Consensus Nomenclature for Reporting Neovascular Age-Related Macular Degeneration Data

Consensus on Neovascular Age-Related Macular Degeneration Nomenclature Study Group

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Purpose: To establish a process to evaluate and standardize a state-of-the-art nomenclature for reporting neovascular age-related macular degeneration (AMD) data.

Design: Consensus meeting.

Participants: An international panel of retina specialists, imaging and image reading center experts, and ocular pathologists.

Methods: During several meetings organized under the auspices of the Macula Society, an international study group discussed and codified a set nomenclature framework for classifying the subtypes of neovascular AMD and associated lesion components.

Main Outcome Measures: A consensus classification of neovascular AMD.

Results: The study group created a standardized working definition of AMD. The components of neovascular AMD were defined and subclassified. Disease consequences of macular neovascularization were delineated.

Conclusions: The framework of a consensus nomenclature system, a definition of AMD, and a delineation of the subtypes of neovascular AMD were developed. Establishing a uniform set of definitions will facilitate comparison of diverse patient groups and different studies. The framework presented is modified and updated readily, processes that are anticipated to occur on a periodic basis. The study group suggests that the consensus standards outlined in this article be used in future reported studies of neovascular AMD and clinical practice.

Age-related macular degeneration (AMD) is a disease complex that is associated with a high risk of blinding complications. The manifestations are variable, and many have been discovered only recently. In 1967, Gass1 provided the first description of many of the pathophysiologic features of neovascular AMD. A few years later, he showed a link between drusen and neovascular AMD.2 In 1970, Gass3, in his first atlas, referred to geographic areas of atrophy, and in 1976, Blair4 described geographic atrophy of the retinal pigment epithelium (RPE) that occurred in “senile macular degeneration,” a former term for AMD. The diagnostic imaging tests at that time were limited to fundus photography and fluorescein angiography, which was a newly described method to evaluate macular disease. Over the 5 decades since Gass’s 1967 article,1 many studies have been performed based on imaging data from various imaging methods, new and old, and have yielded a wealth of information.

