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An international classification and grading system for age-related maculopathy and age-related macular degeneration

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SPECIAL ARTICLE

An International Classification and Grading System for Age-related Maculopathy and Age-related Macular Degeneration

THE INTERNATIONAL ARM EPIDEMIOLOGICAL STUDY GROUP

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Abstract. A common detection and classification system is needed for epidemiologic studies of age-related maculopathy (ARM). Such a grading scheme for ARM is described in this paper. ARM is defined as a degenerative disorder in persons ≥ 50 years of age characterized on grading of color fundus transparencies by the presence of the following abnormalities in the macular area: soft drusen $\geq 63\mu\text{m}$, hyperpigmentation and/or hypopigmentation of the retinal pigment epithelium (RPE), RPE and associated neurosensory detachment, (peri)retinal hemorrhages, geographic atrophy of the RPE, or (peri)retinal fibrous scarring in the absence of other retinal (vascular) disorders. Visual acuity is not used to define the presence of ARM. Early ARM is defined as the presence of drusen and RPE pigmentary abnormalities described above; late ARM is similar to age-related macular degeneration (AMD) and includes dry AMD (geographic atrophy of the RPE in the absence of neovascular AMD) or neovascular AMD (RPE detachment, hemorrhages, and/or scars as described above). Methods to take and grade fundus transparencies are described. (*Surv Ophthalmol* 39:367-374, 1995)

Key words. age-related maculopathy • age-related macular degeneration • classification • drusen • geographic atrophy • neovascular age-related macular degeneration • retinal hemorrhages • retinal pigment epithelium detachment

Age-related maculopathy (ARM) is a degenerative disorder of the central area of the retina (the macula) often associated with visual impairment which is more frequent after 65 years of age. The disciform variant of this disorder was first described in 1875.¹³ In 1885, Haab labelled the disease senile macular degeneration.⁶ Over the years there have been many different names and expressions for ARM.^{1,14}

While ARM has been described for over 100 years, there is neither a standard agreement on

the definition of specific lesions nor a generally accepted classification system. Clinical and epidemiological studies of ARM have used different diagnostic tools such as perimetry, dark adaptation, contrast sensitivity, ophthalmoscopy, fundus reflectometry, scanning laser ophthalmoscopy, biomicroscopy, black-and-white fundus photography, color fundus photography with white, blue or red-free light, angiography with fluorescein or indocyanine green, and histology or electron microscopy. These approaches have

