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CLINICAL LECTURES ON AMBLYOPIA AND AMAUROSIS, BY PROF.  
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IN cases of Amblyopia,\* three things aid us in general in arriving at our conclusions. First, the *functional state* of the eye, carefully considered; second, the *appearance of the papilla*; third, the *manner in which the affection has become developed*.

As regards the functional derangements, it is not to be denied that the amount of impairment of central vision is of great importance; although the prognosis as regards possible blindness would depend yet more on an accurate investigation of the limits of the field of vision and of eccentric sight. Experience has abundantly shown those forms which tend to progressive blindness to be characterized by an early narrowing of the field of vision, a preponderating loss of sensibility of the peripheric portions of the retina. It is, *à priori*, readily imaginable that, in a progressing atrophy of the nervous elements, those regions should first suffer which are most remote from the nutritive and functional centre, and that thus the extinction of power should be successive and, to a certain extent, centripetal.

Inasmuch, therefore, as extreme significance is to be attached to a defective or diminished peripheric vision, our methods of diagnosing the same must be as perfect as possible. Ordinary daylight is insufficient to detect slight defects in making a general examination of the periphery of the field of vision. This must rather be conducted in a darkened room where light proceeds from but a single source. Where absolute accuracy is desirable, the "graduated lamp"† may be used; the diaphragm being set at 100, and a black

\* From this class we of course exclude all those affections which proceed from visible changes in the refractive media, or in the internal structure of the eye; as also cases of neuroretinitis and embolia.

† A lamp so arranged as to diffuse a greater or less amount of light, according to the size of the opening in the movable diaphragm which is placed before it.—TRANSLATOR.

paper without glass being held before the patient (of course at a fixed distance). The limits of the field of vision are ascertained by means of white balls, set on a black rod and gradually removed from the point of fixation. To ascertain the angle of distinction in eccentric vision, the balls may be placed on the two extremities of a blackened pair of compasses.

The results of this, or a similar examination of the limits of the field of vision may be set down under three heads:—

1. Peripheric vision is relatively the same as in a sound eye.
2. Peripheric vision has suffered a diminution, equal, however, in every direction, and relatively of slighter amount than the derangement of central vision.
3. The derangement of eccentric vision is unequal, i. e., most marked in one direction, or in certain directions; extends from the edge over the surface of the field of vision, and plays no longer a subordinate rôle in comparison with the derangement of central vision.

In the first case we designate the limits of the field of vision as *absolutely normal*, in the second as *relatively normal*, in the third as *abnormal*. In considering cases by themselves, we will enter into a more detailed explanation of these distinctions.

Where the limits of the field of vision are absolutely normal (1), progressive atrophy, i. e., actual amaurosis, need never be suspected, provided only that the affection has in other respects properly declared itself. I do not undertake to deny that there is an initial stage where clearly defined symptoms may not yet have become developed, and it is well to avoid giving a decided opinion in a case of recent and imperfectly developed amblyopia. Suppose an instance where, within a few weeks, the acuteness of vision has fallen only to  $\frac{2}{3}$ , and the limits of the field of vision are absolutely normal, we are still in no condition to give a positive opinion for the possibility of a further diminution of the acuteness of vision, and ultimate encroachments on the periphery of the field of vision is by no means excluded. Has, on the other hand, an affection existed several months, and does the periphery of the field of vision remain absolutely normal, even though the marked diminution of the acuteness of vision to  $\frac{1}{4}$ ,  $\frac{1}{5}$ , or even less, shows the settled nature of the difficulty, we may safely conclude that the process is not one of progressive atrophy (amaurosis). And thus it may be seen that we are unable to approach a comparatively light case without some degree of apprehension, and yet may give a favorable opinion in an apparently graver condition of things. In speaking, however, here of a favorable prognosis, I wish to be understood as referring only to the approach of amaurosis, and not of an entire recovery. We meet a variety of amblyopic conditions, where the periphery of the field of vision is intact, but where central or eccentric scotomas exist, which baffle all treatment and, after reaching a certain height or

diminishing within certain bounds, remain permanent. Of this, more hereafter.

