DIFFERENTIAL PERIMETRIC PROFILES IN DISCIFORM MACULAR DEGENERATION: STAGES OF DEVELOPMENT

E.L.GREVE, P.J.M. BOS, P.T.V.M. DE JONG & D. BAKKER

(Amsterdam, the Netherlands)

INTRODUCTION AND METHODS

The purpose of this study is to describe the central and paracentral visual function in drusen and disciform macular degeneration and in the stages between these two extremes of the disease. The functional defects will be compared with the fluorescein angiographic findings.

In 1973 GASS described a four year follow-up of 200 patients with drusen. In 49 cases that had only drusen 20% had serious loss of vision during this period. Another 25% lost two lines of the visual acuity chart. In 91 cases in which one eye had disciform macular degeneration and the other eye had drusen, 33% of the cases with drusen had serious loss of vision and another 33% lost two lines of the visual acuity chart. From this study it is clear that a significant number of cases with drusen deteriorate in a period of a few years.

We will try to establish the stages of deterioration of visual function during the proces that leads from drusen to disciform macular degeneration. Such a description might be of value to identify that stage of the disease in which laser coagulation can best be performed. We have obtained data in 20 patients that were studied during the last year. It is not a longitudinal study. The follow-up period is still not long enough to demonstrate significant deterioration in all individual patients. Different stages of development were observed in different patients. This provides a working hypothesis for the natural history of visual function of the disease in the individual patient.

All patients were examined by means of differential central single stimulus static perimetry. By differential perimetry we mean that perimetry was performed at two levels of adaption. In this case the levels were photopic (3 cd.m^{-2}) and mesopic (0.003 cd.m^{-2}). Comparing the intensity of defects under photopic and mesopic circumstances provided valuable information. The intensity of mesopic and photopic defects will be expressed as an M/P ratio. If the M/P ratio is 1.0 this means that the intensity of the photopic and mesopic defects is equal. If the M/P ratio is larger than 1 this indicates that the mesopic intensity is greater than the photopic intensity. The meridians of static perimetry were selected on the basis of ophthalmoscopy and fluorescein angiography.

Scotopic campimetry has been described by FRANÇOIS & VERRIEST (1956). It is not suitable for clinical purposes.

Kinetic mesopic campimetry has been advocated by JAYLE (1958) who concluded that this method is superior to photopic kinetic campimetry. For

Fig. 1. F.F.A. of case 1.: drusen

Fig. 2. D.S.P. (Differential Static Perimetry) of case 1.: relative paracentral defects with good central sensitivity. M/P ratio is 1.

reasons explained elsewhere static perimetry is to be preferred for visual field examinations that aim at comparing mesopic and photopic results (GREVE, 1973).

The results will be illustrated on the basis of 4 case-reports.

CASE REPORTS

Because of the limited space available only the F.F.A. photographs and perimetric profiles are shown.

Case 1

Woman of 68 years who has a visual acuity of 1.0 in the right eye and of 0.25 in the left eye. The right eye has drusen and the left eye a late stage of disciform macular degeneration. Both the fundus and the fluorescein angiography show a classic picture of drusen (Fig. 1.). The differential static perimetry shows relative paracentral defects where central sensitivity is still quite good. The M/P ratio is 1. (Fig. 2).

Case 2

Woman of 67 years. Visual acuity in the right eye is 0.9 and in the left eye 1.0. The left eye shows only drusen, some of them confluent (Fig. 3). The differential static perimetry shows an increase of the paracentral defects and here it is the mesopic intensity that increases more than the photopic intensity so the M/P ratio is larger than 1. (Fig. 4). The right eye of this patient shows large confluent drusen and a local retinal pigment epithelial (R.P.E.) detachment (Fig. 5). One wonders if there is also some sub-foveal fluid or foveal oedema. Fluorescein angiography shows the R.P.E. detachment. Differential static perimetry shows a paracentral defect with a mesopic intensity that is greater than the photopic intensity and a central defect (Fig. 6). Again there was an M/P ratio greater than 1. The difference between this left eye and the right eye is that central sensitivity is affected in the right eye.