TABLE 1

Definitions of and Age Limits in ARM Used in Population-based Studies

1. Framingham Eye Study ¹¹	<i>Chesapeake Bay Study, Continued</i>
An eye was diagnosed as having senile macular degeneration if its visual acuity was 20/30 or worse and the ophthalmologist designated the etiology of changes in the macula or posterior pole as senile.	<i>Exudative changes:</i> choroidal neovascularization, detachments of the RPE, and disciform scarring.
Age limits: 52-85 years.	<i>Grading of AMD in 4 grades:</i>
2. National Health and Nutrition Eye Study ⁴	Grade 4: geographic atrophy of the RPE or exudative changes.
<i>Age-related macular degeneration:</i> loss of macular reflex, pigment dispersion and clumping, and drusen associated with visual acuity of 20/25 or worse believed to be due to this disease.	Grade 3: grade 4 or eyes with large or confluent drusen or eyes with focal hyperpigmentation of the RPE.
<i>Age-related disciform macular degeneration:</i> choroidal hemorrhage and connective-tissue proliferation between retinal pigment epithelium and Bruch's membrane causing an elevation of the foveal retina (this condition should be differentiated from disciform degenerations of other causes, eg, histoplasmosis, toxoplasmosis, angioid streaks, and high myopia).	Grade 2: grade 4 or 3 or eyes with many small drusen (≥ 20) within 1500 μ m of the foveal center.
<i>Age-related circinate macular degeneration:</i> perimacular accumulation of lipoid material within the retina.	Grade 1: Grade 4, 3, or 2 or eyes with at least five small drusen within 1500 μ m of the foveal center or at least ten small drusen between 1500 and 3000 μ m from the foveal center.
Age limits: 1-74 years.	No visual acuity included.
3. Gisborne Study ¹²	Age limits: ≥ 30 years.
Senile macular degeneration: when the visual acuity in the affected eye was 6/9 (20/30) or worse and senile macular degeneration was identified as the probable cause of this visual loss.	6. Beaver Dam Eye Study ⁹
Age: ≥ 65 years.	Early age-related maculopathy was defined as the absence of signs of late age-related maculopathy as defined below and as the presence of soft indistinct or reticular drusen or by the presence of any drusen type except hard indistinct, with RPE degeneration or increased retinal pigment in the macular area. Late age-related maculopathy was defined as the presence of signs of exudative age-related macular degeneration or geographic atrophy.
4. Copenhagen Study ¹⁶	The grade assigned for the participant was that of the more severely involved eye.
<i>Age-related macular degeneration (AMD):</i> best corrected visual (Snellen) acuity (including pin hole improvement) of 6/9 or less, explained by age related morphologic changes of the macula.	No visual acuity included.
<i>Atrophic (dry) changes:</i> disarrangement of the pigment epithelium (atrophy/clustering) and/or a small cluster of small drusen and/or medium drusen and/or large drusen and/or pronounced senile macular choroidal atrophy/sclerosis without general fundus involvement.	Age limits: 43-86 years.
<i>Exudative (wet) changes:</i> elevation of the neurosensory retina and/or the pigment epithelium and/or hemorrhages, and/or hard exudates and/or fibrovascular tissue.	7. Rotterdam Study ⁷
Age related macular changes without visual impairment (AMCW) is defined as similar morphological lesions but without visual deterioration.	All ARM changes had to be within a radius of 3000 μ m of the foveola. No definition of early ARM, but separate prevalence figures for drusen and retinal pigment epithelial hyperpigmentations or hypopigmentations attributable to age-related causes.
Age limits: 60-80 years.	Late ARM (is similar to AMD): the presence of atrophic AMD (well demarcated area of RPE atrophy with visible choroidal vessels) and/or neovascular AMD (serous and/or hemorrhagic RPE detachment, and/or subretinal neovascular membrane and/or hemorrhage, and/or periretinal fibrous scar) attributable to age-related causes. In a participant the most severely involved eye was taken for the analysis.
5. Chesapeake Bay Study ²	No visual acuity included.
No specific overall definition.	Age limits: ≥ 55 years.
<i>Geographic atrophy:</i> an area of well-demarcated atrophy of the RPE in which the overlying retina appeared thin.	

often resulted in different definitions and severity scales. There is also inconsistency in the interpretation of histological and clinical manifestations of the early stage of ARM. This has limited comparisons of findings among clinical and epidemiological studies.

Various definitions of ARM used in earlier epidemiological studies, are given in Table 1. Some studies required a visual acuity component in their definition of ARM^{4,11,12,16} whereas others did not.^{2,7,9} In more recent studies of ARM^{2,7,9} photographic standards of various abnormalities

have been used in the grading of fundus photographs. The age limits varied widely in these studies from 1 to 98 years (Table 1). To facilitate comparison of data among studies of ARM there is a need for development of commonly used methods to detect, grade and define this disease.

Rationale

There are few epidemiological studies describing the natural history and risk factors for ARM, but a number of such studies are currently in progress or are being planned. These studies are designed to examine the relationship of early morphological changes, such as hard drusen, soft distinct drusen, and increased or decreased retinal pigment epithelial (RPE) pigmentation to the development of late stages of the disease and to visual outcomes. It would be of benefit to have grading systems and definitions for ARM similar to the Airlie House classification scheme for diabetic retinopathy, which would permit the possibility for comparison between studies in the future.³ This paper describes the results of a series of meetings among six groups involved in epidemiological studies of ARM in order to develop a core grading system using color stereoscopic fundus transparencies to detect and define ARM. As more data are collected from studies presently under way or other studies which arise in the future, it is expected that further refinements will be made to the grading system. This is due to the fact that a severity scale will be required for longterm studies of the natural history of this disease in large populations to establish rates of progression successfully.

Methods

In the development of a grading classification for ARM, we have used the anatomical definition of the macula, defining it as that part of the retina centered on the foveola in which the ganglion cell layer is more than one cell in thickness, that has an approximate diameter of 5.5mm.⁸ For descriptive purposes the inner macula is defined as the area within a circle, centered on the foveola, of diameter 3000 μ m, i.e. approximately two disk diameters across (Fig. 1). The outer macula is defined as the area between the inner macula (diameter 3,000 μ m) and a circle with a diameter of 6,000 μ m.

