DRUSEN OF OPTIC NERVE SIMULATING PAPILLEDEMA

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“DRUSEN” is the name applied to hyaline substances occasionally found in the papillary portion of the optic nerve. They were first described by Müller in 1858.6 They are probably a developmental anomaly and occur as amorphous bodies of a yellowish or whitish waxy material, with or without formation of rounded lemon-yellow or golden coin-like deposits.

When these conglomerate coin-like bodies appear on the surface of the disc, they may produce a picture resembling papilledema, but, as a rule, diagnosis is not difficult. However, when they lie buried more deeply in the papilla, they may impart the appearance of papilledema, papillitis, pseudopapilledema or pseudoneuritis, thereby producing serious diagnostic problems.

While these lesions in the disc are not common, during the past two years the authors have seen 7 cases showing well defined drusen in the optic nerve head. In addition to the 7 cases with distinctly visible drusen of the papillae 2 other cases are reported which, in the opinion of the authors, show evidence of drusen deeply hidden below the ophthalmoscopically visible surface of the papilla. This point was stressed by Reese,7 Schlezinger et al.10 and Rucker.8

The purpose of this paper is two-fold: (1) to review the classical picture of drusen of the optic nerve head and (2) to present criteria for the diagnosis of deeply hidden drusen of the papilla, based on our experience with these 9 cases. We had an opportunity to photograph the fundi in 8 of our cases.

RECENT LITERATURE

Since 1858, a number of articles appeared on this subject. In 1904, Cirincione1 showed that drusen of the optic nerve do not have the same origin as drusen of the choroid. In 1923, Fuchs2 expressed the belief that papillary drusen are derived from neuroglia cells. In 1933 Goldstein and Givner3 observed hyalin in the neuroglia of the optic nerve. Since 1933, the literature has been rather scant on this subject. While the occurrence of optic nerve drusen without symptoms is well known, other authors describe them in association with ophthalmological diseases and still others with diseases of the nervous system. Reese7 in 1940 showed evidence that the pathologic process is very similar to that of tuberous sclerosis and stated his belief that drusen of the optic disc are “formes frustes” of tuberous sclerosis, one of the so-called “phakomatoses.”

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In 1941, Samuels described drusen in 20 eyes that were sectioned for microscopic study. In only 1 of the 20 cases were the drusen found on the surface of the papilla. In all the others, they were below the surface of the papilla, and this author also emphasized the point that there may be more cases of hidden drusen than are generally being recognized.

In 1944, Schlezinger, Waldman and Alpers wrote an excellent article on the subject showing how drusen of the optic nerve may produce a clinical picture resembling cerebral tumor.

**AUTHORS' CASES**

In all of our 9 cases, whether the drusen were visible as such or not, the discs presented some of the following features. There was usually some blur-

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Visible Drusen</th>
<th>Blurred Margins</th>
<th>Pallor</th>
<th>Yellow White</th>
<th>Gray Color</th>
<th>Streaks Margin</th>
<th>Fullness of Blind Spot</th>
<th>Peripheral Field</th>
<th>Defect</th>
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FIG. 1.

ring of the margins and elevation of the discs. Often, there was a good deal of yellowish or whitish amorphous hyaline substance distributed within and on the surface of the disc and reaching out on to the retina, thus giving the appearance of atrophy plus blurring. With the exception of Case 2, it was noted that the yellowish discoloration was present in the older age group, and the whitish in the younger age group. Those with the whitish discoloration gave an even greater impression of atrophy than the yellow. As will be seen in Case 4, the same observer who diagnosed the condition as papilledema on one occasion called it “long-standing papilledema with atrophy” one year later.

Two of the discs showed a dirty grayish color fanning out as radial
striations into the peripapillary retina. Practically all the cases showed some fullness of the discs, even when no waxy substance was seen on the surface. The impression was that the nerve with its glial tissue was being pushed forward, as it probably is, by deeply buried drusen. Occasionally, even though most of the disc is blurred and much waxy substance is visible, a part of the disc margin may be well defined. In those cases where definitely formed drusen were seen, the discs, even ignoring the drusen, had many of the above characteristics.

