlebitis seems to have spread from the minute peripheral veins into the larger ones. The changes in the central vein behind the lamina cribrosa are probably the latest to have taken place and may quite well in time have progressed further towards the base of the brain.

The rete mirabile in front of the optic disc was seen to be composed of a few large thin-walled vessels in a matrix which is partly fibro-cellular and partly amorphous. On the surface of this projecting mass, blood vessels were abundant and of small diameter (sections Q and R).

The varicose vessels seen on the iris appeared in the sections as small, thin-walled spaces (section S).

At no point could the accumulation of cells be said to have the characteristics of a tuberculous or syphilitic process. The nature of the exudate, its rapidity, and its mode of spread, suggest that we are dealing with a reaction to some infection.
This case groups itself with a large number that have been variously described, chiefly by Continental observers, as phlebitis, periphlebitis, or perivasculitis of the retina. They have occurred chiefly in the eyes of young adults, usually male. The characteristic features of the group are the white sheathing of the vessels, the age of the patient, and the frequency of vitreous haemorrhages.

We have made an analysis of 68 cases which have been reported in the literature. The average age was 23 years. Only two cases were above 30 years at the outset of the disease. Their ages were 36 and 38 years. One case was under 15 years of age. It was a child of eight months with tuberculous meningitis (Goldstein and Wexler1). There were rather more males than females. Although both eyes were frequently affected, the left one was more often affected than the right.

Many authors in reporting their cases state that the lesion is confined to the veins. Others, however, report cases in which the arteries, or capillaries are likewise affected (Axenfeld and Stock2, Davis3, Alexjewa4, Suganuma5, Marchesani6). Although white sheathing of the vessels appears to be the earliest lesion, most authors describe thrombosis and haemorrhages in the fundal pictures. Alexjewa4 and Axenfeld2 (second case) report cases in which the circulation was unhindered.

Nine cases have been pathologically examined (Fleischer7, Axenfeld8, Eppenstein9, Suganuma5, Goldstein1, Birnbaum10, Marchesani11, Gilbert12, von Hippel13). They were all reported to have shown a cellular exudate in the vessel wall or else in its immediate neighbourhood. Thrombosis and haemorrhage were described as subsequent changes.

In our case the fundal appearances show the preponderating rôle of the veins and suggest changes in their walls as the primary condition. The affection is practically entirely confined to the veins. This is confirmed by the histological findings. In only one or two places were the capillaries or arteries affected. The cellular exudate is definitely, at its onset, within the vessel wall, constituting a phlebitis. The term periphlebitis as applied to the retinal veins is not so significant as when used in connection with the veins elsewhere in the body, because they have much thinner coats, have neither a decided adventitia nor vaso-vasorum and have a trace of elastic fibres only in the largest veins.

Many theories of causation have been advanced. The majority of investigators consider tuberculosis to be the cause, while several are of the opinion that the essential pathology is a thrombo-angitis of the retinal vessels occurring as a localisation of the general condition, thrombo-angitis obliterans (Bürger). It is suggested that
there is an underlying congenital weakness of the vessel wall (artery and vein), or of the vegetative system, or of the ductless glands, which expresses itself by an inflammatory change in the wall of the vessel. We will consider these opinions in the light of the present case and those already reported.

**Tuberculosis as the Cause**

Evidence for this theory of causation is based on the pathological examinations of eyes removed and the presence of tuberculosis elsewhere in the eye or in the body. The evidence based on histological findings is complicated by the facts that the presence of giant-cell systems is not necessarily exclusive of Bürger's disease (Bürger, Letulle, Sigler) and that the absence of giant-cell systems and of the tubercle bacillus is not proof that the disease is non-tubercular in nature. Of the nine cases pathologically examined, seven were described by their authors as probably of tuberculous nature. In two cases the changes were described as typical of thrombo-angeitis obliterans (Birnbaum, Marchesani). One case is reported which showed the presence of the tubercle bacillus in the immediate neighbourhood of a retinal vein (Gilbert).

Eight cases have been reported showing the presence of active tuberculosis elsewhere in the eye. (Axenfeld and Stock, Fleischer, Mayerhofer, second case, Lluesma, Goldstein and Wexler, von Hippel, Kokott). These cases showed tuberculosis of the sclera or uvea.

