

# Age-related macular degeneration

## An overview



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**A**ge-related macular degeneration (AMD) is a slow, progressive and painless eye condition. It is the leading cause of blindness in Western societies, with up to a third of the population over the age of 70 affected to some degree. It accounts for almost 50% of those registered as blind or partially sighted in the UK<sup>1</sup>. This article provides an overview of the clinical features, pathophysiology and management including an update on recent treatment developments of AMD.

Age-related maculopathy (ARM) is defined by the International Epidemiological Study Group<sup>2</sup> as a disorder of the macular area, apparent after 50 years of age. Early stages are characterised by discrete whitish-yellow spots identified as drusen, increased pigment or hyperpigmentation associated with drusen, sharply demarcated areas of depigmentation or hypopigmentation of the retinal pigment epithelium and associated drusen. These changes predispose to the development of late stage ARM, referred to as age-related macular degeneration (AMD). AMD is characterised by geographic atrophy, choroidal neovascularisation (CNV), pigment epithelial detachment and fibrous scarring which can occur in later stages.

### Epidemiology and aetiology

#### Prevalence

Ellwein and co workers<sup>3</sup> found that in the UK, 14.1% of all visits to ophthalmologists by those over 65 were for retinal problems. Macular degeneration accounted for the biggest single group. In the USA, estimates of the prevalence of AMD in the elderly population range from four million to 20 million people.

The prevalence of AMD increases with age. The 10-year incidence of AMD in the Beaver Dam Eye Study<sup>4,5</sup> (a population-based study which evaluated 4,926 adults over 43 years living in Beaver Dam, Wisconsin) of early ARM was 12.1% and of late ARM, 2.1%. Individuals 75 years of age or older at baseline had a higher 10-year incidence of the following characteristics than people 43 to 54 years of age: larger sized drusen (125µm-249µm) (26.3% vs. 3.3%); drusen greater than or equal to 250µm (16.2% vs. 1.0%); soft indistinct drusen (22.2% vs. 2.2%); retinal pigment abnormalities (19.5% vs. 0.8%); exudative macular degeneration (4.1% vs. 0%); and geographic atrophy (3.1% vs. 0%).

The prevalence of visual impairment from all causes increased among the elderly and, in particular, the rate of legal blindness increased from 0.1% in people aged 43 to 54 years, to 2% in people aged 75 to 84

years. The Beaver Dam Eye Study also reported that 1.7% of people over 65 years of age had the exudative form of AMD in one eye<sup>6</sup>.

#### Risk factors

**Gender:** In the Beaver Dam Eye Study, women 75 years or older had twice the incidence of early AMD and seven times the incidence of late AMD as men.

**Ethnicity:** Caucasians are more likely to have choroidal neovascularisation than other ethnic groups<sup>7</sup>.

**Genetics:** Several studies have reported that a family history of AMD was the strongest predictor of its presence<sup>8-10</sup>. Mutations in the ABCA4 gene, which encodes a retinal rod protein, can be associated with AMD. The significance of these findings remain uncertain.

**Socio-economic factors:** In the Beaver Dam Eye Study, there was no association between education, income employment status and early and late AMD<sup>11</sup>.

**Smoking status:** Cigarette smoking has been postulated to cause AMD by its depression of antioxidants and alterations in choroidal blood flow and RPE detoxification pathways. In the Rotterdam Study, amongst individuals younger than 85 years, current smokers had a 6.6-fold increased risk of neovascular AMD compared to those who had never smoked. Former smokers had a 3.2-fold increased risk of neovascular AMD compared to non-smokers in this age group. An increased risk of neovascular AMD was found in those who had smoked the most. The Beaver Dam Eye Study also found that people who had smoked more cigarettes were more likely to develop large soft drusen and pigmentary abnormalities than people who had smoked less. In the Blue Mountains Study in Australia, current smokers had an increased risk of five-year incident late ARM lesions and retinal pigmentary abnormalities<sup>12</sup>.

**Environmental factors:** Light toxicity – In the Watermen Study amongst 838 watermen who worked on the Chesapeake Bay, cumulative ocular exposure to blue light, or all wavelengths in the visible spectrum, within the 20 years before examination was

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associated with increased prevalence of late AMD<sup>13</sup>. Other studies did not find an association between increased ultraviolet exposure and development of AMD.