Our cases were divided into 3 groups. *Group 1*: those with definitely visible drusen on both discs; *Group 2*: those with definite drusen on one disc and with ophthalmoscopic evidence of deeply hidden drusen in the other disc; *Group 3*: those with ophthalmoscopic and other clinical evidence of deeply hidden drusen in both discs.

In Group 1, the drusen were easily seen and offered no particular difficulty in diagnosis. However, even in this group, some of the observers considered them as a form of papilledema and did not recognize the drusen as such. In Group 2, one eye of each patient showed definite drusen, while the fellow in each case showed many of the characteristics of discs with drusen but not the definitely formed drusen themselves. Therefore, those eyes without the visible drusen must have had them below the papillary surface. In Group 3, 2 cases are presented. Here we found many of the characteristics of the discs in Group 1 and Group 2, but no visible drusen were seen on the surface of any of the papillae.

*Group 1. Ophthalmoscopically visible drusen on both discs*

*Case 1.* A.W., 26-year-old white male, with long-standing history of headache. X-rays of the skull and neurological examination were normal. His fundi showed drusen of both optic discs. Visual fields showed enlarged blind spots and nasal defects (Fig. 2).

*Case 2.* G.C., 81-year-old white female, also with a history of headache for many years. Neurological examination and x-rays of the skull revealed a completely normal
status except for drusen of the optic discs. There was generalized contraction of the visual fields and both blind spots were enlarged (Fig. 3).

Case 3. S.D., 45-year-old white male, with no symptoms referable to his eyes or head. The drusen were discovered on routine examination. The right visual field showed enlargement of blind spot and peripheral field defect (Fig. 4). Unfortunately, fundus pictures could not be obtained in this case.

Group 2. Ophthalmoscopically visible drusen in one disc

Case 4. S.E., 50-year-old white acromegalic female. Drusen were found on the left disc and evidence of subsurface drusen on the right one. The visual fields (Fig. 5) showed no evidence of chiasmal interference, but enlarged blind spots and some peripheral contraction of the lower nasal fields.

Case 5. S.W., 46-year-old white female, with complaints of headaches. Since 1939, she had been completely investigated by various observers on a number of occasions. A diagnosis of long-standing papilledema was made and used as evidence of a brain tumor to account for her headaches. She received a total of 65 roentgen treatments from 1940 over scattered intervals during a 7-year period. In 1946, she was referred to us for consultation. Both discs were found to have many of the characteristics of subsurface drusen. The optic nerve heads had a yellowish waxy appearance with definitely blurred margins. In addition, the right disc showed a few coin-like excrescences on its surface. Despite the so-called "papilledema" in 1939, at the time of our examination in 1946 there was no neo-vascularization of the disc as one might expect in long-standing papilledema. In 1944 one ophthalmologist made a diagnosis of papilledema and, in 1945, the same ophthalmologist recorded the appearance of these discs as "blurring with atrophy." This ophthalmologist was kind enough to read his findings from his records to the authors, and the description of the disc margins and color in 1944 and 1945 were practically an exact description of what we saw in 1946, and again in 1948. In other words, this was a picture that resembled papilledema with atrophy but did not change for at least 5 years and probably longer. Our visual field studies (Fig. 6) revealed enlarged blind spots and some peripheral contraction which also did not change over a period of 2 years while under our observation.

Case 6. M.A., 19-year-old white female, admitted to the hospital October 1946. The patient complained of headaches for 6 months. A complete neurological examination, including pneumoencephalography and electroencephalography, was not remarkable. The left fundus revealed distinct drusen on the optic disc, with blurring of the margins by a whitish waxy material, some of which extended into the retina around the macula. The right fundus showed blurred margins and fulness of the disc. The visual field studies (Fig. 7) showed enlargement of both blind spots and some irregular peripheral contraction.
This patient was seen again a year after her discharge from the hospital with no complaints and no new findings.

Case 7. B.R., 45-year-old white female. In 1944, on routine ocular examination for refraction purposes, drusen were discovered in the right optic disc. Both discs showed blurring of the margins by a yellowish waxy material. The visual field studies (Fig. 8) revealed enlarged blind spots and some peripheral contraction. Up to the present, 1949, none of these findings has changed.

Group 3. Subsurface drusen in both discs

These patients, although showing no visible drusen, were believed to have deeply buried drusen within the papilla. The diagnosis was made by the ophthalmoscopic findings, the history, the visual field changes and the exclusion of increased intracranial pressure by neurological and laboratory investigations.