Each form of imaging is a source of data that may provide varying amounts of independent information about the structure or physiology of the macula in health and disease and that shapes the concurrent understanding of the underlying pathophysiologic characteristics. The terminology based on fluorescein angiography, used in most of the literature, does not...
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<th>Term</th>
<th>Definition</th>
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<tr>
<td>Age-related macular degeneration</td>
<td>A condition in patients, typically beyond 50 years of age, in which the structure and function of the macula deteriorates. A salient characteristic is the accumulation of extracellular deposits including subretinal drusenoid deposits, basal linear, and basal laminar deposit. These eyes may demonstrate neovascularization or atrophy.</td>
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<tr>
<td>Macular neovascularization</td>
<td>Denotes neovascular disease in the macula from many causes. In AMD, the neovascularization may start in the outer retina, and therefore, the term choroidal neovascularization is not appropriate for the class.</td>
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<tr>
<td>Type 1 MNV</td>
<td>Ingrowth of vessels initially from the choriocapillaris into and within the sub-RPE space. Leads to varying types of PEDs.</td>
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<tr>
<td>Polypoidal choroidal vasculopathy</td>
<td>A variant of type 1 MNV commonly seen in Asian persons. Indocyanine green angiography imaging shows a branching vascular network and aneurysmal dilations of varying number at the outer edge of the expanding lesion. The internal structure of the aneurysmal structures, often termed polyps, is controversial.</td>
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<tr>
<td>Type 2 MNV</td>
<td>Neovascularization that originates from the choroid that traverses Bruch’s membrane and the RPE monolayer and then proliferates in the subretinal space.</td>
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<tr>
<td>Type 3 MNV</td>
<td>Neovascularization that originates from the retinal circulation, typically the deep capillary plexus, and grows toward the outer retina.</td>
</tr>
<tr>
<td>Retinal-choroidal anastomosis</td>
<td>Aberrant connection from the retinal to the choroidal circulation.</td>
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<tr>
<td>Leakage</td>
<td>Exudation of fluid and serum components from a lesion because of the breakdown of the blood—retinal barrier. Fluorescein angiography is a common way to detect leakage because in health, the blood—retinal barrier blocks the extravascular egress of fluorescein from vessels.</td>
</tr>
<tr>
<td>Intraretinal fluid</td>
<td>Leakage in excess of the local capability of removal leading to accumulation of the fluid in retinal thickening and formation of cystoid spaces.</td>
</tr>
<tr>
<td>Subretinal fluid</td>
<td>Leakage in excess of the local capability of removal leading to accumulation of the fluid under the retina. The fluid source generally is from underlying neovascularization in AMD in the context of an intact external limiting membrane.</td>
</tr>
<tr>
<td>Lipid (hard exudates)</td>
<td>Lipoprotein particles that precipitate in the retina related to chronic vascular leakage.</td>
</tr>
<tr>
<td>Subretinal hyperreflective material</td>
<td>Exudation into the subretinal space of material likely comprising serum, fibrin, and inflammatory cells.</td>
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<tr>
<td>Retinal pigment epithelial detachment</td>
<td>A clinically evident separation of the RPE monolayer from the underlying Bruch’s membrane. This can occur from drusenoid material, serous fluid, neovascular infiltration, or blood. Collections of drusen material of more than 350 μm in diameter are called drusenoid PEDs. Serious PEDs are collections of fluid, but in AMD, serious PEDs typically are associated with neighboring MNV. Neovascular infiltration usually is associated with some element of fibrotic tissue and are called fibrovascular PEDs. Elevations with blood are called hemorrhagic PEDs.</td>
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<tr>
<td>Hemorrhage</td>
<td>Extravasation of blood from the neovascular complex located in the sub-RPE, subretinal, intraretinal, or occasionally, preretinal compartments.</td>
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<tr>
<td>Fibrosis</td>
<td>Buildup, in any layers of the retina, the subretinal space, the RPE monolayer, or the sub-RPE space, of tissue with significant collagen deposition.</td>
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<tr>
<td>Rip (or tear) of the retinal pigment epithelium</td>
<td>Disruption with scrolling and contracture of the RPE monolayer, usually occurring in association with a fibrovascular PED, but on rare occasions with a serous PED. For fibrovascular PEDs, the sub-RPE proliferation is thought to contract because of the angioblastic switch, and the tensile force created leads to the rip.</td>
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<tr>
<td>Outer retinal atrophy</td>
<td>Loss of the ellipsoid and interdigitation zones usually with corresponding loss of thickness of the outer nuclear layer. Outer retinal atrophy most commonly occurs after prolonged subretinal fluid accumulation, regression of field of subretinal drusenoid deposit, or over large collections of drusen material.</td>
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<tr>
<td>Retinal pigment epithelial and outer retinal atrophy</td>
<td>Atrophy refers to absence of a clinically normal RPE monolayer, usually by cell death. Therefore, it is not really atrophy, which implies a withering, but rather persistence of cells. In OCT imaging, RPE atrophy is characterized by a loss of the RPE band with associated choroidal hypertransmission. The loss of RPE cells usually is accompanied by concomitant loss of the outer retina. This combination forms RPE and outer retinal atrophy. If the zone of abnormalities is more than 250 μm in diameter, then the condition is termed complete RPE and outer retinal atrophy. If the zone of abnormalities is less than 250 μm, or if the hypertransmission is fragmentary, the eye is said to have incomplete RPE and outer retinal atrophy.</td>
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AMD = age-related macular degeneration; MNV = macular neovascularization; PED = pigment epithelial detachment; RPE = retinal pigment epithelium.
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<th>Old Term</th>
<th>Multimodal Imaging Correlate</th>
<th>Old Term</th>
<th>Color Fundus and Fluorescein Imaging Findings</th>
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<tr>
<td>Type 1 MNV</td>
<td>Type 1 MNV represents areas of neovascular complexes arising from the choroid and imaged with OCT as an elevation of the RPE by material with heterogeneous reflectivity; vascular elements may be seen. OCT angiography shows vessels below the level of the RPE.</td>
<td>Occult CNV</td>
<td>Stripped hyperfluorescence over an area of elevated RPE, which expands to coalesce in the later phases of the angiography.</td>
</tr>
<tr>
<td>Polypoidal choroidal vasculopathy</td>
<td>OCT findings similar to type 1 MNV; however, in some patients, dilated vascular elements at the outer border of the lesion are apparent. Stripped hyperfluorescence over an area of elevated RPE, which expands to coalesce in the later phases of the angiography. The pattern of the RPE elevation may suggest nodules. Indocyanine green angiography shows a branching vascular network with aneurysmal dilations.</td>
<td>Polypoidal choroidal vasculopathy</td>
<td>Stripped hyperfluorescence over an area of elevated RPE that expands to coalesce in the later phases of the angiography. The pattern of the RPE elevation may suggest nodules. Indocyanine green angiography shows a branching vascular network with aneurysmal dilations.</td>
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<tr>
<td>Type 2 MNV</td>
<td>Neovascular complex located in the subretinal space, above the level of the RPE. May be associated with subretinal hyperreflective material and separation of the neurosensory retina from the RPE. OCT angiography demonstrates vascular elements above the level of the RPE.</td>
<td>Classic CNV</td>
<td>Early hyperfluorescence and late leakage that pools in the subretinal space. Neovascular elements may be detected in the very early phase of the angiogram.</td>
</tr>
<tr>
<td>Mixed type 1 and type 2 MNV</td>
<td>OCT findings of both type 1 and type 2 MNV together. OCT angiography demonstrates neovascularization in the sub-retinal pigment epithelial and subretinal compartments.</td>
<td>Minimally classic CNV</td>
<td>Early hyperfluorescence with late leakage and a larger surround of stripped hyperfluorescence that also shows leakage late in the fluorescein angiogram. Difficult to differentiate from type 3 neovascularization.</td>
</tr>
<tr>
<td>Type 3 MNV</td>
<td>Extension of hyperreflectivity from the middle retina toward to level of the RPE associated with intraretinal edema, hemorrhage, and telangiectasis. OCT angiography shows the downgrowth of new vessels toward or even penetrating the level of the RPE.</td>
<td>Retinal angiomatous proliferation</td>
<td>Focal hyperfluorescence associated with intraretinal staining. Often shows fluorescence from deeper layers suggestive of occult CNV. The neovascularization is not necessarily CNV.</td>
</tr>
<tr>
<td>Retinal-choroidal anastomosis</td>
<td>Aberrant connection from the retinal to the choroidal circulation. Course of vessel can be seen occasionally with OCT or OCT angiography. Although visible on fluorescein angiography, indocyanine green angiography often is better at demonstrating the anastomosis.</td>
<td>Retinal-choroidal anastomosis</td>
<td>Aberrant connection from the retinal to the choroidal circulation. Although visible on fluorescein angiography, indocyanine green angiography often is better at demonstrating the anastomosis.</td>
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<td>Leakage</td>
<td>Breakdown of the blood–retinal barrier, typically demonstrated by fluorescein angiography.</td>
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<td>Breakdown of the blood– retinal barrier, typically demonstrated by fluorescein angiography.</td>
</tr>
<tr>
<td>Intraretinal fluid</td>
<td>Cystoid spaces in the retina typically associated with increased retinal thickening. Readily detected using OCT.</td>
<td>Cystoid edema</td>
<td>Thickening of the retina that may be difficult to detect and cystoid spaces that also may be difficult to detect by color photography. Fluorescein angiography shows pooling of dye in some of the cystoid spaces.</td>
</tr>
<tr>
<td>Subretinal fluid</td>
<td>Separation of the neurosensory retina from the RPE by fluid. Readily detected using OCT.</td>
<td>Subretinal fluid</td>
<td>Exaggerated accumulations in the macula may be detected with stereo color photography and also may be suggested by a loss of transparency of the detached retina.</td>
</tr>
<tr>
<td>Lipid (hard exudates)</td>
<td>Yellow-white globular material in or under the retina. OCT shows hyperreflective foci in the retina, some of which are not visible by ophthalmoscopy.</td>
<td>Lipid (hard exudates)</td>
<td>Yellow-white globular material in or under the retina.</td>
</tr>
<tr>
<td>Subretinal hyperreflective material</td>
<td>Exudation in the subretinal space of material that is hyperreflective as compared with fluid.</td>
<td>Not named before OCT era</td>
<td>In extreme cases, material is seen on color photography that is difficult to differentiate from fibrosis.</td>
</tr>
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<tr>
<td>Retinal PED</td>
<td>Several forms of elevation of the RPE monolayer from the underlying Bruch’s membrane. This includes drusenoid, serous, and fibrovascular. Some forms of early type 1 neovascularization produce a relatively flat elevation. Many cases of serous PED show evidence of MNV. OCT angiography is particularly useful in detecting the presence of neovascularization.</td>
<td>Retinal PED</td>
<td>Several forms of elevation of the RPE monolayer from the underlying Bruch’s membrane. These include drusenoid, serous, and fibrovascular. Accurately delineating serous and fibrovascular PEDs can be difficult. Early type 1 MNV with RPE elevation may not be detectable.</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>Blood in the retina, subretinal, or sub-RPE compartments. Exact location of blood apparent in OCT examination.</td>
<td>Hemorrhage</td>
<td>Blood in the retina, subretinal, or sub-RPE compartments. Location of blood can be inferred.</td>
</tr>
<tr>
<td>Fibrosis</td>
<td>White or yellow-white accumulation of material, usually in the subretinal or sub-RPE space. On OCT, the material is hyperreflective and may have a multilaminar appearance.</td>
<td>Fibrosis</td>
<td>White or yellow-white accumulation of material, usually in the subretinal or sub-RPE space.</td>
</tr>
<tr>
<td>Rip (or tear) of the RPE</td>
<td>Area of increased pigmentation from the scrolled RPE adjacent to a zone of decreased pigmentation. During fluorescein angiography, the increased pigmentation blocks the underlying fluorescence, whereas the area denuded of RPE is hyperfluorescent. OCT shows the anatomic configuration of the scrolled RPE and hypertransmission in the denuded zone.</td>
<td>Rip (or tear) of the RPE</td>
<td>Area of increased pigmentation from the scrolled RPE adjacent to a zone of decreased pigmentation. During fluorescein angiography, the increased pigmentation blocks the underlying fluorescence, whereas the area denuded of RPE is hyperfluorescent.</td>
</tr>
<tr>
<td>Outer retinal atrophy</td>
<td>On OCT imaging, loss of the ellipsoid and interdigitation zones associated with thinning of the outer nuclear layer.</td>
<td>Not named before OCT era</td>
<td>No color photograph or fluorescein angiography correlate.</td>
</tr>
<tr>
<td>RPE and outer retinal atrophy</td>
<td>OCT features of outer retinal atrophy and signs of RPE loss to include decrease or absence of the RPE monolayer and hypertransmission into the underlying neovascular lesion and choroid.</td>
<td>Roughly correlates to geographic atrophy</td>
<td>The color photographic definition of geographic atrophy includes a round or oval well-defined area in which the underlying choroidal vessels are seen more easily. In neovascular cases, there is no reason the RPE loss must be round or oval and well defined. The presence of underlying neovascular lesion may block visualization of the choroidal vessels in any case.</td>
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</table>