**Ocular factors:** Hyperopia has been suggested as a risk factor for AMD in several studies, including the Eye Disease Case-Control Study and National Health and Nutrition Examination Survey I (NHANES I). However, the recent 10-year report from the Beaver Dam Eye Study did not confirm an association of refractive error with developing AMD.

Increased risk of AMD was found in people reported as having light colour irides in youth, and in those people having dark colour irides in youth which changed to light colour in adulthood<sup>14</sup>. The increased risk is thought to be related to lower levels of protective melanin in the eye.

The Beaver Dam Eye Study and NHANES 1 suggested an association between cataract surgery and AMD<sup>15</sup>. It is possible that the presence of a cataract may be protective against the development of AMD.

**Nutritional factors:** Antioxidants, such as vitamin C, vitamin E and the macular carotenoids, lutein and zeaxanthin, found in green leafy vegetables, may protect against macular degeneration by limiting oxidative damage<sup>16,17</sup>. In some studies, higher blood levels of beta-carotenes and carotenoids were associated with a decreased risk of macular degeneration. A high lipid intake and increased serum cholesterol level, on the other hand, are risk factors for developing AMD<sup>18</sup>. A recent study from the Netherlands showed that the prevalence rate of AMD in patients with low antioxidant intake and low lutein intake was nearly twice as high as that in patients with high intake of these nutrients. Further specification of intake data into quartiles of antioxidant intake and lutein/zeaxanthin intake, showed a clear dose-response relationship<sup>19</sup>.

### Pathophysiology

Metabolic debris, which consists of incomplete degradation and clearance of phagocytosed rod and cone membranes, accumulates in the retinal pigment epithelium (RPE). Progressive engorgement of these RPE cells leads to lipofuscin formation. Cellular breakdown of Bruch's

membrane and the presence of multinucleated cells are thought to play a role in the pathogenesis of choroidal neovascular membrane (CNVM), creating points of minimal or absent resistance in Bruch's membrane through which new vessels can preferentially pass.

The stimulus for CNVM formation appears to involve angiogenic growth factors involved in the initial response to the Bruch's membrane injury<sup>20</sup>. Vessel in-growth may involve metabolic factors released from tissues, mechanical factors acting on the walls of the blood vessels, physical and chemical properties of extracellular matrix, pericyte-endothelial interactions and various peptide-signalling molecules, such as fibroblast growth factor, vascular endothelial growth factor and transforming growth factor beta. Calcification and fragmentation observed in the Bruch's membrane may represent a breach in this anti-angiogenic barrier, facilitating CNVM development.

### Clinical classification

Two main clinical types of AMD exist, referred to as the 'dry form' and the 'wet form'. Blindness is usually associated with the exudative, or wet form of AMD. Amongst eyes with severe visual loss, 80% of cases are due to wet AMD, while 20% are due to the dry form.

The dry, or non-exudative form involves atrophic changes in the RPE and in the photoreceptors accompanied by drusen. Eighty-five percent of AMD patients have dry AMD. The appearance on fundoscopy of dry AMD may include hard drusen, soft drusen, RPE geographic atrophy and pigment clumping. Visual loss may be severe in dry AMD, when geographic atrophy of the RPE develops.

In wet AMD, CNVMs develop under the retina. They leak various fluid and blood components and ultimately cause a disciform scar of the retina. Fifteen percent of patients with AMD have this exudative form.

The Macular Photocoagulation Study (MPS)<sup>21</sup> found that patients, who present with CNVM in one eye and small drusen in the fellow eye, have a 42% risk of CNVM development in the fellow eye within five years. If either large drusen or RPE clumping is present, the risk of CNVM development

increases to approximately 30% within five years. If both large drusen and RPE clumping are present, the risk to the fellow eye increases to nearly 60%.

### Signs and symptoms

Macular degeneration rarely results in complete blindness. Peripheral vision is usually not affected. Patients with early AMD may report slightly blurred central vision, difficulty reading, colour and contrast disturbances and mild metamorphopsia. If geographic atrophy develops, they may note a corresponding central scotoma, which can progress. Patients with exudative AMD experience painless, progressive blurring of central vision. Symptoms may be either acute or insidious in onset.