If the field of vision is *relatively normal* (2), i. e., if an equal loss has taken place in all portions of the periphery, slight in comparison with the derangement of central vision, the affair is a dubious one. We may get information from a simultaneous glance at the optic nerve, the age and the manner in which the disease has developed itself, but not from the functional derangements alone. Considered by itself, this form is by no means a serious one, being the same that occurs in loss of retinal sensibility; for example, in long-continued cases of loss of vision of one eye, and may be artificially produced by bringing a piece of deeply smoked glass before the eye. Just, then, as eyes excluded from the act of common vision by a cause still in force—strabismus, for example—may have eccentric vision outwards predominate over that inwards, and finally over the central, and may thus become progressively amaurotic, so we see, in the case of amblyopic eyes with a relatively normal field of vision, the cause of the disease still existing (as in the case of drunkards), that progressive atrophy may result. On the other hand, we may witness complete restitution, as in anopsia. In fact, where the field of vision is still relatively normal, we are not dealing with a characteristic case of progressive atrophy. A rational and discriminating system of treatment is here specially called for.

And, finally, if the limits of the field of vision be *abnormal* (3), the case assumes a more threatening aspect; though it would be going much too far to regard all belonging to this class as necessarily tending to a fatal termination. We have to first take into account the manner in which the field of vision is contracted, next to compare this with the acuteness of vision in the centre of the field; thirdly, to regard the appearance of the papilla; fourthly, the manner of development of the disease. The last two points will be considered in another connection. The following remarks pertain to the first two.

If the limitation of the field of vision be on one and the same side of the body, for example on the right (or right and downwards, right and upwards), and if central vision is normal, or nearly so, then only one tractus opticus is affected. The disease, as such, may end in complete hemiopia on corresponding sides, never, however, in blindness (Case IV.). An extremely exceptional state of things (and one that admits as yet of no anatomical explanation) is the finding of limitations in the field upwards or downwards, on one or both sides, in the last event symmetrical, which, when they occur separated by a sharply-defined boundary from that portion of the field retaining its normal functions, and when vision is of normal acuteness, give no reason for suspecting progressive atrophy. Actual concentric narrowing of the field of vision sometimes may be observed to result in blindness, the field growing gradually smaller, but preserving its form (as in exceptional cases of glaucoma), al-

though such a state of things seems in general to depend on causes which may be arrested in their operation and even removed. The latter may with some confidence be looked for when the papilla has preserved a normal appearance, when the acuteness of vision has become only moderately impaired, and when by the use of dark blue glasses (shade No. 6 to No. 8) a partial increase of peripheric vision may be effected (as in hysterical anæsthesia of the retina and a peculiar form met with in nervous children). The most unfavorable cases are those where an irregular lateral contraction of the field of vision has taken place, attacking the two eyes either simultaneously or successively, and after such a fashion that the periphery of the field of vision becomes principally impaired inwards or outwards (or in an intermediate direction, outwards and downwards, inwards and upwards, &c.); I say *principally* impaired, for besides the marked contraction on one side there is generally a lack of distinct perception in other directions. The principal distinction between these limitations and those described in hemiopia consists in the fact that the portion whose function has become impaired is never separated by a sharply-defined line of demarcation from a part retaining its normal functions, but that a gradual transition takes place through a tract the activity of which grows greater towards the centre and less towards the periphery. The graver forms of amaurosis generally run such a course as to have seriously affected the first eye, having caused, for example, the contraction of the field of vision to have already passed the point of fixation, when the second eye begins to be involved (see below). For, in order to be assured of the soundness of the second eye, its field of vision must be closely scanned in that quarter where ominous symptoms are most to be feared. Was the first eye first invaded by a cutting off of the field of vision downwards and inwards, the periphery of that of the second eye must be carefully watched in the same region, and so must the temporal border if the temporal side of the other eye was first affected. These observations are all the more essential because, why we know not, an interval of several or even of many years often elapses between the affection of the two sides, while, on the other hand, one may follow on the heels of the other. It most frequently happens in amaurosis that the first derangement occurs on the nasal border of the field of vision, and that the temporal half holds out the longest. This may be owing to the anatomical arrangement of the optic-nerve expansion and to its physiological consequences, inasmuch as that lateral portion of the field of vision which belongs to each eye for itself is furnished exclusively by the distribution of the fibres on the nasal side. Although, indeed, in processes involving atrophy, so many cases occur where an exactly opposite condition of things is found, viz., the occurrence of the first derangement in the temporal half of the field of vision, that we cannot, as in glaucoma, name them exceptions to a general

rule, but must rather look upon them as in the minority. Should it happen that the second eye should not become affected on the same side (medial or temporal), but rather on the opposite, i. e., the side corresponding with that side of the body, the case might, as in the former instance, be one involving only one tractus opticus, developing itself successively in the fasciculus lateralis and cruciatus, and threatening consequently not blindness, but only hemiopia on corresponding sides; in this hope, however, we only dare indulge when, 1st, the limitation of the field of vision on the first eye does not cross the vertical line of separation passing through the point of fixation; 2d, when the acuteness of vision has not materially diminished, perhaps not below  $\frac{1}{3}$  or  $\frac{1}{4}$ . If the case be otherwise, this mode of development, relatively infrequent though it be, must excite the suspicion of approaching atrophy.