We defined ARM primarily on the basis of morphological changes seen on, preferentially stereoscopic, color fundus transparencies and defined its presence as "age-related" by inclusion of age (e.g., ≥ 50 years). Visual acuity is not a

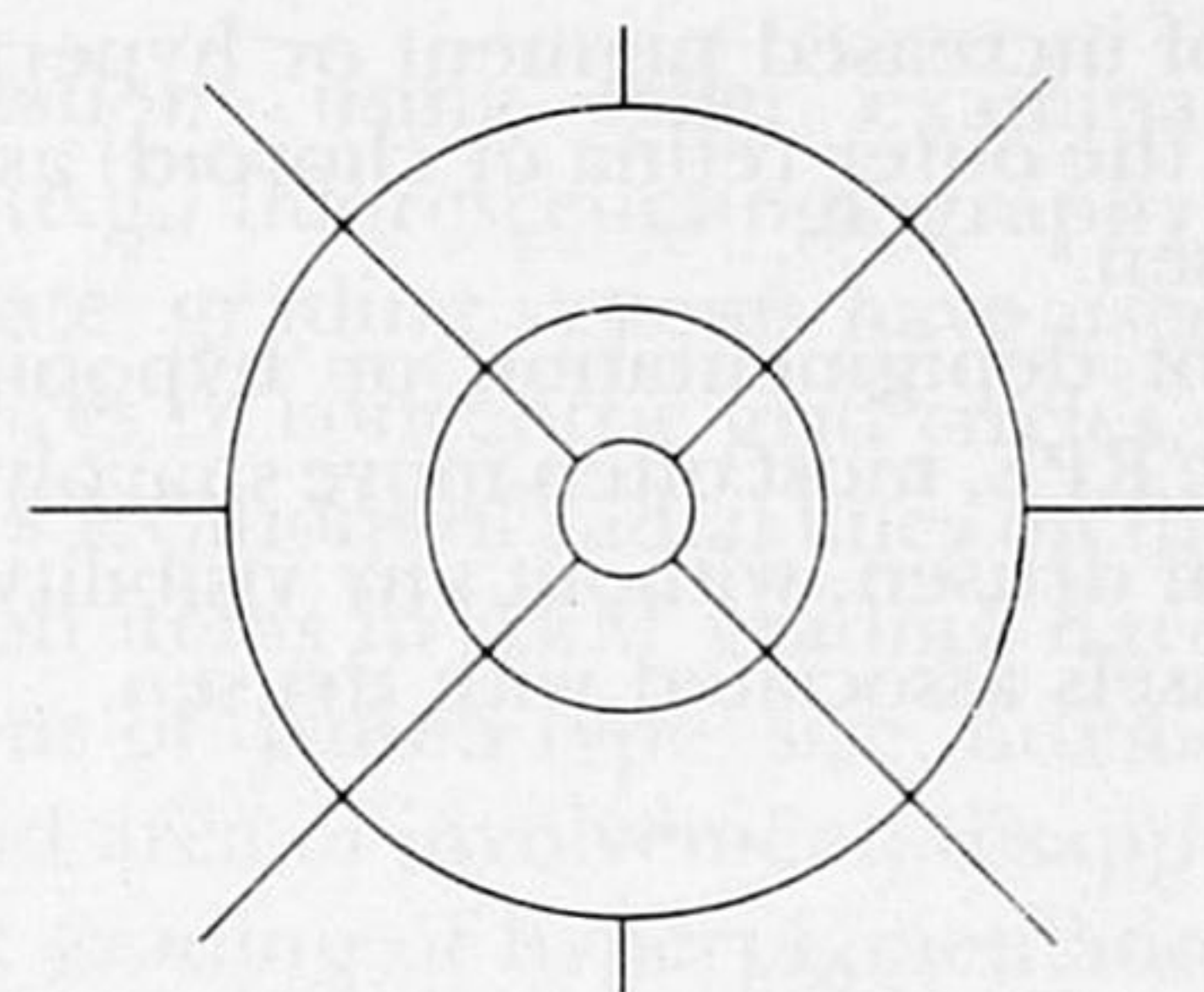


Fig. 1. Standard grid for ARM classification. For a 30° fundus camera the diameter of the central, middle and outer circle is respectively 1000, 3000 and 6000 μ m. These circles represent respectively the central, middle and outer subfield. The midperipheral subfield is outside the outer circle within field 2.³ The spokes may be of help in centering the grid on the macula and in estimating the length of a lesion. (Reprinted courtesy of *Ophthalmology* from Klein R et al: The Wisconsin age-related maculopathy grading system. *Ophthalmology* 98:1128-1134, 1991)

criterion for the presence or absence of ARM. Other historical or clinical information, if available, is used prior to defining a lesion as one associated with ARM.