Patients who develop sub-retinal haemorrhage from a CNVM, will often report an acute onset visual disturbance. They may also complain of relative or absolute central scotomas, metamorphopsia and difficulty with reading.

Patients with non-exudative AMD may have a combination of drusen and geographic atrophy (atrophy of photoreceptors, RPE and choriocapillaries). Those with exudative AMD may have subretinal fluid, retinal pigment epithelial detachments (PEDs), subretinal lipid or subretinal haemorrhage visible in the affected eye. These may be in addition to RPE changes and drusen.

On fundoscopy, CNVM may be visible as greyish or pinkish yellow elevated lesions of varying size. Other signs associated with leakage of CNVM are serous retinal elevation and sub-retinal fluid or lipid. Occasionally, the subretinal haemorrhage can break through the retina and cause vitreous haemorrhage. Additional signs of CNVM include subretinal pigment proliferation, haemorrhagic PEDs, RPE tears, and subretinal fibrosis.

In advanced cases, an area of collection of subretinal fibrosis, known as disciform scar is seen. This often appears as yellow or white. However, it may sometimes be darker in colour. Blood, lipid exudates and localised detachment of sensory retina may be present.

## Management

### History and clinical evaluation

Visual acuity both for distance and near viewing should be recorded and is usually reduced. The Amsler grid should be used to test for central scotoma and metamorphopsia. Evaluation of AMD patients includes slit lamp biomicroscopy with the non-contact lens and/or fundus contact lens.

### Investigations

**Colour photography and fundus fluorescein angiography:** Colour fundus photography and rapid sequence fundus fluorescein angiography (FFA) are the standard investigations. This test is indicated in patients with large soft drusen or signs of wet AMD with symptomatic visual loss because of the possibility of CNVM in these eyes. Subretinal haemorrhage and lipid will block the choroidal fluorescence.

The MPS described two important patterns of CNVMs on angiography. These are 'classic' or 'occult' types of CNVM. Classic CNVMs appear as discrete lesions (lacy pattern) with early hyper-fluorescence and with late leakage of the fluorescein dye into the overlying neurosensory retinal detachment. Occult CNVMs appear as either late leakage of undetermined source or fibrovascular PEDs.

Fibro-vascular PEDs appear on FFA as an irregular elevation of RPE, which is associated with stippled leakage into an overlying neurosensory retinal detachment in the early and late frames of the angiograms. This is as opposed to serous PEDs, which show more rapid homogenous filling of the lesion in the early frames. They have well defined hyper-fluorescent contours.

**Other investigations:** Digital indocyanine green (ICG) video angiography has been available in some centres for several years and may be useful in the evaluation of patients with poorly delineated CNVMs or in the presence of haemorrhage. In either primary, i.e. first occurrence, or recurrent occult CNVM, ICG angiograms in selected cases may allow detection of a more localised area of CNVM or feeder vessels and be a further aid to laser photocoagulation. Unlike fluorescein, the ICG molecule is strongly bound to plasma proteins. This prevents diffusion of the compound through the fenestrated choroidal capillaries thereby facilitating the study of the choroidal circulation. It is therefore useful in studying the choroidal vasculature in patients with retinal haemorrhage. CNVM are seen as localised hot spots or as diffuse hyper fluorescent plaques using this technique.

## Treatment

### Laser photocoagulation

Despite a growing interest in AMD, the options for treatment remain limited. Treatment is currently mainly targeted at the neovascular form of the disease using laser photocoagulation. The MPS and several other studies demonstrated that laser photocoagulation of CNVM helps prevent a large decrease in visual acuity compared to no treatment, i.e. observation. Patients enrolled for laser photocoagulation had extrafoveal CNVM, i.e. those located from 200-2500µm from the foveal centre, or juxtafoveal CNVM, i.e. within 1-199µm from the foveal centre, but not under it<sup>22</sup>. Poorly defined CNVMs were not included in that study.