The description "tuberculosis elsewhere in the body" is an extremely ill-defined one. There are three types of cases to which that description is often applied: first the type of case with a positive von Pirquet reaction in an adult with X-ray evidence of a "closed" lung lesion; secondly, the case showing these signs accompanied, however, by a general or a focal reaction on the injection of tuberculin; thirdly, the case with an "open" tuberculous lesion. The first type is of no special significance, the second must be assessed by the clinical experience of the observer, while the third must be considered of first rate aetiological importance.

Seven cases have been reported in which there was a positive, local, focal and general reaction on the injection of tuberculin. (Cords, Igersheimer, Davis, two cases, Nicolate, Axenfeld and Stock, Natale).

Nine cases have been reported in which active tuberculosis was present elsewhere in the body (Axenfeld and Stock, second case, Igersheimer, second case, Fleischer, Gilbert, Mayerhofer, Goldstein and Wexler, Löwenstein, Gilbert, Kokott).
Excluding a diagnosis based on purely pathological grounds, we find that 19 cases have a definite clinical association with tuberculosis. This is 28 per cent. of the reported cases which we have investigated.

General examination of the present case revealed no tuberculosis. He had several tuberculin injections, but there was no focal reaction. There was no evidence of tuberculosis elsewhere in the eye. No tubercle bacilli were found in the sections stained for them. The sections showed an infiltration of the vessel wall which was not typical of tuberculosis in so far as there were no tubercle formations and no giant-cell systems. The relatively few endothelial cells present originated obviously from the endothelial vascular lining.

**Thrombo-Angeitis as the Cause**

The diagnosis of thrombo-angeitis obliterans is based on the presence of symptoms indicating the existence of the disease elsewhere in the body. Marchesani postulates that coldness of the extremities with a tendency to redness or blueness, sweating of the hands and feet, trophic disturbances in the skin and nails, paraesthesia, gangrene, and absence of the pulse in the dorsal artery of the foot are suggestive of thrombo-angeitis. The main defect is a narrowing of the lumen of the vessel, vein or artery, through an overgrowth of fibro-plastic tissue between the elastic tissue layer and the endothelium. The overgrowth of fibrous tissue obliterates the lumen of the vessel.

Six cases have been reported in which vascular disease of the retina was associated with symptoms ascribed to thrombo-angeitis (Birnbaum, Marchesani, Gilbert). The evidence has been chiefly clinical, although in two instances the diagnosis was supported by the pathological findings (Birnbaum, Marchesani); von Hippel, however, rightly points out that cold feelings in the extremities, paraesthesia, etc., are quite commonly found in healthy people and that the pulse of the dorsal artery of the foot is very often not easily palpable. The most definite sign of thrombo-angeitis is gangrene. Only four cases have been reported with this symptom. There were no evidences, clinical or pathological, of thrombo-angeitis in the case which we report.

**Other Causes**

Santowsky reported a case with a positive Wassermann reaction.

Anthonisen reported a case which had carcinoma of the stomach.
**CASE OF PERIVASCULITIS RETINAE**

Knapp\(^3\) reported a case in which septic tonsils appeared to have an aetiologcal importance.

Eccheverria\(^2\) reported 6 cases of sympathetic ophthalmitis, which showed a perivasculitis retinae.

As mentioned above the clinical-pathological findings in our case suggest an infection, but there was nothing in the general condition of our patient to indicate the nature of this infection.

The path by which an infection may reach the vein wall has been much discussed. It is variously believed to leave the blood stream through the vein wall, to leave it in the neighbouring capillaries, or else to spread backwards from the uvea. The variability of the path of infection is denoted by the following facts. Six cases have been reported where the peripheral veins were first affected. (Ballantyne\(^30\), Igersheimer\(^21\), Davis\(^3\), first case, Kokott\(^19\)). Five cases have been reported where the central veins were first affected (Davis\(^3\), second case, Aléxiwá\(^4\), Gilbert\(^12\), Axenfeld\(^3\), first case, Goldstein and Wexler\(^1\)). Eleven cases have been reported with an accompanying uveitis (Ballantyne\(^30\), first case, Fleischer\(^7\), Davis\(^3\), second case, Nicolate\(^22\), Mayerhofer\(^17\), second and third cases, Axenfeld\(^3\), Goldstein\(^1\), Kokott\(^19\)).