Is the survey of the *periphery of the field of vision* of the first importance as regards progressive atrophy, so, on the other hand, may we deduce from a knowledge of its *continuity* very important inferences as regards the question of recovery. It may be generally laid down that those cases of amblyopia in which the continuity of the field is nearest its normal state, offer the best chance of recovery (Case I.). Accordingly if, with a diminution of the acuteness of vision, we find the eccentric acuteness correspondingly affected, so that, in accordance with the common law, it gradually diminishes towards the periphery and does not in certain spots undergo interruptions or sudden diminutions, we are at liberty to form a more favorable prognosis than if central acuteness of vision had been impaired over a defined spot, sharply separated from the surrounding parts (central blur, central scotoma, central defect), or if a slight impairment of acuteness of vision were accompanied by eccentric interruptions. Causes of disease seem often to be at work, in the case of central or eccentric scotoma, which lead to a permanent impairment of sensitiveness. We often witness, at any rate, the persistence of such a state of things, and are therefore in a situation to give a prognosis only favorable as regards blindness, doubtful as regards ultimate recovery (Case III.). In such cases the state of the papilla and the course of the disease afford us more tangible information. I again insist on the fact that, in order to give a favorable prognosis as regards blindness in cases of central and eccentric scotoma, we must have a satisfactory amount of eccentric vision beyond the scotoma, especially towards the periphery of the field. But if the case be one of scotoma, beyond which and in certain directions, even to the periphery of the field, the eccentric vision has become impaired, we have generally to do with a form of progressive atrophy (Case V.). So, too, must we carefully investigate cases of eccentric scotoma, occupying corresponding places in the field of vision, for example, on each side the lower part. If the eccentric vision in the neighborhood of the scotoma, in the last-cited case below, is entirely

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normal, blindness is not to be feared, indeed the capacity of the layer of fibres corresponding to the scotoma must be normal. If the case be otherwise, such a derangement is not infrequently the precursor of an amaurotic affection.

Beside the diminution of central and eccentric acuteness of vision, many other features of amblyopic affections have had more or less importance attached to them as influencing the prognosis. This was particularly the case before the invention of the ophthalmoscope, when it was impossible to accurately distinguish amblyopia, in the present sense of the word, from affections of the internal structures, from inflammations of the optic nerve, and even in part from impairments in the transparency of the refractive media. Since the classification has been completed, the worthlessness of most of these symptoms has become manifest. Let me briefly refer to some of them. The *subjective appearances of light*, both plain and colored, as also in the form of subjective pictures, occur to any extent in comparatively few amblyopic cases, and, when present, give more information as to the accompanying condition of the brain itself (as in encephalitis, delirium tremens) than as to the state of the amblyopia. Vastly more importance is to be attached to these phenomena in diseases of the deep-seated membranes, as they here not only sometimes indicate the duration of the progressive periods, but are even of importance as prodromal symptoms (as, for example, in cases of separation of the retina, where they may occur as white balls, drops, or in crescentic shapes, which I attribute to the tension near the equator). The weight laid on these symptoms formerly in cases of amaurosis is due in great measure to the fact that these cases were confounded with affections of the deeper structures. Again, these appearances may be present in their most intense form in an affection, which (so far as it occurs idiopathically, involving neither the field nor the acuteness of vision) may be of some significance as relating to the cerebral economy, but never passes into amaurosis; I mean the so-called hyperæsthesia retinæ. In cases of genuine amblyopia, misty or smoky vision is most intimately connected with a diminution of the central or eccentric acuteness of vision, and often only the direct indication of this on the part of the retina.

It is at this day hardly necessary to state that the pronounced *mouches volantes* we often meet in normal eyes (*myodesopsia*) are in no wise indicative of amaurosis. Their cause is partly optical, alterations of the state of refraction, of the range of accommodation, irregularities in the refractive media all facilitating the production of entoptical shadows of diffraction, partly depends on hyperæsthesia of the retina, where shadows ordinarily invisible are brought out by the attention concentrated on them.