In the extrafoveal CNVM group, the proportion of eyes with severe visual loss (SVL) (defined as six or more lines of vision on a high contrast test chart) in control versus the treated eyes was:

- 41% control versus 24% in treated group at one year
- 63% control versus 45% in treated group at three years
- 64% control versus 46% in treated group at five years

In the juxtafoveal CNVM group, similarly, the proportion of eyes which experienced SVL in control eyes versus treated eyes was:

- 45% control versus 31% in treated group at one year
- 58% control versus 49% in treated group at three years
- 65% control versus 55% in treated group at five years

Angiography should, ideally, be performed within 72 hours prior to laser photocoagulation, as CNVM morphology and resulting treatment parameters can change rapidly. Patients are monitored periodically, within the first three months after treatment and then as required. They are observed closely for CNVM in the fellow eye. They are instructed to present immediately to the relevant healthcare professional, if any changes in central vision occur, particularly if new metamorphopsia or scotomas on Amsler grid testing, are reported.

The Subfoveal Recurrent CNVM Study<sup>23</sup> addressed the efficacy of laser photocoagulation for extrafoveal or juxtafoveal CNVM which had recurred through the centre of the fovea. Patients with classic, well-demarcated CNVM which had recurred through the centre of the fovea were treated.

1. At three months, the proportion experiencing SVL in the control group compared with treated eyes was 9% versus 14%.
2. At two years, the proportion experiencing SVL was 28% versus 9% (control vs. laser-treated eyes, respectively).

Laser-treated eyes in the subfoveal recurrent studies also experienced treatment benefit with respect to reading speed and contrast sensitivity.

The main limitations of this procedure is that photocoagulation to the foveal centre usually results in immediate loss of vision. Secondly, only a small proportion of patients with recurrences had classical recurrent CNVM on angiography that was eligible for treatment. Furthermore, 50% of the treated patients developed a further recurrent CNVM within two years<sup>24</sup>. Only patients with a small, subfoveal CNVM lesion were treated by this technique due to the blinding central scotoma following laser.

## Novel treatments

### Photodynamic therapy

Photodynamic therapy (PDT) is a newer treatment modality for AMD. This relies on photochemical injury to the vessel wall and selective damage to CNVM. It can be used to treat diseased areas selectively while potentially sparing the overlying retina. PDT offers a potential valuable therapeutic benefit for the treatment of CNVM, especially subfoveal CNVMs<sup>25,26</sup>.

Photodynamic compounds are special compounds which react when stimulated with a specific wavelength of light. An inert substance, usually a benzoporphyrin derivative, is injected into the peripheral bloodstream. After a length of time (minutes or hours), the substance enters all cells of the body, but is then cleared from healthy cells preferentially. The dye remains associated with proliferative cells (such as new blood vessels). A low power laser, calibrated to a specific wavelength of non-thermal red light, then activates the photosensitive drug to form peroxides. The result is cell death in these tissues. The laser is said not to be powerful enough to cause any damage on its own.

Verteporfin (Visudyne®) is one such dye which can be given intravenously. The maximum absorption is near 689nm. The treatment of wet AMD with photodynamic therapy, known as the TAP Study, found that those patients with predominantly classic CNVMs benefited from PDT treatment in terms of a reduction in the risk of losing three or more lines of vision<sup>27</sup>. Over the course of one to three months, the blood vessels treated with PDT may open again and leakage may recur. Re-treatment may thus be required at three-month intervals, if there is evidence of continued leakage from the blood vessels. Stability of vision and resolution of leakage may, nevertheless, be achieved in many of these affected patients. PDT has received approval from the US Food & Drug Administration (FDA) and European agencies. The working party of the Royal College of Ophthalmologists is of the opinion that PDT with verteporfin will benefit selected groups of patients with

'classic' or 'predominantly classic' subfoveal CNV. It is uncertain whether it is necessary to continue treatment once vision has stabilised.

The role of PDT in the UK in the NHS remains limited, at present, by evolving guidelines from the National Institute for Clinical Excellence (NICE) – a special Health Authority for England and Wales and a part of the NHS. Its role is to provide patients, health professionals and the public with authoritative, robust and reliable guidance on current 'best practice'. The recent Final Appraisal Determination (FAD) from NICE recommended that PDT therapy should be made available for patients with wet macular degeneration who have "classic with no occult" CNV and a best corrected visual acuity of 6/60 or better. The change from their earlier recommendation, that only patients with "wholly classic CNV" could be treated, will now allow patients with classic or predominantly classic CNV to receive treatment. However, they recommend that this latter treatment only be undertaken as part of on-going or new clinical studies. Discussions as to the meanings of some of the terms used are continuing at the time of writing. The most up-to-date information can be found on the NICE website at [www.nice.org](http://www.nice.org).