It is proposed to name all signs of age-related macular changes as age-related maculopathy (ARM) and to classify them by presumed order of severity. Further classification of severity using this system will depend on findings from large population-based studies and clinical trials.

Definitions

ARM is a disorder of the macular area of the retina, most often clinically apparent after 50 years of age, characterized by any of the following primary items, without indication that they are secondary to another disorder (e.g., ocular trauma, retinal detachment, high myopia, chorioretinal infective or inflammatory process, choroidal dystrophy, etc):

- Discrete whitish-yellow spots identified as "drusen" which are external to the neuroretina or the RPE. They may be soft and confluent, often with indistinct borders. Soft distinct drusen have uniform density with sharp edges. Soft indistinct drusen have decreasing density from center outwards with fuzzy edges. Hard drusen, usually present in eyes with as well as those without ARM, do *not* of themselves characterize the disorder.

- Areas of increased pigment or hyperpigmentation (in the outer retina or choroid) associated with drusen.
- Areas of depigmentation or hypopigmentation of the RPE, most often more sharply demarcated than drusen, without any visibility of choroidal vessels associated with drusen.

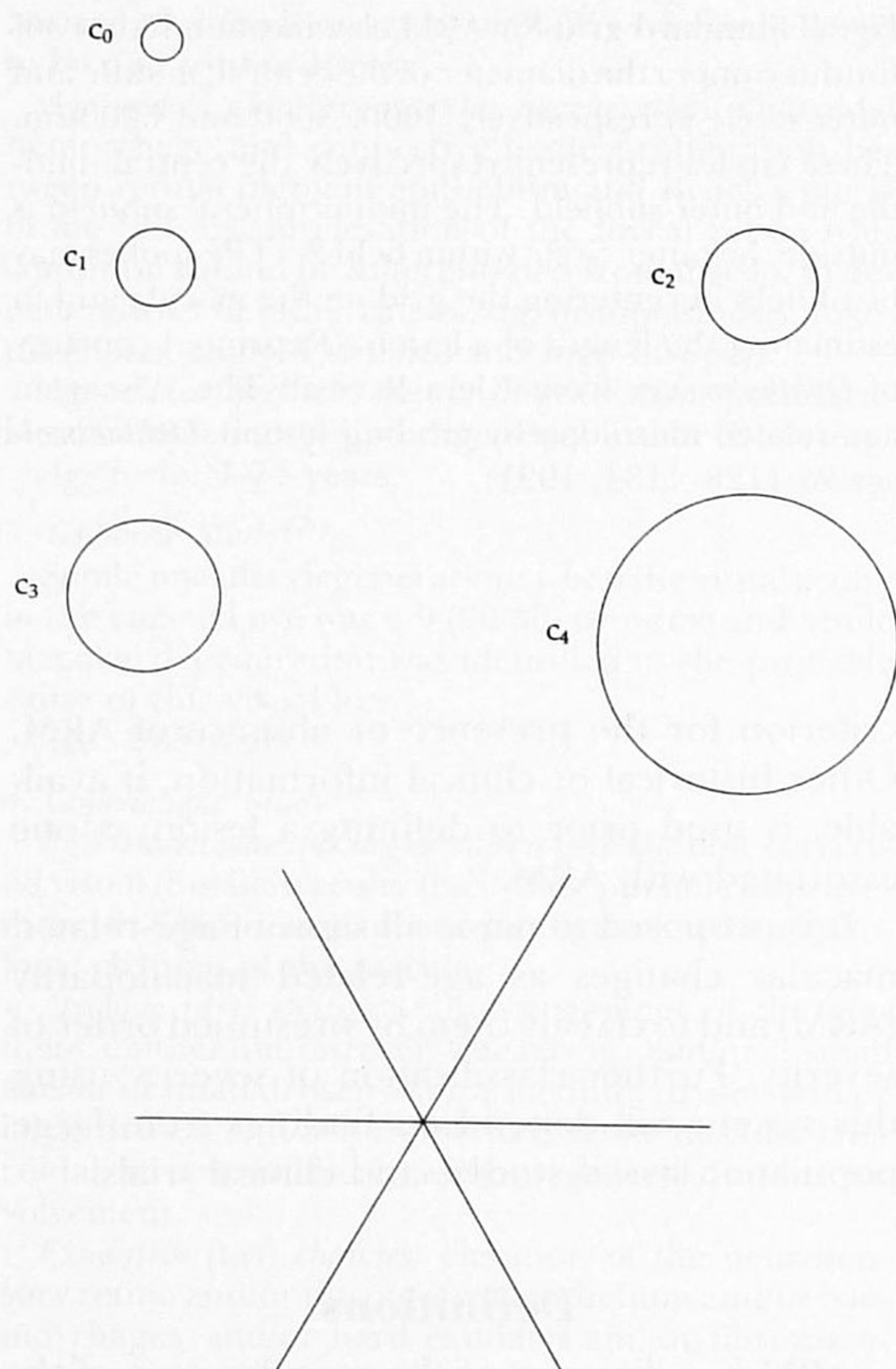


Fig. 2. Standard circles for grading of ARM related fundus changes. The circles C_0 , C_1 , C_2 , C_3 , and C_4 are used for all subfields. The circles should be reduced on a transparent sheet, according to the fundus camera used, so that they are 1/24, 1/12, 1/8.6, 1/6, and 1/3 disk diameter, resulting in approximate diameters in the average fundus of $63\mu\text{m}$, $125\mu\text{m}$, $175\mu\text{m}$, $250\mu\text{m}$, and $500\mu\text{m}$. Note that the diameter of circle C_4 is half the diameter of the inner circle on figure 1. All circles may be used for estimation of drusen size. Circle C_0 differentiates small from large drusen. Circles C_1 and C_2 may be used for grading area involved by increased pigmentation or RPE depigmentation, circle C_2 for minimum area of geographic atrophy, and C_3 and C_4 for area of geographic atrophy or neovascular AMD. The spokes facilitate locating the center point and estimating the size of lesions.