Case 3

A man of 68 years with visual acuity in the right eye of 0.5 and in the left eye of 1.0. The right eye shows drusen and R.P.E. detachment with extension of fluid under the fovea. Fluorescein angiography shows the pigment epithelial detachment but no leakage (Fig. 7). The left eye has only drusen. The differential static perimetry of the right eye shows paracentral and central defects with an M/P ratio that is larger than 1. (Fig. 8). In this case the central defect is deeper than in case 3 (right eye).

Case 4

A man of 60 years old with disciform haemorrhagic exsudative macular degeneration. Fluorescein angiographic shows the typical picture with leakage (Fig. 9). Differential static perimetry shows a large central and paracentral defect with a M/P ratio of more than 1. (Fig. 10).

Fig. 3. F.F.A. of case 2 (left eye): drusen

Fig. 4. D.S.P. of case 2 (left eye): paracentral defect with intensity greater than in case 1. and increase of M/P ratio in the defect.

Fig. 5. F.F.A. of case 2. (right eye): drusen and small R.P.E. detachment.

Fig. 6. D.S.P. of case 2 (right eye): paracentral defect of intensity greater than in case 2 (left eye) and in addition the appearance of a central defect with an M/P ratio greater than 1.

Fig. 7. F.F.A. of case 3: R.P.E. detachment; no leakage.

Fig. 8. D.S.P. of case 3: Paracentral defect as in case 2 (right eye) and a central defect with an intensity that is greater than the intensity of the central defect of case 2. M/P ratio greater than 1.

DISCUSSION

The case reports shown here demonstrate the typical configuration of defects as measured by central static perimetry. The different stages of the development of the disease have been grouped from I to IV. The group II has been subdivided in a group IIa and IIb. The stages are based on the configuration of the defect and the behavior of the mesopic/photopic ratio. An overview of the stages is given in Table I. Again it is emphasized that these stages are a working hypothesis. Certainly not all defects in disciform macular degeneration develop in the way described here. For practical purposes however the described cases are the most interesting because only cases with paracentral detachment of the retinal pigment epithelium (R.P.E.) are available for treatment. In group I and IIa the fundus and fluorescein angiographic findings are described as drusen. In group I there are relative paracentral defects and the mesopic/photopic ratio is 1.0 (case I).

In group II a deeper paracentral defect develops and the mesopic/photopic ratio increases. From this study and from earlier work on central serous choriopathy (GREVE et al. 1972, 1973, 1976), we have concluded that the increase of the mesopic/photopic ratio means that there is fluid either under the retinal pigment epithelium or under the retinal neuro-epithelium. In the case of stage IIa it is impossible to prove that there is fluid under the confluent drusen but it is highly probable (case 2 left eye). The clinical difference between stages I and stages IIa is in the size of the drusen. Stage IIa is close to a small retinal pigment epithelium detachment.

In stage IIb the fundus shows a hazy appearance of the fovea suggesting that foveal edema is present (case 2, right eye). The difference between IIa and IIb is that in addition to the paracentral defect now there is also a central defect with an increasing central mesopic/photopic ratio. The transition from stage IIa to IIb is an important one because it indicates that the localized parafoveal sub R.P.E. fluid of stage IIa has extended under the fovea. In stage IIa we only deal with a paracentral defect that in principle is available for treatment. Visual acuity in stage IIb is still quite good. On fluorescein angiography no leakage could be shown. In stage III there is a clear R.P.E. detachment with foveal oedema and there is a marked increase of the relative central defect which corresponds with the foveal oedema (case 3). On fluorescein angiography again there is no leakage. In fact the stages I, II and III are the most interesting of this study, because they are the early stages of development of disciform macular degeneration. Stage IV is already a relatively late stage with a deep central and paracentral defect (case 4).

An extremely useful and new finding from our study is that the mesopic/photopic ratio indicates the presence of fluid or call it oedema. We use this routinely if we are in doubt whether there is foveal oedema or not. As shown in Table I, fluorescein angiography in the early stages indicates the retinal pigment epithelium detachment but not the foveal oedema.

Careful biomicroscopy of the fundus may indicate the foveal oedema. Differential static perimetry is a highly sensitive and objective means of detecting foveal oedema and a welcome confirmation of biomicroscopy

Fig. 9. F.F.A. of case 4: disciform macular degeneration with leakage.

Fig. 10. D.S.P. of case 4: large central and paracentral defect.