A 15mg vial of verteporfin (sufficient for one PDT treatment) costs £850 (British National Formulary 43, September 2002). The high cost of the dye and the limited health economic and patient quality of life outcomes evidence available to date, are posing issues for NHS practitioners and purchasers.

### Transpupillary thermotherapy

Transpupillary thermotherapy (TTT) involves slowly heating the subfoveal choroidal neovascular complex with the infrared (810nm) diode laser light to occlude the CNVM. The infrared wavelength is thought to penetrate the retina and RPE to maximally affect the CNVM, while minimising thermal injury to the outer retina. Treatment is performed with a large single spot, which covers the entire complex. This technique may play a role in occult subfoveal CNVM in addition to classic CNVM treatment.

### Pharmacological therapy

A balance between endogenous inhibitors and stimulators of angiogenesis normally controls ocular angiogenesis. Angiogenic factors such as vascular endothelial growth factor (VEGF), growth hormone (GH) and insulin-like growth factor (IGF) have been detected in CNVM.

Interferon-alpha is known to inhibit vascular endothelial proliferation and migration in the laboratory. However, it has not proved effective in clinical trials in AMD patients.

Non-steroidal anti-inflammatory agents such as indomethacin, sulindac and steroids have been shown to inhibit

neovascularisation in animal models of CNVM<sup>28</sup>. The outcomes of on-going clinical investigations of intravitreal injections of the steroid drug triamcinolone are awaited. Thalidomide, which inhibits angiogenesis, is also being studied for AMD-related CNVM.

### Radiation therapy

CNVs are composed of endothelial cells, which proliferate more rapidly than the endothelial cells of the retina, and may be more sensitive to radiotherapy than the retinal vasculature. Consequently, radiation therapy has been suggested as a treatment for subfoveal CNVMs.

The recently published Medical Research Council multi-centre study<sup>29</sup> looked at external beam irradiation to subfoveal CNVM. Treatment was given in six fractions to a total dose of 12Gy in 203 patients. The visual outcome among treated patients was little or no different than amongst controls (observation only) at 12 or 24 months after treatment. Similarly, several other non-randomised studies have shown no therapeutic benefits with external beam irradiation treatment.

However, Bergink and co-workers did find some benefit from radiotherapy. They randomised 74 patients with classic, occult or mixed subfoveal CNVM to observation versus external beam irradiation<sup>30</sup>. Six non-standard fractions of 4Gy (total 24Gy) were used. At one-year follow up, 52.2% of the observation group versus 32% of the treatment group lost three or more lines of visual acuity ( $P = 0.08$ ). Six or more lines of visual acuity loss was observed in 40.9% of the observation group versus 8.8% of the treatment group ( $P=0.002$ ).

### Surgery

Macular translocation surgery is designed for patients with potential for central neurosensory retinal function. The procedure should be performed before irreversible damage to the fovea has occurred. In this technique, the retina is shifted away from the underlying subfoveal CNVM. The entire retina is rotated 360°<sup>31</sup>. This is a complex vitreo-retinal surgical procedure and is not without significant risks for intra-operative and post-operative complications. Another technique, described by de Juan et al<sup>32</sup>, involves limited macular translocation. In this procedure, pars plana vitrectomy is followed by detachment of the temporal retina through one or more retinotomies. The retina is reattached after the sclera has been surgically foreshortened.

Direct surgical excision of subfoveal CNVM has also become possible and is currently being studied in the Submacular Surgery Trial in USA. The recently published Swedish study<sup>33</sup> on the surgical removal of sub macular CNV found that such surgery does not appear to improve visual acuity in patients over 50 years of age.