- The late stages of ARM, that will be called age-related macular degeneration (AMD). Thus, AMD is a late stage of ARM and includes both "dry" and "wet" AMD.

Dry AMD or geographic atrophy is characterized by:

- Any sharply delineated roughly round or oval area of hypopigmentation or depigmentation or apparent absence of the RPE in which choroidal vessels are more visible than in surrounding areas that must be at least $175\mu\text{m}$ in diameter ($\geq C_2$; Figure 2) on the color slide (using a 30° or 35° camera).

Wet AMD is also called "neovascular" AMD, "disciform" AMD, or "exudative" AMD and is characterized by any of the following:

- RPE detachment(s), which may be associated with neurosensory retinal detachment, associated with other forms of ARM.
- Subretinal or sub-RPE neovascular membrane(s).
- Epiretinal (with exclusion of idiopathic macular puckers), intraretinal, subretinal, or sub-pigment epithelial scar/glia tissue or fibrin-like deposits.
- Subretinal hemorrhages that may be nearly black, bright red, or whitish-yellow and that are not related to other retinal vascular disease. (Hemorrhages in the retina or breaking through it into the vitreous may also be present).
- Hard exudates (lipids) within the macular area related to any of the above, and not related to other retinal vascular disease.

Because geographic atrophy and neovascular AMD may be different manifestations of the disorder and may have different causes, it may be useful to separate them, especially when examining relationships to risk factors. Rarely neovascular AMD may develop in an area of geographic atrophy.

Photography and Film Processing

Preferentially color 30° or 35° stereoscopic transparencies of a modified field 1 (centered on the temporal edge of the disk) and field 2 (centered on the fovea) and an optional modified field 3 (temporal to the fovea but including the fovea in the nasal edge) are taken after pupillary dilation.³ Inclusion of modified fields 1 and 3 may help the grader detect subtle drusen, changes in pigmentation, and other lesions associated with ARM.

