IMMUNOLOGICAL SIGNIFICANCE OF DEMYELINATION OF MEDULLATED NERVE FIBRES OF THE EYE*

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A very important case report by W. A. Anderson (1942) has come to my attention. The patient, aged 60 years, showed marked medullated nerve fibres of his fundi completely covering the edge of each disk. In this case an upper respiratory infection was followed by an optic neuritis with disappearance of the medullated nerve fibres. Anderson stated that there was a change in the medullated nerve fibres secondary to an optic neuritis, which he had never seen before and which was not without interest, as it revealed the effect of an inflammatory change on the medullation of the nerve fibres.

In the spring of 1948, I saw a case not unlike that described by Anderson. The patient was a 42-year-old coloured male whose chief complaint was loss of vision of several days' duration associated with headache involving the mid frontal area. In the past history it was learned that the patient was employed by the city as a "snow-shoveller". He had suffered from various colds and a persistent cough which had not disappeared. His present illness probably dated back about three weeks before admission to hospital, at which time he noted burning, lacrimation, fatigue, and inability to read for very long. He was admitted directly from the railroad station where he had fallen asleep for two hours and was unable to see with either eye when he awoke. The positive physical findings included an element of drowsiness and a suggestion of inability to concentrate. His pupils were widely dilated and failed to react to light. There was no restriction of motility. The conjunctiva and cornea were normal. There was no disturbance of aqueous, lens, or vitreous. Tension was recorded as 9 (Schiötz) in each eye. The pathological findings were restricted to the fundi, the picture being more pronounced in the left eye than in the right. In each fundus there appeared to be an area of neuroretinitis in the region around the disk, with the circumpapillary retinal tissue being whitish, oedematous, and fibrillated. Shining through this hazy retinal oedema were two whitish masses, in each of which appeared specifically to be groups of medullated nerve fibres such as might be seen through dense

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clouds. By focusing carefully upon these areas the characteristic fibrillations and striations seen in medullated nerve fibres of the fundus could be ascertained. The entire picture was one of retinal oedema restricted to this area of usual location of medullated nerve fibres above and below the disk.

The veins were neither full nor tortuous; the arteries on the other hand appeared lighter and narrower than usual. In some areas there appeared a suggestion of beading or connective tissue cuffing of the arterioles. In the temporal area of the right fundus there were several old round globular exudative foci and some pigment nearby. The maculae looked radiolucent and their glow seemed to be emphasized by a change in the perimacular colour.

The spinal fluid showed 75 mg. protein per 100 cc. The blood showed a white count of 2,900 with 50 per cent. lymphocytes.

The patient was kept under observation for several months. The oedema gradually subsided and left an atrophy in its wake (see Fig. 1). There was some slight visual improvement so that the patient could discern large objects in the periphery, but he was still unable to get about to any degree when he was transferred to a veterans' hospital.

Some months ago while studying the problem of post-vaccinial encephalitis, I expressed the view that, through study upon patients whose eye grounds showed medullated nerve fibres, the solution to the problem of the aetiology of the demyelinating encephalitides, especially multiple sclerosis, and the acute exanthemata, might be greatly facilitated. To the ophthalmologist and possibly also to the neuropathologist this statement might seem somewhat unconnected, and so I should like to clarify this suggestion through the introduction of some basic immunologic principles as yet little known. Morrison (1947) reported
upon a disseminated encephalomyelitis experimentally produced by the use of homologous antigen. Morrison concluded that encephalomyelitis may be experimentally produced in laboratory animals by the repeated injections of heterologous brain antigen. He furthermore stated: "Without belaboring this point unduly, it is becoming apparent that there are many features of histologic similarity in the various stages of progress of multiple sclerosis, Schilder's disease, neuromyelitis optica, and post-infectious and post-vaccinal encephalomyelitis." It also has been shown that there is a certain similarity between these demyelinating diseases, on the one hand, and the experimentally produced encephalomyelitis reported in his study, on the other. The number and variety of histological reactions in the brain are of necessity limited, and the same conclusion must be assumed within the eye; and if the process is one of reaction to virus it is likely to be the same for all viruses with little or slight modification. And if such an eye fortunately or unfortunately has a ring of medullated nerve fibres surrounding the optic nerve, and if a reaction is taking place upon white matter within the brain, what better place is there to observe this site of reaction than in the eye ground?

Noran, Baker, and Larson (1947) noted that the morphological alterations observed in the human nervous system in cases of "pneumonic encephalitis" and in experimental lesions are essentially identical. This suggested that both are the result of the same process, namely the introduction of some product from the lung into the blood stream which facilitates blood clotting, and that these pathological observations are additional proof that the cerebral complications of pneumonia may result from a disturbance of the clotting mechanism. This experimental reproduction of the lesions of so-called "pneumonic encephalitis" clearly indicates that pneumonitis liberates some product from the patient's lung which, in turn, produces an intravascular clotting in the cerebral vessels. When one considers the frequency of infections of the respiratory tract, and the possibility that a patient may be affected by a breakdown of his own lung tissue, it becomes apparent that this phenomenon may have implications of significance in other conditions. There are many examples which illustrate the importance of the lung in cases of encephalitis, i.e., Krieder (1943), Fyfe and Fleming (1943), Wohlwill (1928) and Ansell (1948).

Since most of the acute exanthematous diseases of viral aetiology have their portal of entry via the upper or lower respiratory system, and since the organism may act upon and produce certain changes which subsequently influence the development of an encephalomyelitis with predilection for the white matter, and since antigenic
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White matter may be visualized in the ocular fundus if it fortunately contains the anomalous medullated nerve fibres, the importance of these medullated nerve fibres is at once quite evident.

In restudying Professor Anderson’s case it seems evident that a patient whose vision was normal (and with medullated nerve fibres) suffered from a pharyngeal and then a pulmonic infection, and then developed an optic neuritis with eventual optic atrophy and complete disappearance of the medullated fibres. This seems quite like the experimental respiratory changes which subsequently produce a demyelination of the brain and optic nerve with its medullated nerve fibres.

REFERENCES


BOOK NOTICE


The ophthalmological section of the 1949 Year Book of Eye, Ear, Nose and Throat is edited by Derrick Vail, the previous editor, Louis Bothman, having died. The lay-out of the book corresponds to that in previous editions, the different ocular tissues—lids, orbit, conjunctiva, cornea, uveal tract, lens, retina, choroid, and optic nerve—being treated seriatim. There are full sections on glaucoma, refraction, motility, neurology, therapy, and surgery, and a miscellaneous chapter dealing with conditions not easily classified. The book contains a résumé of the more important articles on each subject and, the editor’s choice being remarkably sound, provides a very ready and readable means of keeping abreast of the more important recent advances in ophthalmology.