	I	II A	II B	III	IV
FUNDUS	DRUSEN	DRUSEN	R.P.E. DETACH. + ? SUBFOVEAL FLUID ?	R.P.E. DETACH. + SUBFOVEAL FLUID	DISCIFORM MACULAR DEGENERATION
F F A	DRUSEN	DRUSEN	R.P.E. DETACH. NO LEAKAGE	R.P.E. DETACH. NO LEAKAGE	D.M.D. LEAKAGE
V F
	SLIGHT PARACENTRAL DEFECTS	DEEPENING PARACENTRAL DEFECT M > P	BEGINNING DETERIORATION OF CENTRAL SENS M > P	FURTHER DETERIORATION OF CENTRAL SENS M > P	DEEP CENTRAL DEFECT LATE STAGE
M/P RATIO	1.0	1.2 - 1.5	1.8	1.5	1.2
V A	1.0	1.0	0.75 - 1.0	0.5	< 0.5

findings. We feel that differential static perimetry is a better indicator of the severity of the disease than fluorescein angiography. Both diagnostic methods should go hand in hand in the early stages of disciform macular degeneration. Also differential static eprimetry showed severe defects when visual acuity was still good. The reason for this is that the para-foveal retina is affected in an earlier stage than the fovea itself.

Now a few remarks about therapy. BIRD stated in 1974 that until a method is devised of indentifying eyes at high risk it is likely that prophylactic laser coagulation of senile choroidal macular degeneration will remain in abeyance. Bird's series of laser coagulation in avascular disciform macular degeneration suggested that laser coagulation can improve visual acuity, at least temporarily. If one looks at the stages of development of disciform macular degeneration as indicated by differential static perimetry one is tempted to suggest that stage IIb might be the stage where laser coagulation could prevent further deterioration of central sensitivity. We have not yet started laser coagulation in that stage because we want to extend our follow-up period, but we hope to be able to use differential static perimetry as a prognostic index in the early stages of development of disciform macular degeneration.

SUMMARY

The purpose of this study is to describe the central and paracentral visual function in drusen and in disciform macular degeneration and in the stages between these two extremes of the disease. The functional defects will be compared with the fluorescein angiographic findings. Function is measured by means of central single stimulus static perimetry at a mesopic and photopic level of adaptation.

The results show:

1. A typical configuration of defects in the different stages of drusen and disciform lesions. The transition to the stage with foveal oedema is indicated very well by differential static perimetry.
2. A greater intensity of defects at mesopic levels of adaptation than at photopic levels of adaptation in the case of sub-retinal or sub R.P.E. fluid.
3. Differential static perimetry is better indicator of the severity of the disease than fluorescein angiography.
4. Differential static perimetry showed severe paracentral defects when visual acuity was still good.
5. A stage of development of the disease where profilactic laser coagulation might be practised is suggested.

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Authors' address:

Eye Clinic of the University of Amsterdam
Wilhelmina Gasthuis
1e Helmersstraat 104
Amsterdam
The Netherlands

DISCUSSION

x: I would like to ask Dr Greve whether he has used his perimetric profiles in other diseases with macular oedema especially in central serous retinopathy. I am asking him this question because recently we found that if an adaptometric curve is plotted in patients with quite typical central serous retinopathy, you get a very distinct and marked scotopic defect which is peripheral to the macular oedema and this somehow could correlate with his results.

Dr Greve: In fact, in 1972 we started this project on central serous chorioidopathy and it was then we found that the mesopic defects were much deeper. There were two defects: one of the pigment epithelial detachment and one of the neuro epithelial detachment. The defect of the neuro epithelial detachment correspond exactly to the perimetric defect. Why we have not done scotopic perimetry is because it is a very difficult method of measuring visual function. You are coming to problems of adaptation, problems of fixation and all that. I think mesopic perimetry provides as much information as does the scotopic perimetry. We have carried out examinations in a lot of other macular diseases which have been reported recently to the Dutch Ophthalmological Society and, for instance, dry senile macular degeneration does not have this mesopic-photopic ratio, the recently described neuro-epitheliopathy of Bos and Deutman does not have this mesopic-photopic ratio, so we really feel that it is a very good tool for finding out if there is oedema or not.