Kodachrome ASA 25 or 64 film or equivalent should be used. If other equivalent film types are used, they should have similar color and grain

characteristics and similar stability over time. Other films such as Ektachrome 100 may be used. However, because in the past Ektachrome has been less stable over time than Kodachrome, it may be less appropriate for a longterm study. Faster films with higher ASA rating may appear more "grainy." Films which have too much "red" or "brown" in them may cause problems in grading some lesions associated with ARM such as retinal pigment epithelium hypopigmentation. The film processor should be carefully chosen and if possible the same processor and process should be used throughout an entire study. Color shifts in the processing may cause problems in grading of some lesions associated with ARM. The same film type, (preferentially bought from the same lot and frozen at the beginning of a study), may minimize changes in manufacture of films.

The 30° or 35° photographic field has become the standard used in most studies of ARM. The magnification provided by a 30° field is usually adequate to determine most lesions associated with ARM. Variations in field size may lead to difficulty in comparisons among studies, should be limited between 25° and 40°, and call for adaptation of the grid template.¹⁵

The fundus transparencies are returned as slides, usually mounted in clear plastic sheets. The system of grading relies heavily on excellent quality stereoscopic transparencies, especially in detecting subtle drusen, and hyper- and hypopigmentations. This requires photographer certification and an ongoing system of quality control. Graders need an adequate time to be trained and intra- and interindividual (if there are more than one grader) variations are usually measured using a standard set of transparencies. Protocols for quality control procedures used for one study are available.⁹

Grading

Grading of ARM for epidemiological population-based studies can best be performed on stereoscopic color slides of the macular area using standard grids. The grid templates are based on the longstanding clinical convention of considering the diameter of the average optic disk to be 1500 μ m, even though 1800 μ m may be a better estimate. Grading of fundus transparencies is more reliable and provides more objective measures than ophthalmoscopy.^{10,15} The grading system permits detailed refinement with basic standards to allow comparison of data among different studies. It also will form the basis for

modifications using other examination techniques (e.g., fluorescein angiography).

To date, grading systems have used different grids, sizes of concentric grid circles, and numbers and locations of radial lines on the grids.^{2,5,9} Common items in ARM grading have been descriptions of drusen type, size, number, confluence and area of involvement; disappearance of drusen; grading of hyperpigmentation and hypopigmentation; serous or hemorrhagic RPE detachment; RPE tears; retinal hemorrhages; hard exudates; subretinal or sub-RPE hemorrhage; subretinal fluid; epiretinal or subretinal fibrous or glial scar or fibrin; and geographic atrophy. Other lesions such as surface wrinkling retinopathy and peripapillary atrophy also have been graded in some systems. Other groups have also considered the fluorescein angiographic features.

For grading, the sheets of slides are placed on a fluorescent viewing box furnishing light with a Kelvin rating of approximately 6200° (i.e., bluer than sunlight, which has a Kelvin rating of approximately 5400°). This wavelength was chosen because of the observation that light with a lower Kelvin rating, with its more yellow hue, was less suitable for identification of subtle drusen (Klein R, unpublished data). Graders examine the slides with stereoscopic viewers. Those used in most systems provide 5 \times magnification. Combined with approximately 3 \times magnification provided by the fundus camera, this results in a total magnification of 15 \times .

The standard grid (Fig. 1) formed by opaque lines on a transparent background consists of three circles concentric with the center of the foveola and four radial lines in an oblique position. It is superimposed over one member of the stereoscopic pair of field 2 and used to define 10 subfields. The subfields defined by the grid and their proposed names are: the central subfield (within the central circle); the middle subfield (between the central and middle circle) subdivided in superior, nasal, inferior and temporal subfields; the outer subfield (between the middle and outer circle) subdivided in superior, nasal, inferior and temporal subfields; and the midperipheral subfield outside the outer circle within field 2.

The magnification produced by the 30° fundus camera is such that 4.7 mm on the grid corresponds to approximately 1500 μ m in the average fundus. Using this scale, the grid can be defined such that the diameter of the central circle corresponds to 1000 μ m in the fundus of an average eye, and the diameters of the middle and outer

TABLE 2
Grading of Drusen

1.1 *Drusen morphology. Grade highest # present within outer circle.*

- 0) absent
- 1) questionable
- 2) hard drusen ($<C_1$, $125\mu\text{m}$)
- 3) intermediate, soft drusen ($>C_0 \leq C_1$; $>63\mu\text{m} \leq 125\mu\text{m}$)
- 4) large, soft distinct drusen ($>C_1$, $125\mu\text{m}$)
- 5) large, soft indistinct drusen ($>C_1$, $125\mu\text{m}$)
 - 5a) crystalline/calcified/glistening
 - 5b) semisolid
 - 5c) serogranular
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