CNV = choroidal neovascularization; MNV = macular neovascularization; PED = pigment epithelial detachment; RPE = retinal pigment epithelium.
apply to many aspects of the new data obtained by state-of-the-art imaging. Although using multiple imaging methods contributes different viewpoints on macular pathologic features, this expanded capability can give rise to a fractured conceptualization of disease with the potential for varied terminology. Developing a standardized nomenclature system would improve clarity and accuracy of communication and enhance comparability of research results from different centers using diverse imaging methods. To develop a better nomenclature to describe disease, it is necessary to improve the clarity of concepts involved and evaluate these concepts regarding multimodal imaging and known histopathologic characteristics.

Nomenclature systems have been developed by hundreds of organizations and ad hoc working groups to describe disease and treatment, including standardized nomenclature of medicine for clinical terms, bone density, bipolar disorders, radiation therapy, nursing diagnoses, and medical documentation. In ophthalmology efforts have been undertaken to standardize the nomenclature of trauma, uveitis, and anatomic labeling of OCT.

Age-related macular degeneration is a leading cause of irreversible visual impairment despite landmark advances, such as the injection of anti–vascular endothelial growth factor (VEGF) agents for macular neovascularization (MNV), a term recognizing that neovascularization does not necessarily originate from the choroid. As the population continues to age, the incident cases of neovascular AMD are projected to rise. As in other fields, AMD could benefit from standardization of nomenclature that integrates concepts informed by recent advances in imaging technology. Given the rapid rate of change in AMD knowledge, any nomenclature system is likely to be a work in need of periodic revision. To work toward a consensus, a series of group meetings of experts were held under the auspices of the Macula Society. The participants were an international group of retinal specialists, imaging experts, and ocular pathologists.

**Methods**

**Formation of the Classification of Macular Neovascularization Group**

An international team of experts in AMD and AMD imaging research was assembled to address the definitions and classification of atrophy in the setting of AMD. The Classification of Atrophy Meetings group was selected by 3 chairs (S.R.S., G.S., and F.G.H.) using criteria that included a history of relevant publications, recent AMD and imaging research contributions, a track record of success in previous collaborative, consensus efforts, and availability to attend
An extension of this meeting addressing MNV was organized with the addition of 1 additional chair (R.F.S.) in conjunction with the Macula Society and the Federation France Macula. The study group, referred to as the Consensus on Neovascular AMD Nomenclature (CONAN) group, comprised an international panel of retina experts with an extensive publication history in neovascular AMD, representatives of retinal reading centers that have participated in major trials in AMD, and ocular pathologists with a considerable history of neovascular AMD publications.

To start the process, an international working group conducted several meetings to establish the range of concepts pertinent to OCT angiography, particularly the limitations of current imaging methods. The meetings were also attended by imaging scientists from the OCT industry (Heidelberg Engineering, Inc, Franklin, MA; Optovue Inc, Fremont, CA; Topcon Medical Systems, Inc, Oakland, NJ; and Carl Zeiss Meditec, Inc, Dublin, CA) who jointly served as a resource on imaging technologies and their limitations but did not have any influence on the outcome of the deliberations. For the present article, the group prepared preliminary definitions of various disease states before the meeting. Initially, these components were introduced in prepared presentations, which were followed by discussion. From those discussions, a series of schematic drawings of MNV were prepared and distributed for independent grading by the working group members. Initial examination of the responses from experts of this set of schematic images of MNV yielded nearly complete disagreement in terminology. Extensive group discussions were followed by the formation of small groups, each charged with developing definitions for a subset of entities. These definitions were then presented to the

Figure 2. Light microscopy images showing drusen. A, A solitary druse and thick layer of basal laminar deposit (BLamD). Although drusenoid deposits are visible by ophthalmoscopy, BLamD is not typically recognized in the clinic. B, Confluent soft drusen, which are accumulations of BLamD, are clinically evident (toluidine blue, ×100).