Case 8. R.B., 14-year-old white female, admitted to the hospital on April 23, 1947 for what was thought to be papilledema. Right eye: the disc showed some grayish peripapillary striations all around, except at the temporal border where the disc margin was well defined. The upper and lower nasal portions of the disc were elevated and appeared edematous at the margins. Despite the apparent edema involving three-fourths of the circumference of the disc, the temporal margin remained sharp and the physiological cup was still present. The vessels were not engorged and there were no haemorrhages or exudates. Left eye: the entire disc appeared blurred, with a
hazy whitish material extending into the circumpapillary retina. Again, a very small sharp temporal border was visible, and the vessels were not engorged. Visual field studies (Fig. 9) showed very definite enlargement of both blind spots, together with some irregular peripheral contraction, a little more marked below and nasally. Because of the lack of central and paracentral defects, the good corrected visual acuity, and the lack of perivascular exudates or changes in calibre of retinal vessels, optic neuritis was discounted. In view of the persistence of some clear disc margins with so much apparent edema and with a history of 10 days’ duration and the lack of haemorrhages or engorgement of the retinal veins, papilledema due to increased intracranial pressure was considered unlikely. Since the blind spots were enlarged, the diagnosis of “pseudopapilledema” was discounted. For these reasons, a diagnosis of drusen of the optic discs was made, and it was believed that they were hidden below the surface of the papillae. Complete neurological investigation including pneumoencephalography and electroencephalography showed no abnormal findings. Reexamination in 1947 and again in 1949 revealed no changes in the ophthalmoscopic or visual status.

Case 9. A.L., 45-year-old white female. In March 1948, the patient complained of blurring in the left eye. She was examined at a hospital on April 1, 1948, and was told she had “papilledema.” She left the hospital and went to a neurologist who thought it more likely that she had optic neuritis. On May 21, 1948, she was admitted to our service for investigation, and it was found that the “blur” in the left eye was correctible with a +1.00 sphere. Both blind spots were definitely enlarged (Fig. 10). The peripheral field of the left eye showed a mild irregular contraction. Both discs appeared full with a yellowish undertone. The left disc showed definite yellowish blurring of the margins, while, in the right disc, the margins were still easily visible. In both fundi, there was a dirty gray color with striations coming off radially from around the disc margins. Neurological examination, electroencephalography and roentgenograms of the skull were all normal.

DISCUSSION

In all the cases in this series there was a definite enlargement of the blind spots, and such enlargement has been described by some of the observers mentioned above.7,8,9,10 This is readily understandable when one examines the sketches and
Fig. 11. Points of resemblance of cases in Group 3 (no definite drusen visible on surface) to the other
disks, with drusen visible or drusen in fellow eye.

Case 8. Left eye: looks very much like left eye in Case 6 except for visible drusen in the latter. Right
eye: nasal margin is whitish and blurred, like most of Case 6’s left eye and, even more, right eye.

Case 9. Left eye and right eye: this is an older patient, and the whole fundus is consequently a little
more yellowish. The color is very much like that of right eye in Case 4, as well as left eye in Case 4,
except for the actual drusen in the latter. The two discs also resemble that of left eye in Case 7, as well
as right eye of Case 6, although the latter is a younger patient and, consequently, has a less yellowish or
more whitish fundus and disc.
microphotographs published by Samuels, who made a histopathological study of 20 globes with drusen of the optic disc. In this study, the drusen were seen to encroach upon the peripapillary percipient elements pushing aside the peripapillary rods and cones. This would account for an enlargement of the blind spots in the same way as is produced by papilledema.

The peripheral field changes described have been diverse in character. On purely theoretical grounds, many types of defects can be found, depending on the number and distribution of drusen and the amount of interference they cause in the nerve fibre bundles in their proximity. Rucker reported a few diverse types he encountered with papillary drusen and concluded that there may be arcuate defects, either small or breaking through to the periphery, or peripheral contraction, mostly nasal and below.

In our series of cases, while most of them showed rather irregular peripheral contractions, the most numerous were on the nasal side, and some of the deepest indentations from the periphery were below and nasal (Cases 1, 4 and 8). However, we do not believe any practical diagnostic importance can be ascribed to these particular field defects, since they depend on the fortuitous distribution that the hyaline bodies happen to have.