It should be noted that all these surgical



Figure 1.1

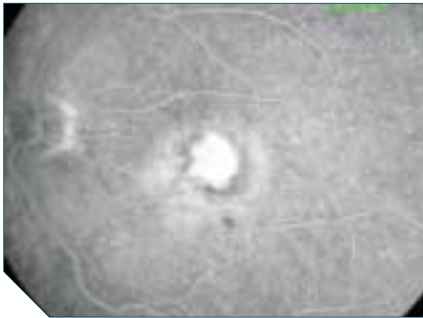


Figure 1.2



Figure 2.1

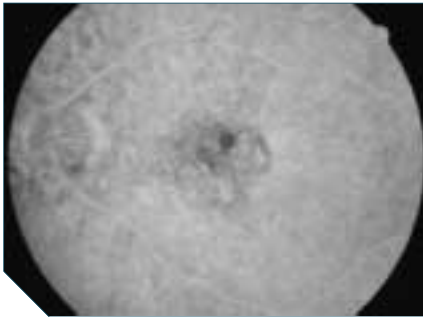


Figure 2.2



Figure 3.1

options are limited. In practice, they require lengthy and complex surgical manoeuvres. Surgery to realign the extraocular muscles is often required in addition to the vitreo-retinal procedure. These procedures are less than ideal for the elderly patients affected by AMD.

### Diet and micro-nutrients

The recently published large Age-Related Eye Disease Study (AREDS) looked at the value of long-term dietary supplementation on severe AMD development<sup>34</sup>.

The AREDS categories were:

- **Category 1.** No AMD; few or small drusen. It should be noted that most people over 60 years have some small drusen.
- **Category 2.** Mild AMD; several small drusen or a few medium-sized drusen in one or both eyes, or pigment abnormalities.
- **Category 3.** Moderate AMD; many medium-sized drusen (63-125 microns) or one large drusen (larger than 125 microns) in one or both eyes.
- **Category 4.** Advanced AMD; advanced AMD, or vision loss due to AMD in one eye only.

Participants in the moderate and advanced, i.e. Category 3 or 4, AMD groups had a lower risk of progression to advanced AMD and visual acuity loss in the good eye if they took both antioxidants (vitamin C 500mg, vitamin E 400IU and beta carotene 15mg) and zinc (80mg as zinc oxide and copper, 2mg as cupric oxide) compared with a placebo for seven years. There is no evidence at present that people with early signs of AMD, i.e. Category 1 or 2 groups, should take supplementation.

The recent Australian study found no protective or deleterious effect of the daily dietary supplementation of 500IU of vitamin E alone on incidence or progression of AMD.

The recent AREDS results suggest that supplementation is beneficial to those patients with Category 3 or 4 AMD. Note, however, that copper supplementation is needed to prevent the copper deficiency anaemia otherwise caused by this high intake of zinc. Secondly, it should be noted that in other studies, beta-carotene has been linked to an increased risk of lung cancer in smokers<sup>35</sup>.

The AREDS findings are drawn from a relatively well-nourished American population. To apply these findings more generally, these results need to be replicated by other large, well-conducted randomised controlled trials in other populations<sup>36</sup>. Studies in the future will need to investigate the use of lutein or zeaxanthin as an alternative to beta-carotene.

Increasing dietary intake of fruits and

vegetables, foods rich in lutein and zeaxanthin, and stopping cigarette smoking, are both beneficial and sensible lifestyle choices which can be recommended to patients.

### Rehabilitation

For the majority of patients, the provision of low vision aids (LVAs) and support from visual impairment community workers is the cornerstone of management. Registration with the local authority, as blind or partially sighted, facilitates access to these and other services<sup>37</sup>. Several types of benefits are available either as of right, or at the discretion of the local authority concerned.

### Referral guidelines

The current Royal College of Ophthalmologists guidelines<sup>38</sup> recommend that as a mild, low risk disease, AMD requires no special management and can be managed in the community. Optometrists should carry out routine examinations and refraction. Reassurance and advice about the value of magnification and lighting may be helpful. Patients do not necessarily require referral to the Hospital Eye Service (HES). Referral is indicated from the primary sector when there is rapidly developing visual failure but still reasonable vision suggestive of exudative disease, which might benefit from urgent assessment and laser treatment. Cases of significant visual loss needing accurate diagnosis, LVA assessment and/or needing partially sighted or blind registration should also be referred to the HES for certification purposes and social needs assessment. Practitioners need to remember that AMD can often be concurrent with other diseases, such as cataract and glaucoma, which need to be identified and treated appropriately.

### Case examples

#### Patient 1

##### Subfoveal CNVM, classical type

A 79-year old female patient presented with a three to four-month history of reduced vision and distortion in the left eye (VA 6/18).