Figure 3. Light microscopy images showing neovascularization arising from the choroid. A, Neovascularization in this case proliferates in the potential space under the basal laminar deposit (BLamD) above the trilaminar Bruch’s membrane. B, The ingrowth site is evident as a defect in Bruch’s membrane (arrow) (hematoxylin and eosin, ×250).
larger group and then refined by the group at large until consensus was reached. Additional consultation was obtained from reading centers and authors outside of the meeting group. Definitions for atrophy in the context of neovascular AMD were developed because these lesions are common.

**Results**

**Consensus Definitions**

A list of definitions is shown in Table 1. A comparison of the new terms with older terms developed during the fluorescein angiography era is shown in Table 2. No direct porting of the new terms to the old ones and vice versa exists because newer imaging technologies, such as OCT and OCT angiography, have an ability to detect abnormalities not imaged by color fundus photography or fluorescein angiography and have greater precision for many entities that are imaged using these technologies. Using OCT and OCT angiography does not replace fluorescein angiography or color photography; rather, these additional forms of imaging augment those forms of imaging and provide additional data to improve classification possibilities.

Age-related macular degeneration is a process by which the structure and function of the macula deteriorates over time in association with distinguishing signs and symptoms that typically become evident clinically beyond 50 years of age and do not seem to be secondary to other processes such as pathologic myopia, central serous chorioretinopathy, monogenetic inherited retinal disease, chorioretinal uveitic syndromes or infections, or trauma. The salient characteristic of AMD is the accumulation of extracellular deposits within the macula. Basal laminar deposits are located between the RPE cell’s plasma membrane and its basal lamina (Fig 1). Basal linear deposits are located external to the RPE basal lamina (also known as the lamina densa, as identified by electron microscopy). Both types of deposit occur internal to the inner collagenous layer of the trilaminar Bruch’s membrane. Diffuse thickenings of these deposits may not be detectable by conventional ophthalmoscopy, but mounds of basal linear deposit appear as soft drusen (Fig 2). Subretinal drusenoid deposits are accumulations of material located above the RPE and appear as pseudodrusen. Associated with the extracellular deposits are morphologic changes in the RPE visible by histopathologic analysis and, in more advanced stages, clinical imaging.

In the early phases of AMD, the visual performance may show minimal changes. With time, vitelliform deposit may accumulate, pigment may migrate into the retina, drusen size may increase, and...
hypopigmentation and hyperpigmentation of the RPE may develop. Late phases of the disease include atrophy of the outer retina, thinning and loss of the RPE, and MNV (Fig 3). Neovascular disease can lead to leakage, bleeding, and scarring as well as severe vision loss. Age-related macular degeneration can be asymmetrical; one eye may show manifestations, such as drusen, in the absence of fellow-eye abnormalities. The risk for progression in the eye without AMD stigmata is nearly zero, and accordingly, one should not diagnose AMD in an eye without visible abnormalities. This raises a conundrum: should AMD be diagnosed per eye or per patient? The group elected to consider AMD a disease diagnosed per patient given the use of vitamin supplements and other measures to reduce risk are deployed on a per patient basis.

Neovascularization Subtypes

Macular neovascularization is an invasion by vascular and associated tissues into the outer retina, subretinal space, or sub-RPE space in varying combinations. The ingrowth of neovascularization is generally considered to be pathologic but may have some beneficial secondary effects as well, in that the neovascularization may be an ocular protective response whereby the choriocapillaris is recapitulated to improve a deficient oxygen and nutrient supply. The anatomic location of the neovascularization determined by OCT imaging is used to subclassify the vascular component of the disease process.

Type 1 Macular Neovascularization. Type 1 MNV is an ingrowth of vessels initially from the choriocapillaris into the sub-RPE space (Fig 4). With growth and expansion of the lesion, remodeling and enlargement of the feeding and draining vessels occurs within both the choroid and the lesion. Accompanying the ingrowth is a varying amount of additional cellular elements including fibroblasts, myofibroblasts, and macrophages that seem to participate in the disease process and can lead to formation of fibrotic tissue. With fluorescein angiography, type 1 MNV commonly displays ill-defined regions of multipunctate leakage that correspond topographically to a region of elevated RPE (i.e., stippled hyperfluorescence) and thus was termed occult neovascularization (Fig 5). Indocyanine green angiography may help to visualize some of the vascular structure but often shows just late staining of the lesion, referred to as a plaque. OCT angiography may aid in the visualization of these lesions. Leakage from vessels, hemorrhage, or associated proliferation of fibrotic tissue can cause expansion of a fibrovascular pigment epithelial detachment (PED). The relative role of the induced curvature of the pigment epithelium and other biological alterations on the outer blood—retinal barrier is not yet fully understood. However, in many eyes, increased intralresional hydrostatic pressure coupled with breakdown of the outer blood—retinal barrier leads to exudation into the subretinal space. Intraretinal fluid accumulation may occur in conjunction with breakdown of the external limiting membrane, or VEGF expression may induce intraretinal leakage independently.
In 1973, Sarks reported histopathologic results of eyes with what is now known as type 1 MNV. These patients showed no clinical signs of neovascularization. In 1987, Gass proposed that patients can demonstrate an occult stage of disease (not the same as occult type of neovascularization) in which “the patient is asymptomatic and the new vessels may not be apparent either ophthalmoscopically or angiographically.” With the development of indocyanine green angiography, neovascular plaques with no signs of exudative disease were discovered in fellow eyes harboring soft drusen. Patients with these nonexudative neovascular plaques had a much higher risk of progressing to exudative manifestations than eyes without nonexudative plaques. In 2012, Amissah-Arthur et al found OCT evidence of neovascularization in 88% of eyes before the development of exudation, with conversion occurring up to 35.5 months after initial entry in the study. After this report, Querques et al in 2013 reported cases of neovascularization without exudation in separate examinations separated by 6 months or more and called this form quiescent neovascularization. In 2018, de Oliveira Dias et al reported eyes with nonexudative MNV in swept-source OCT angiographic imaging had a much higher risk of progressing to exudative manifestations than eyes without nonexudative plaques. In 2012, Amissah-Arthur et al found OCT evidence of neovascularization in 88% of eyes before the development of exudation, with conversion occurring up to 35.5 months after initial entry in the study. After this report, Querques et al in 2013 reported cases of neovascularization without exudation in separate examinations separated by 6 months or more and called this form quiescent neovascularization. In 2018, de Oliveira Dias et al reported eyes with nonexudative MNV in swept-source OCT angiographic imaging had a much higher risk of progressing to exudative manifestations than those without manifestations of nonexudative MNV. The CONAN group recognizes nonexudative MNV and that this form of neovascularization could be identified more commonly with advances in imaging technology. The group could not come to a consensus that the designation quiescent was a needed term.