While 5 of the 9 patients in this series complained of headache, and various authors have attempted to show that headache may be an accompaniment of this condition, we must remember that people with headache from any cause are more apt to come to the attention of neuro-ophthalmological observers. We do not know how many people with papillary drusen and without headache never come to the attention of the neuro-ophthalmologist.

From the viewpoint of the clinical neurologist and ophthalmologist, the most important significance of these drusen lies in their resemblance to papilledema. Four of our cases had been seen by ophthalmologists and neurologists who labelled them as papilledema.

Less frequently, optic neuritis and pseudopapilledema may be confused with this condition. The visual field changes, however, more closely resemble papilledema than papillitis, because of the preponderance of peripheral rather than central defects.

So-called “pseudopapilledema” should not show any enlargement of the blind spots. However, until definite histological studies of discs with pseudopapilledema are made, we may even suspect the possibility that such discs have deeply buried drusen not reaching out enough to encroach on peripapillary percipient elements and therefore presenting a normal blind spot. The possibility of so-called “pseudopapilledema” really being cases of deeply buried drusen has also been mentioned by several of the authors quoted by us.

The absence of a sudden onset of central and caeco-central scotomas will usually rule out papillitis, although nerve fibre bundle defects can occur in both.

A very important step in evaluation is the static nature of the process.
While increase in size and number have been described by Walker,11 Lauber,5 and Reese,7 this growth is very slow and may take place over a number of years.

True papilledema is not likely to last for long periods of time without showing haemorrhages, exudates, venous engorgement, etc. Even if it is low grade and the venous system can accommodate itself to the increased intracranial pressure without becoming engorged, one would expect secondary vascularization on the disc and much more pronounced field changes from the inevitable optic atrophy that must accompany long-standing papilledema.

There may be, however, mixed pictures of recurrent papilledema with underlying atrophy that can simulate drusen of the nerve head. In such cases the patients will have had papilledema for a long time and will, in all likelihood, show much more clinical evidence of increased intracranial pressure.

For these reasons, it is important to obtain previous records of funduscopic examinations. In cases such as these, the authors make every attempt to obtain a history of a previous ocular examination by an ophthalmologist. A record by a colleague indicating blurring of discs or a yellowish appearance 3 or 4 years before could be of great help in reaching a decision as to whether one is dealing with hidden drusen or true papilledema. It is evident how important it is for ophthalmologists to make a few notes as to the appearance of all discs, even normal ones, on routine examination, with particular reference to the disc margins, the cup, the color and calibre of vessels.

SUMMARY AND CONCLUSIONS

Drusen of the optic discs occur as a developmental anomaly and may cause a picture resembling papilledema or papillitis. When lying on the surface as discrete, coin-like bodies, they are easily recognizable as such ophthalmoscopically. When buried below the surface of the papilla, they may so closely resemble papilledema or papillitis as to cause a serious diagnostic problem.

If one sees discs that are swollen, blurred at the margins and having a yellowish or whitish waxy material and perhaps a grayish discoloration off the disc; furthermore, if the veins are not engorged and no haemorrhages or discrete exudates are found in the peripapillary retina, and, if the blind spot is enlarged but the rest of the clinical picture does not suggest increased intracranial pressure, the diagnosis of deeply hidden drusen of the optic nerve must be considered.

If in doubt, and the presenting symptoms are not urgent, it is worthwhile following the case with funduscopic study and blind-spot plotting over a period of weeks or even months. Papilledema should certainly show some remarkable fluctuations both in ophthalmoscopic appearance and blind-spot size, while drusen will show little or no changes.

If symptoms appear to be acute, one may have to do pneumoencephalo-
grams. If the gas studies are normal and the neurosurgeon convinced of the absence of increased intracranial pressure, one may assume the presence of drusen of the optic nerve.

The authors do not imply that all cases with deeply hidden drusen can be diagnosed clinically with ease. Surely, many cases will need gas studies, angiography, and other forms of neurological investigation to satisfy the neurosurgeon.

Again, once such diagnosis is made, the patient should be followed at reasonable intervals for a year or so, during which time the fundi and blind spots should be studied comparatively.

REFERENCES