Our case showed no uveitis except at a very late stage. In the first affected eye, the left, the condition began in the peripheral vessels, and in the second eye it appeared to begin near the disc. There is thus no evidence for a consistent mode of entrance of an infection.

Several authors have suggested that the cerebral vascular system is coincidentally implicated, as it very frequently is in retinal arterio-sclerosis. Eleven cases have been reported in which there were symptoms associated with the central nervous system, that is, about 17 per cent. of reported cases (Ballantyne\(^30\), Löwenstein\(^25\), Marchesani and Stauzi). The symptoms have been those of hemiplegia, disseminated sclerosis, tumour, or epilepsy. Our case gave a definite history of fits and showed a well-marked increase in the pressure of the cerebro-spinal fluid. Several physicians who examined him were of the definite opinion that his symptoms indicated a diffuse brain lesion.

Recurring haemorrhage in the vitreous of adolescents (Eales’ disease) has obviously much in common with the retinal disease under discussion. Until about 25 years ago it was assumed that the bleeding took place from the anterior uvea. Within recent years it has been considered by almost all observers to be frequently associated with disease of the retinal vessels (Igersheimer\(^21\), Davis\(^3\), Axenfeld\(^3\), Marchesani\(^5\)). The one-time difficulties were that in many cases the haemorrhage was too dense to permit of ophthalmoscopic examination, and that frequently there were no
The British Journal of Ophthalmology

Retinal disturbances to be seen after the vitreous haemorrhages had absorbed. Many cases have been reported, however, with fundus-obscuring haemorrhages in one eye and vasculitis in the other one (Axenfeld and Stock, Igersheimer, Suganuma, Kokott). The absence of retinal disturbances can well be explained by the very brief duration of the retinal changes in carefully watched cases (Axenfeld and Stock, four to six weeks, Alexjewa, three weeks). Had the case, which we now report, been first seen at a late stage it might quite well have been described as a case of Eales' disease. We may therefore, reasonably assume that our comments on the nature and aetiology of perivasculitis of the retina in young adults apply to at least many cases of recurring vitreous haemorrhages in people of that age.

Summary

A case of perivasculitis retinae has been clinically and pathologically described.

A group of 68 similar cases reported in the literature has been discussed with regard to the clinical facts, the pathological appearances, the aetiology, the path of entrance of an infection, the implication of the cerebral vascular system, and the association with recurring vitreous haemorrhages.

Conclusion

The pathology of perivasculitis retinae in young adults is an inflammatory cellular exudate within the vessel walls, and usually confined to the veins.

A similar condition probably affects some of the intracranial vessels.

Perivasculitis retinae probably frequently manifests itself in the clinical condition described as recurring haemorrhage in the vitreous of adolescents.

The cause is not definitely determined although a good percentage of cases are associated with active tuberculosis.

The case which we report appears to be due to an unknown infection.

It is possible that perivasculitis retinae is not the expression of a single disease, but rather a notable clinical phenomenon common to several diseases, of different aetiology and distinguished from each other clinically by such features as differences of age incidence, localisation of the changes in the veins alone or in both arteries and veins, the more or less peripheral situation of the early lesions, the rapidity of the pathological process, the occurrence of vitreous haemorrhage, and the presence of disturbances of the central nervous system.
Katholysis in the Treatment of Retinal Detachment

This case was first seen by Mr. Inglis Pollock, to whom we are indebted for permission to publish the above report.

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Katholysis in the Treatment of Retinal Detachment. A Preliminary Note

By

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Electrolysis was tried in the surgical treatment of retinal detachment towards the end of the 19th century by Montgomery, Snell, Terson, Motais, Abadie, Schoellers, Albrand and others, and it has recently been revived by Imre and Vogt and others who have termed it katholysis. The main difference between this therapeutic procedure in those days and now is the importance of the accurate localization of retinal tears with the object of closing