Polypoidal Choroidal Vasculopathy. Polypoidal choroidal vasculopathy is an important subtype of neovascularization defined by a branching vascular network and nodular vascular agglomerations (Fig 6), also called polyps. Although a minority subtype in white populations, it accounts for approximately half of MNV seen in Asia. In polypoidal choroidal vasculopathy, the branching vascular network may have ophthalmologically visible large vessels (Fig 7), some that can be as large as the retinal arcade vessels. At the outer border of the vascular lesion, nodular vascular elements can be present that suggest the appearance of aneurysms. The morphologic features of the vascular lesion is imaged best with indocyanine green angiography and OCT angiography. In the earlier phases of the indocyanine green angiographic sequence, the branching vascular network fills, and next, the dilatations are imaged. Over time, the dye is removed from the circulation and late staining of tissue around the dilatations occurs. Polypoidal choroidal vasculopathy expands slowly in the sub-RPE space over time and may grow to considerable size before having any meaningful impact on vision. The polyps may be pulsatile and are particularly prone to bleed. In OCT angiographic imaging, the aneurysmal dilations may not be imaged, suggesting the flow in these lesions is less than the detection limit for this method of imaging, but the branching vascular network is otherwise imaged. In Asian persons, the typical presentation comprises isolated macular involvement, unilateral, and male preponderance, whereas in white persons, bilateral involvement, female preponderance, and the neovascular lesion originating from the peripapillary region are more common. Because of the slow perfusion dynamics, most polyps remain undetected by OCT angiography.

When polypoidal choroidal vasculopathy was named, the lesion was thought to be a distribution of abnormally dilated choroidal vessels bordered by enlargements called polyps. Shortly thereafter, separate histopathologic reports established that the lesion was the growth of cavernous thin-walled vessels immediately external to
the RPE.\textsuperscript{39–41} above Bruch’s membrane. The word polypl ordi-
narily refers to either a sedentary aquatic invertebrate or a solid
growth of tissue from a mucous membrane, and not a vascular
abnormality. Thus, every word of the term polyploidal choroidal
vasculopathy is incorrect. An alternate term, aneurysmal type 1
neovascularization, has been proposed, but consensus could not be
reached regarding whether polyps were simple aneurysms or more
complicated vascular structures.\textsuperscript{42}

Type 2 Macular Neovascularization. Type 2 MNV refers to the
proliferation of new vessels arising from the choroid into the sub-
retinal space (Fig 8). Although these vessels traverse the sub-RPE
space, the disease process in type 2 neovascularization is domi-
nated by the subretinal portion (Fig 9). These lesion types are
associated with exudation or hemorrhage directly into the sub-
retinal space. Type 2 neovascularization may be a component
of a larger process including other forms of neovascularization in
varying amounts. Type 2 lesions have the fluorescein angiographic
characteristics of early, typically well-defined hyperfluorescence
with late leakage. OCT angiography shows a neovascular network
above the level of the RPE. Type 2 MNV occurs in conditions other
than AMD that affect the RPE, such as angioid streaks, lacquer
cracks, and chorioridopathy.

Type 3 Macular Neovascularization. Type 3 MNV refers to a
dowgrowth of vessels from the retinal circulation toward the
outer retina. Thus, the term choroidal neovascularization is not
accurate for type 3 neovascularization. The vascular proliferation
is suspected to start from the deep capillary plexus in the retina
with the vector of growth extending toward the outer retina.
Increasing blood flow within the angiomaticus proliferation is
supplied by the retinal vessels, which seem to remodel over time to
handle the flow requirements (Figs 10 and 11). Scattered flecks of
intraocular hemorrhage (always outside the foveal avascular zone)
and cystoid spaces are present, both of which may appear before
the neovascularization. The neovascularization has the potential
to leak and bleed. Fluorescein angiography demonstrates
intraocular leakage of fluorescein with potential for cystoid
macular edema, which can be substantial (Figs 12 and 13).
Indocyanine green angiography shows a small hyperfluorescent
lesion, which likely represents descending vessels viewed
axially. OCT shows varying amounts of intraocular edema, which
in some eyes can be widespread compared with any
neovascularization present. OCT angiography shows
proliferation of vessels into the deeper portions of the retina;
although these vessels seem to originate from the deep vascular
plexus, with increasing proliferation and flow, remodeling of the
vessels supplying and draining the neovascularization occurs.
The eyes may also show subretinal fluid and exudation,
subsidence of the retina, and development of a PED, findings
highlighted by available histopathologic results (Fig 14).

Proliferation to the level of the RPE and eventual breakthrough
of this layer can lead to sub-RPE neovascularization with potential
for anastomosis to deeper layers. Although both type 2 and type 3
neovascularization lead to new vessels in the subretinal space, type
3 neovascularization originates from the retinal microvasculature,
whereas types 2 and 1 develop from the choroid. Earlier de-
scriptions of this form of neovascularization varied in content and
used terms including retinal vascular anomalous complex,\textsuperscript{5}
retinal angiomaticus proliferation (also known as RAP),\textsuperscript{12,44}
and occult retinal choroidal anastomosis.\textsuperscript{5}

Retinal-Choroidal Anastomosis. An anastomosis is a vascular
communication between channels that are not ordinarily connected
by means of vessels typically larger than a capillary. These vessels
are a conduit for blood flow through neovascular networks that
allows blood flow either from the retina to the choroid or the
opposite, depending on relative pressure differences. The CONAN
group recommends that the lesion should be named retinal-
choroidal anastomosis, consistent with a retina-to-choroid hierar-
chical naming strategy that does not refer to the directionality of
blood flow. Retinal-choroidal anastomoses are detected commonly
using dye-based angiography, although OCT and OCT angiog-
raphy may prove sufficient.