The *favorable influence of convex glasses* in amblyopia, as facilitating the recognition and survey of letters, has been used to aid the prognosis. This experiment, leaving out of account any mere correction of refraction, may be used in some cases to demonstrate the continuance of the acuteness of vision, and the full activity of the retina at its centre, gives us, however, in the end, no results that we could not have obtained from the examination of the central and eccentric vision.

The old division of amaurosis into *active* and *passive* has practically passed away; although it is not to be denied that in different forms, the relations of the acuteness and field of vision being apparently the same, the capacity of perception is very differently affected by the amount of illumination, and that in this sense we may be said to be dealing with active and passive forms. It is well known that, in the case of a normal eye, the amount of illumination may vary within tolerably wide bounds; for example, from bright daylight to much less, without exerting a perceptible influence on the acuteness of central or eccentric vision. It first becomes felt (in accordance with a yet undiscovered law) when the amount of illumination is reduced within certain bounds—for example, approaches twilight. In the case of amblyopic eyes we find considerable fluctuations often produced by slight changes in the amount of natural, and generally by greater variations in the amount of artificial light. Where a decided diminu-

tion is thus observed, we are justified in speaking of torpor of the retina in connection with the other circumstances of the case. Taking into account the prevalent amount of central and eccentric vision, this "torpor" consists in an abnormally rapid diminution of each (or particularly of eccentric vision), the amount of illumination being diminished. On the other hand, cases are to be met with where perception is not diminished, or is even increased by a withdrawal of illumination that normal eyes would sensibly feel.\* In these rare cases we find that in the twilight or while looking through deep-blue glasses distinctness of vision increases, and we may therefore contrast them as active forms with the more strongly-marked passive, and this all the more because, other things being equal, the prognosis is better.

*Color-blindness*, a not infrequent accompaniment of amblyopic affections, has been recently carefully investigated by Benedict, and especially by Schelske. That it is of any nosological use is, up to the present time, neither possible nor probable, inasmuch as Benedict declares that the pathological color-blindness may give way without any special alteration in the power of perception.

Some, following in the footsteps of Serres d'Uzès, would find a thorough means of diagnosis in the examination of the *phosphenes* produced by pressure. This method is, however, here even less admissible than in cataracta complicata and closure of the pupil, inasmuch as in the unimpeded open determination of the powers of vision we possess a method at once more delicate, better calculated to directly ascertain the true nature of the disease, and more easy to carry into execution. Only in rare cases of peripheric anæsthesia (as, for example, where concentric narrowing of the field of vision occurs in connection with a sudden failure of cutaneous sensibility) are we forced to the interesting conclusion that phosphenes may be produced by pressing against portions of the retina that are insensible to light. In my opinion the solution is to be found in a loss of connection between the layer of rods and the nerve-fibres, and in such a case we may look upon the existence of the phosphene, taken in connection with other circumstances, as rendering the prognosis more favorable.

Finally, an attempt has been made to levy, for diagnostic and prognostic purposes, on the results of galvanic stimulation, and Remak has recently published some communications of much interest, the continuation of which we must await, on the different reactions with regard to colors of the centre of the optic nerve in various cases of amblyopia.

We turn now to the second head, namely, the *condition of the optic-nerve entrance*. We are indebted to the ophthalmoscope for having not only set defined bounds to the class of amblyopic affections by the exclusion of other intra-ocular diseases, but also for having discovered in the state of the optic papilla diagnostic marks of much importance in separate cases. Our attention is to be paid to four characteristic points, closely connected together and partially dependent the one on the other, viz. (a), *alteration in color*; (b), *opacity*; (c), *excavation*; and (d) *diminution of the calibre of the vessels*.

[To be continued.]

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\* In order to be exact in these statements many details must be added, and above all the intensity (I.) of illumination which is to be placed at the head of the scale of gradually decreasing amounts of light. If a large amount of I. is taken, as much, for example, as would be represented by intense daylight, many amblyopic eyes possessing but confused vision would, as this intensity is decreased, at first seem to lose no distinctness of perception, and only show signs of "torpor" after still further diminution. The remarks in the text above refer to that decrease in central and eccentric vision which follows when we descend the scale from ordinary daylight to that amount of I. which was recommended to be employed in the more delicate examinations of the field of vision.