**Figure 1.1** – Fundus photograph of the left eye showing well defined grey lesion at the fovea.

**Figure 1.2** – Mid-phase of the angiogram of the left eye shows predominantly classical CNVM.

Six months later, and after two PDT treatments, vision in the left eye is 1/18.

#### Patient 2

##### Occult subfoveal CNVM

An 82-year old lady was referred with a six-week history of blurred vision and distortion in the left eye (VA 6/18).

**Figure 2.1** – Fundus photograph of the left eye showing irregular elevation of RPE and hemorrhage at the fovea.

**Figure 2.2** – Late phase angiogram of the left eye showing a stippled pattern of leakage and staining at the fovea. This type of CNVM is not amenable to current treatments.

This patient has been advised Amsler grid monitoring of the right eye. VA in the right eye was 6/6 and in the left eye, 6/36 on her last review.

**Patient 3**

**Classical juxtafoveal CNVM**

A 74-year old male with a six-month history of decreased vision and a black shadow in front of the right eye. Vision in the right eye was 6/36.

**Figure 3.1** – Fundus photograph of the right eye showing round grey lesion surrounded by subretinal fluid inferonasal to the fovea (juxtafoveal).

**Figure 3.2** – Early phase angiogram of the right eye, demonstrates early and distinct, well defined hyperfluorescence.

This patient underwent argon laser treatment.

**Figure 3.3** – Fundus photograph of the right eye following laser treatment.

**Patient 4**

**Classical juxtafoveal CNVM with recurrence**

An 80-year old male with a three-month history of reduced central vision and distortion of the right eye. AMD had been diagnosed in the left eye four years previously. Vision in the right eye was 6/18 and in the left eye, 1/60.

This patient underwent argon laser treatment to the right eye, following which the vision improved to 6/12. Three months later, he noticed a sudden deterioration in vision. Vision was 6/60.

He has since been referred for photodynamic therapy.

**Figure 4.1** – Fundus photograph of the right eye shows a greyish area in juxtafoveal location.

**Figure 4.2** – Mid phase angiogram of the right eye, showing leakage of the membrane.

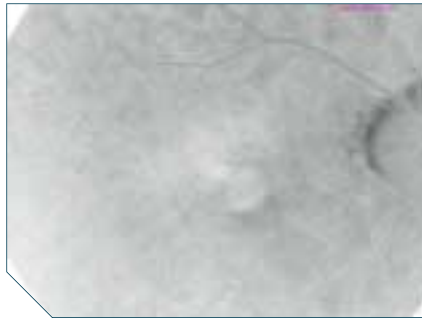


Figure 3.2



Figure 3.3



Figure 4.1



Figure 4.2

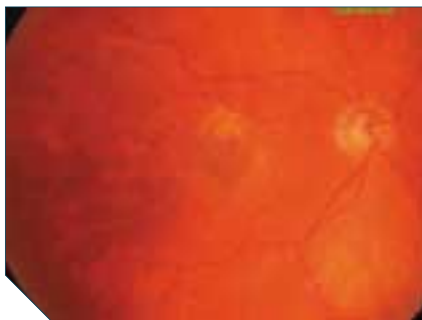


Figure 4.3

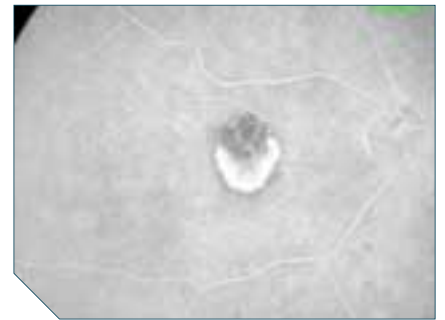


Figure 4.4

**Figure 4.3** – Fundus photograph of the right eye showing a grey lesion (recurrence of SRNVM) with laser scars from previous treatment superior to it.

**Figure 4.4** – Late phase angiogram of the right eye showing laser scar with recurrence of SRNVM inferior to the scar.

**Figure 4.5** – Fundus photograph of the left eye showing a large area of subretinal fibrosis inferonasal to the fovea (disciform scarring).