Neovascular Lesion Nomenclature. Based on the foregoing
descriptions, the CONAN group proposes that the following terms
should be used. Type 3 neovascularization is to be used when the
vascular complex originates in the retina. Type 1 neo-
vascularization is applied when the vessels originate from the
choroid and remain under the RPE. Type 2 neovascularization is
denoted if neovascularization that originates in the choroid breaks
through the RPE to reach the subretinal space. The term type 2 is
derived from the anatomic location of the proliferating neovascular
frond, although blood flow has to transverse the sub-RPE space
to reach the subretinal space. If prominent neovascularization is
present in the subretinal and sub-RPE compartments, the term
mixed type 1 and type 2 neovascularization can be applied (Fig
15). Comparison of the histopathologic features of type 2 versus
a mixed type 1 and 2 lesion is shown in Figure 16. Patients with
mixed type 1 and type 2 lesions can show apparent regression of
the type 2 component after initiation of treatment.\textsuperscript{46} An eye with
type 3 disease that has penetrated the RPE monolayer without
making an anastomosis with the choroidal circulation is said to
have extension of the type 3 disease into the sub-RPE space.
Although the extension is under the RPE, it may not have the same
long-term consequences as does type 1. Some evidence exists that

Figure 7. Light microscopy images showing polyploidal choroidal vascul-
opathy. A, A large lesion with subretinal and sub—retinal pigment epithelium
hemorrhage (hematoxylin and eosin, \( \times 100 \)). B, Area shown in the bounding
box in (A). Note the large thin-walled neovascular vessel (arrow) flanked by
intraocular hemorrhage (arrowheads) (hematoxylin and eosin, \( \times 200 \)).
eyes with type 1 disease may be less likely to demonstrate RPE atrophy than other forms of MNV, even with anti-VEGF treatment. Some eyes may show type 3 neovascularization and a separate unconnected region of another form of neovascularization, for example type 1 neovascularization. This situation may be summarized as type 3/1 neovascularization, in which the “/” is interpreted as meaning “and” in an independent sense.

Exudative Features of Macular Neovascularization

Exudation is a common feature of MNV and can manifest in 4 basic forms: leakage, subretinal fluid, lipid, and subretinal hyper-reflective exudative material (SHRM).

Leakage. Leakage is the release of excess fluid and serum components as the result of the breakdown of the blood—ocular barrier. Leakage is typically detected with fluorescein angiography, in which hyperfluorescence outside of vascular confines is seen to expand in area over the course of the angiographic sequence. The dye may accumulate in tissue, a process called staining, or into fluid filled spaces, termed pooling. The appearance of hyperfluorescence does not necessarily mean that edema is present. It is possible that alteration in tissue function associated with local leakage could be present without overt signs of edema.

Intraretinal and Subretinal Fluid. Intraretinal and subretinal fluid accumulate if the leakage is in excess of local capability to remove the fluid. Intraretinal fluid may accumulate from retinal vasculature leakage or intraretinal neovascularization or diffusion of fluid through the outer retina related to abnormalities of the external limiting membrane and associated structures. The accumulation of subretinal fluid is dependent on removal rates; for example, disturbances in the RPE pump function may contribute to the buildup of subretinal fluid.

Lipid (or Hard Exudates). Lipid (or hard exudates) are lipoprotein precipitates related to chronic vascular leakage. The aqueous component of the leakage may be reabsorbed by different mechanisms that do not remove associated lipoprotein molecules directly. As such, the concentration of lipoprotein molecules may exceed their solubility, resulting in tissue deposition.

Subretinal Hyperreflective Material. Subretinal hyperreflective material is the exudation into or under the retina of material excluding red blood cells, as would be detected by color fundus photography. The material is detected by OCT and appears as regions of featureless accumulations of relatively uniform increased reflectivity. The material may include an admixture of serum, fibrin, and inflammatory

Figure 8. Diagram showing type 2 macular neovascularization. The ingrowth of vessels arises from the choriocapillaris and extends up through the retinal pigment epithelium (RPE) monolayer to proliferate in the subretinal space. To arrive in the subretinal space, the blood flow must traverse the sub-RPE space to reach the plane of neovascularization.
cells. Subretinal hyperreflective material is not hyperautofluorescent, as opposed to vitelliform material, which is hyperautofluorescent. Subretinal hyperreflective material can resolve, but fibrosis can occur in its wake. The presence of SHRM is associated with poorer visual outcomes. Patients with type 2 neovascularization demonstrate exudation directly into the subretinal space. Clues to the presence of type 2 neovascularization in the context of SHRM include a classic pattern on fluorescein angiography, disruption of the external limiting membrane, and intraretinal fluid. Reappearance of SHRM is a sign of recurrent exudative activity resulting from neovascularization.

Lesion Components in Addition to Macular Neovascularization

Classification of the neovascularization concentrates on the topologic features of the new vessel growth but does not describe the resultant lesion. Additional terms are needed to describe the associated lesion components. The separation of lesion features from lesion components is somewhat arbitrary, but historically, exudation such as lipid or SHRM does not inhibit measurement of lesion size when imaged using fluorescein angiography. Lesion components can prevent the proper appreciation of the size of the neovascular lesion as assessed by fluorescein angiography, and so were considered to be part of the larger lesion. With the advent of modern imaging techniques such as OCT angiography, some of these considerations were obviated.

Retinal Pigment Epithelial Detachment. In AMD, RPE detachments are caused by an elevation of the RPE monolayer and its basement membrane from the inner collagenous layer of Bruch’s membrane by sub-RPE fluid, blood, or fibrovascular material. Serous PEDs may occur in the context of nonneovascular AMD, but indocyanine green angiography has shown the large majority in eyes with AMD occur because of neovascularization. The RPE may be elevated by fluid released from the neovascularization, and this may occur eccentric to the neovascular tissue, producing a notched PED where the neovascularization is in the notch. More commonly, the neovascularization is seen adherent to the undersurface of the RPE and its basal lamina. The structure of a fibrovascular PED is dominated by vessels and fibrotic tissue in a complex arrangement, although serous fluid may also be present. OCT and OCT angiography can be used to detect the internal anatomic structure of the PED, and OCT angiography can be particularly effective to image the associated vascular network, particularly if the PED is shallow. A special class of PED, drusenoid PED, is a large druse or a confluence of drusen, with a size at least 350 μm as defined by the Age-Related Eye Disease Study or at least 433 μm as defined in the Age-Related Eye Disease Study 2. Because measurements are typically performed digitally now, instead of using a standard circular

Figure 9. Images showing type 2 neovascularization. A, Fundus photograph from a 74-year-old showing a hyperpigmented ring in the fovea (arrow). B, C, Early-phase fluorescein angiogram showing (B) a well-defined lesion with late leakage and (C) obscuration of the borders of the neovascular lesion. D, B-scan OCT showing the outer retinal lesion with extension of subretinal fluid under the fovea. The ingrowth site through the retinal pigment epithelium is evident (arrow).
Figure 10. Diagram showing initiation of type 3 neovascularization. When the regional proangiogenic—antiangiogenic balances shift in favor of neovascularization, proliferation of vessels occurs along a vector along the vascular endothelial growth factor concentration gradient. The new vessels originate from and invade into tissues below the plane of the deep capillary plexus. Elevated cytokines, particularly vascular endothelial growth factor levels, can induce vascular leakage and intraretinal hemorrhage in addition to stimulating angiogenesis. RPE = retinal pigment epithelium.