1.2 *Predominant drusen type within outer circle*

- 0) absent
- 1) questionable
- 2) hard drusen ($<C_1$, $125\mu\text{m}$)
- 3) intermediate, soft drusen ($>C_0 \leq C_1$; $>63\mu\text{m} \leq 125\mu\text{m}$)
- 4) large, soft distinct drusen ($>C_1$, $125\mu\text{m}$)
- 5) large, soft indistinct drusen ($>C_1$, $125\mu\text{m}$)
 - 5a) crystalline/calcified/glistening
 - 5b) semisolid
 - 5c) serogranular
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

1.3 *Number of drusen*

- 0) absent
- 1) questionable
- 2) 1-9
- 3) 10-19
- 4) ≥ 20
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

1.4 *Drusen size*

- 1) $<C_0$ ($<63\mu\text{m}$)
- 2) $\geq C_0 < C_1$ ($\geq 63\mu\text{m}$, $<125\mu\text{m}$)
- 3) $\geq C_1 < C_2$ ($\geq 125\mu\text{m}$, $<175\mu\text{m}$)
- 4) $\geq C_2 < C_3$ ($\geq 175\mu\text{m}$, $<250\mu\text{m}$)
- 5) $\geq C_3$ ($\geq 250\mu\text{m}$)
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

1.5 *Main location of drusen.* Drusen may not be central to indicated subfield, but may be more to periphery.

- 1) outside outer circle (mid-peripheral subfield)
- 2) in outer subfield
- 3) in middle subfield
- 4) in central subfield
 - 4a) outside fovea (center point)
 - 4b) in fovea
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

1.6 *Area covered by drusen in subfield 1.5*

- 1) $<10\%$
- 2) $<25\%$
- 3) $<50\%$
- 4) $\geq 50\%$
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

In some categories, numbers are missing due to similar use of 7) and 8).

TABLE 3
Hyperpigmentation and Hypopigmentation of the Retina

Hyperpigmentation

- 0) absent
- 1) questionable
- 2) present $<C_0$ ($<63\mu\text{m}$)
- 3) present $\geq C_0$ ($\geq 63\mu\text{m}$)
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Hypopigmentation

- 0) absent
- 1) questionable
- 2) present $<C_0$ ($<63\mu\text{m}$)
- 3) present $\geq C_0$ ($\geq 63\mu\text{m}$)
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Main location hyper/hypopigmentation. This may not be central to indicated subfield, but may be more to periphery. Choose most central location.

- 1) outside outer circle (mid-peripheral subfield)
- 2) in outer subfield
- 3) in middle subfield
- 4) in central subfield
 - 4a) outside fovea (center point)
 - 4b) in fovea
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

circle to $3000\mu\text{m}$ and $6000\mu\text{m}$, respectively. The system permits detailed grading of some lesions in each subfield or summary type grading with lesions graded either within the central, inner, or outer circles or in field 2 as a whole.

Five open circles printed on clear plastic (Fig. 2) can be used to estimate size of drusen, area involved by drusen, and area involved by increased or decreased pigmentation, or by AMD as described below. The diameter of C_0 is equivalent to $63\mu\text{m}$ (more or less similar to $50\mu\text{m}$ circles used by some centers for grading), for C_1 it is $125\mu\text{m}$, for C_2 it is $175\mu\text{m}$, for C_3 it is $250\mu\text{m}$, and for C_4 it is $500\mu\text{m}$. The central circle with a diameter of $1000\mu\text{m}$ can also be used. These circles replace those used in a more detailed grading system.⁹

The following grading should only be used when there are signs of ARM present. If lesions such as hard exudates, hemorrhages, hyper- or hypopigmentations are present as a result of other non age-related chorioretinal conditions (see definitions) they should be graded under "other lesions." An overview of the grading for drusen, retinal pigmentary changes, geographic atrophy and neovascular AMD is given in Tables 2 to 5.

TABLE 4
Geographic Atrophy

Presence

- 0) absent
- 1) questionable
- 2) present: $\geq C_2$
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Location. Choose most central location.