Figure 11. Images showing type 3 neovascularization. A, Diagram showing proliferation of vessels posteriorly with formation of what has been called an angiomatous lesion. The vessels supplying the blood flow to the angiomatous proliferation remodel into larger feeding and draining vessels. The edema and hemorrhage in the retina are from both the neovascularization and to increased local tissue levels of vascular endothelial growth factor. Some evidence is present that the retinal pigment epithelium monolayer may not be intact, even before penetration of new vessels into the basal laminar or basal linear material. B, Comparative indocyanine green angiographic image of a patient with an established type 3 neovascular lesion.
measurement, 350 μm would be more convenient. Pigment epithelial detachments can occur in the context of type 1 or type 3 MNV. The association with type 1 may be related to the sub-RPE location of the vessels and potential exudation. The association with type 3 is harder to explain with current knowledge. Although outer retinal exudation from the descending neovascularization may overwhelm the fluid diffusion abilities through Bruch’s membrane, why similar PEDs do not form in the context of type 2 MNV is not known.

**Hemorrhage.** Hemorrhage is an extravasation of blood from the neovascular complex and can be located in the sub-RPE, subretinal, intraretinal, and occasionally preretinal compartments. Fresh blood is red and hypoa autofluorescent. As blood ages, it becomes yellow, does not stain during fluorescein angiography, and also is hypera autofluorescent, in contradistinction to fibrosis, which is not hypera autofluorescent.

**Fibrosis.** The clinical definition of fibrosis is based on color photography and fluorescein angiography and refers to the apparent build-up of tissue in any layers of the retina, including the subretinal space, RPE monolayer, or sub-RPE space, of tissue suspected of harboring significant collagen deposition. The fibrotic region typically stains on fluorescein angiography and is not hypera autofluorescent in autofluorescence imaging. Fibrosis as imaged by color photography or fluorescein angiography has an uncertain OCT correlate at present. Fibrotic tissue as seen by histopathologic examination has not been correlated closely with the clinical imaging but in histologic specimens contains type 4 collagen deposited by fibroblasts, myofibroblasts, and potentially transdifferentiated RPE cells and may be a lesion component in its own right but may be admixed with neovascular tissue. Fibrosis is a part of the wound-healing response that results from numerous cytokines and factors such as transforming growth factor β1, pigment epithelial growth factor, and connective tissue growth factor. Fibrotic tissue is associated with lesion contraction; it has been proposed that a balance between VEGF and connective tissue growth factor may control the behavior of fibrovascular tissue. Higher levels of VEGF in relation to connective tissue growth factor may promote vascular growth, whereas decreases in the ratio may lead to increased fibrosis, scarring, and contracture of that tissue.

**Rip.** Rip (or tear) of the RPE is caused by a tractional dehiscence of the RPE monolayer. It is theorized that contracture of the
sub-RPE fibrovascular tissue leads to sub-RPE traction across the inner chord diameter of the RPE detachment.\textsuperscript{57,58} Tensile forces greater than the structural strength of the RPE monolayer can lead to a tear. The contracture of the fibrovascular tissue may be related to the angiofibrotic switch.\textsuperscript{59} The dehisced RPE monolayer retracts to a varying extent, producing a heaped-up retinal pigment epithelial detachment (arrow) is evident. Note the edema nasal and temporal to the area of neovascularization is greater than that immediately surrounding the new vessels. D, OCT scan of the inferior macula showing edematous thickening of the retina and subretinal fluid. E, Fluorescein angiogram showing a small area of hyperfluorescence corresponding to the hyperreflective area in (C). F, Later fluorescein angiogram showing pooling of dye in cystoid spaces as well as diffuse staining well away from the area highlighted by the arrow in (E). G, Fundus photograph of magnification of the central portion of the involved macula showing the numerous isolated hemorrhages, many of which were in the inner retina. The green arrow shows the section captured by the OCT angiogram in (H). H, OCT angiogram showing the small focus neovascularization found within the outer retina (open arrow). The vertical double arrow is 150 µm. Note that the hemorrhages do not colocalize with the neovascularization.

Figure 13. Images showing type 3 neovascularization with prominent edema and hemorrhage. A, Fundus photograph from an 87-year-old showing dozens of small fleck hemorrhages in the superior and nasal macula. The blue arrows show the location of the structural OCT scans. B, OCT scan of the section through the superior arcade showing expansion of the inner nuclear layer (arrowhead) and Henle’s fiber layer from edema fluid (arrow). C, OCT scan of the section through the superior parafovea revealing edema of inner nuclear layer and Henle’s fiber layer with cystoid spaces (yellow and green asterisks, respectively). Hyperreflectivity within the retina overlying the apex of the retinal pigment epithelial detachment (arrow) is evident. Note the edema nasal and temporal to the area of neovascularization is greater than that immediately surrounding the new vessels. D, OCT scan of the inferior macula showing edematous thickening of the retina and subretinal fluid. E, Fluorescein angiogram showing a small area of hyperfluorescence corresponding to the hyperreflective area in (C). F, Later fluorescein angiogram showing pooling of dye in cystoid spaces as well as diffuse staining well away from the area highlighted by the arrow in (E). G, Fundus photograph of magnification of the central portion of the involved macula showing the numerous isolated hemorrhages, many of which were in the inner retina. The green arrow shows the section captured by the OCT angiogram in (H). H, OCT angiogram showing the small focus neovascularization found within the outer retina (open arrow). The vertical double arrow is 150 µm. Note that the hemorrhages do not colocalize with the neovascularization.
Outer retinal atrophy can be seen in areas overlying large drusen, after regression of SDD, over areas of neovascularization, over areas of fibrosis, and in regions affected by subretinal fluid. Histologic evaluation has shown loss of photoreceptor outer segments, retraction and widening of the inner segments, and loss of the number of nuclei in the outer nuclear layer. In complete outer retinal atrophy (cORA), the ellipsoid zone and the interdigitation zone are not visible, the external limiting membrane may not be discernable, and the outer nuclear layer becomes thinner. In incomplete ORA, a discontinuous loss of the ellipsoid zone has occurred, and the interdigitation zone is typically not visible.