- 1) outside outer circle (mid-peripheral subfield)
- 2) in outer subfield
- 3) in middle subfield
- 4) in central subfield
 - 4a) not in fovea (center point)
 - 4b) in fovea
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Area covered

- 1) $\geq C_2 < C_3$ ($\geq 175\mu\text{m} < 250\mu\text{m}$)
- 2) $\geq C_3 < C_4$ ($\geq 250\mu\text{m} < 500\mu\text{m}$)
- 3) $\geq C_4$ and $< 1000\mu\text{m}$ (~central circle of grid)
- 4) $\geq 1000\mu\text{m}$ and $< 3000\mu\text{m}$ (~middle circle)
- 5) $\geq 3000\mu\text{m}$ and $< 6000\mu\text{m}$ (~outer circle)
- 6) $> 6000\mu\text{m}$
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

The predominant drusen type is the most common type of drusen present within the outer circle of the grid. Large drusen ($> 63\mu\text{m}$) should be counted separately, but small drusen should not. The area covered by the drusen can be estimated within each of the three circles in the grid and expressed as percentage of the area within the specific subfields defined by the grid.⁹

Hyperpigmentations of the retina adjacent to the optic disk and surrounding hard drusen are not graded as ARM. The term hypopigmentation of the RPE should be used instead of RPE degeneration or atrophy for depigmentations that do not meet the criteria for geographic atrophy.

Geographic atrophy is an entity different from the hyperpigmentations and hypopigmentations consisting of one or more sharply defined, roughly round or oval areas of RPE hypopigmentation with clearly visible choroidal vessels. It is graded according to presence, location and area covered by it. The minimum area involvement by geographic atrophy is that of a circle of about $175\mu\text{m}$ diameter (C_2) because it is difficult to detect choroidal vessels and determine the edges of the atrophy in smaller areas.

Neovascular AMD may be made up of non-rhegmatogenous sensory retinal detachments or

TABLE 5
Neovascular AMD

Presence

- 0) absent
- 1) questionable
- 2) present
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Typifying features

- 1) hard exudates
- 2) serous neuroretinal detachment
- 3) serous RPE detachment
- 4) hemorrhagic RPE detachment
- 5) retinal hemorrhage
 - 5a) subretinal
 - 5b) in plane of retina
 - 5c) subhyaloid
 - 5d) intravitreal
- 6) scar/glial/fibrous tissue
 - 6a) subretinal
 - 6b) preretinal
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Location. Choose most central location.

- 1) outside outer circle (mid-peripheral subfield)
- 2) in outer subfield
- 3) in middle subfield
- 4) in central subfield
 - 4a) not underlying (in) fovea (center point)
 - 4b) underlying (in) fovea
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

Area covered

- 1) $\geq C_2 < C_3$ ($\geq 175\mu\text{m} < 250\mu\text{m}$)
- 2) $\geq C_3 < C_4$ ($\geq 250\mu\text{m} < 500\mu\text{m}$)
- 3) $\geq C_4$ and $< 1000\mu\text{m}$ (~central circle of grid)
- 4) $\geq 1000\mu\text{m}$ and $< 3000\mu\text{m}$ (~middle circle)
- 5) $\geq 3000\mu\text{m}$ and $< 6000\mu\text{m}$ (~outer circle)
- 6) $> 6000\mu\text{m}$
- 7) cannot grade, obscuring lesions
- 8) cannot grade, photo quality

serous RPE detachments. Without angiography these types of detachments may not be easily distinguishable from one another and they will both be graded as neovascular AMD. They will be graded according to presence, location, and area covered by the lesion.

If neovascular AMD has started in an eye previously classified with geographic atrophy, it is arbitrarily reclassified as neovascular AMD. If from previously demonstrated neovascular AMD, only minimal neovascular signs remain with surrounding geographic atrophy or when only geographic atrophy is visible on subsequent pictures, it still arbitrarily classified as neovascular AMD.

Definitions used in the preceding paragraphs and in the accompanying tables provide a framework to be used in grading of color transparencies for ARM. Extensive training with experienced graders is important prior to using this system in practice.

Summary

There is a need for an internationally accepted nomenclature for ARM as well as for a uniform grading system for cross-sectional, longitudinal or case-control epidemiological studies. The purpose of this report is to describe a proposed grading scheme and stimulate researchers to use this system, or modifications derived from it, that will permit more comparable data collection. In addition, this classification and grading system may be useful to others using supplemental techniques of assessing AMD, such as angiography or histology.

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