Retinal Pigment Epithelial and Outer Retinal Atrophy. In complete RPE and outer retinal atrophy, an absence of the RPE is present, as manifested in OCT imaging by a loss of the RPE band with associated choroidal hypertransmission in OCT imaging, together with the findings of cORA in a zone of at least 250 μm (Fig 17). Incomplete RPE and outer retinal atrophy is defined in OCT imaging by heterogeneous hypertransmission and associated fragmentary attenuation or loss in the reflectivity from the RPE band with overlying photoreceptor degeneration in a zone less than 250 μm. In patients with MNV with exudation or in treated patients, the extent of RPE loss can be difficult to determine from OCT scans, because it may be difficult to identify with certainty the RPE band when adjacent exudation or fibrosis decreases local contrast. Autofluorescence imaging is very helpful; a region with decreased or absent autofluorescence in the absence of overlying hemorrhage implies a loss of functional RPE cells.

Varying amounts of atrophy are often present in eyes with MNV. Loss of more central macular tissue leads to the use of parafoveal areas for fixation at a cost of decreased visual acuity. Visual acuity is related to the health and proximity that the new retinal locus of fixation has to the macular center. If parafoveal and perifoveal atrophy are present, the patient may retain relatively good visual acuity because the central fovea is intact. Subsequent involvement of the fovea with neovascularization would compromise foveal function, but then the nearest intact area of the retina to establish eccentric fixation may be outside of the anatomic confines of the macula. In these cases, a small area of neovascularization may cause a large loss of visual acuity.

Discussion

Advances in diagnostic imaging and learnings from therapeutic outcomes have substantially changed the understanding of neovascular AMD as a morphologic disease entity. The substitution of largely angiographic definitions by OCT-based feature identification, the insight into the origins of neovascular development including both the retina and choroid, and the differentiation of neovascular and atrophic pathways including their concomitant occurrence are prominent examples of evolution of disease conceptualization and the need for adjustment in AMD terminology. The OCT and OCT angiography findings, both noninvasive methods of imaging MNV, do not correspond directly to the older fluorescein angiographic categories such as classic, occult, or mixed. Over a period of 3 years, the CONAN study group held 3 two-day meetings to achieve consensus on many aspects of AMD. Consultation with outside experts and reading centers was obtained to help harmonize the definitions. The proposed classification has been propelled by advances in imaging technology.
particularly OCT and OCT angiography, which have provided detailed 3-dimensional analysis of the vascular anatomic and topographic characteristics within neovascular AMD lesions. Use of accepted classification and terminology will improve standardization of investigation and reporting of AMD. Better precision in terminology will enhance reporting and comparability of AMD studies. The CONAN group recommends that the consensus standards outlined in this article should be used in future reported studies of neovascular AMD.

A plethora of terms exist in the literature to describe the lesions seen in neovascular AMD, and many of these continue to appear in the current literature. Many of these terms are based on older imaging technologies. For example, the term occult neovascularization is a fluorescein angiographic term describing MNV in which the vessels are not visualized directly but are rather presumed to be present based on certain fluorescein leakage characteristics. This fluorescein angiographic appearance was used to infer that a subtype of neovascularization was present. These fluorescein angiographic imaging characteristics are the result of discernible fluorescence within and in tissue around vessels but are influenced by many associated nonvascular factors, including vessel location, pigmentation, permeability of overlying RPE, and associated hemorrhage and exudation. OCT and OCT angiography techniques afford direct imaging of the anatomic features with precision in evaluating each component, neovascular or not.

Limitations and Challenges for the Future

The classification system is based on current knowledge of neovascularization imaged with contemporaneous imaging capabilities. Producing the most robust models of visual
function, disease severity, and prediction for future vision loss will require additional information from multimodal imaging and cross-correlation with functional data. New research will be required to reach these goals. Over time, knowledge about neovascularization will increase and associated concepts will be refined. Concurrently, imaging will improve, and additional biomarkers may be realized. The current classification provides a method to categorize neovascularization and other lesion components in neovascular AMD and should help to improve standardization and communication among researchers, clinicians, and patients. This new classification should help future studies to be more rigorous and generalizable. It should also help in harmonizing definitions among both reading centers and clinical investigators. The general framework of this classification allows its refinement with the addition of future data, including analysis of accuracy and repeatability of the definitions.

With a classification system in place, a method of grading neovascular AMD disease severity would be possible. Currently, AMD is typically classified into stages, such as early, intermediate, or late.68 The risk of progression from an earlier stage to late disease was analyzed extensively from data obtained in the Age-Related Eye Disease Study and used to create the Beckman classification.67 Late AMD was defined as either geographic atrophy or choroidal neovascularization. Substituting more modern terms, late AMD would be complete RPE and outer retinal atrophy,20 an OCT-defined entity that corresponds roughly to geographic atrophy or MNV. Criticisms of this approach are that complete RPE and outer retinal atrophy and MNV are different conditions with dissimilar pathophysiologies, and therefore, they should not be lumped together. The basis of this staging system was from an era when late AMD implied an extraordinary risk for severe vision impairment. Detecting a neovascular lesion by fluorescein angiography, for instance, generally meant the patient harbored an extreme risk for profound vision loss. The goal was to predict the likelihood of progressing to late disease, not to predict visual function. With modern treatment, stabilization or improvement of visual acuity is likely in patients with MNV, leading to the need to grade disease severity, which is an assessment of the total effect of disease on an organ, both reversible and irreversible. The CONAN group envisions that an extension of proposed terminology to describe disease severity in neovascular AMD and its relationship to visual function will be developed.

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Abbreviations and Acronyms:
AMD = age-related macular degeneration; CONAN = Consensus on Neovascular AMD Nomenclature; cORA = complete outer retinal atrophy; MNV = macular neovascularization; PED = pigment epithelial detachment; RPE = retinal pigment epithelium; SHRM = subretinal hyper-reflective exudative material; VEGF = vascular endothelial growth factor.
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