Figure 4.5

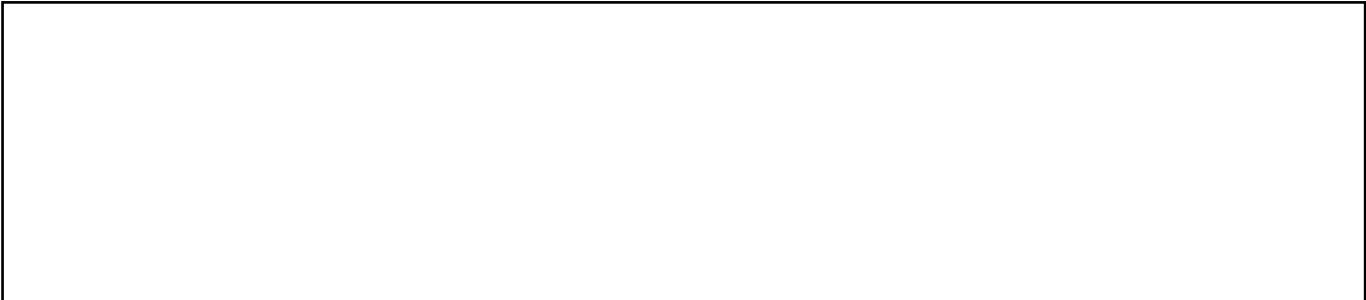




Figure 5.1

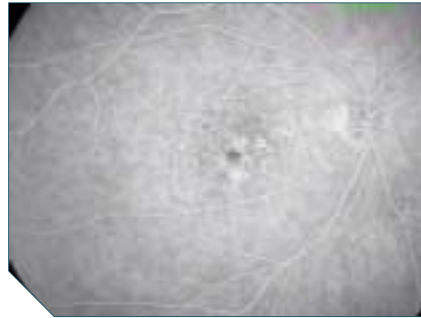


Figure 5.2



Figure 6.1



Figure 6.2

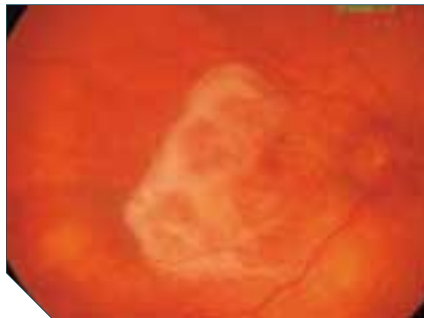


Figure 6.3

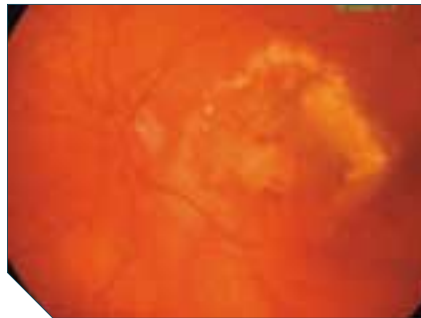


Figure 6.4

### Patient 5

#### Severe dry AMD (soft drusen)

A 66-year old male patient was noticed to have age-related changes in his right eye while he was being reviewed for pigment epithelial detachment in the left eye, which progressed to a disciform scar. He was asymptomatic in his right eye. Vision in the right eye was 6/9 and in the left eye, counting fingers.

This patient was a chronic smoker and was given dietary advice and advised to stop smoking. He was discharged with Amsler grid monitoring.

**Figure 5.1** – Fundus photograph of the right eye showing extensive soft drusen at the macula.

**Figure 5.2** – Mid phase angiogram of the right eye showing staining of the drusen. No leakage was seen.

### Patient 6

#### Mixed and confluent drusen leading to disciform lesion

A 77-year old female patient with symptoms

of decreased vision in both eyes for the past six months. Vision in the right eye was 6/12 and in the left eye, 6/18.

**Figure 6.1** – Fundus photograph of the right eye showing mixed drusen (soft and hard drusen) at the macula.

**Figure 6.2** – Fundus photograph of the left eye showing confluent drusen at the macula.

Three years later, retinal examination showed disciform scarring with subfoveal involvement in each eye. Vision in the right eye was 2/60 and in the left eye, 2/36. She was registered blind.

**Figure 6.3** – Fundus photograph of the right eye showing a large area of subretinal fibrosis at the fovea (disciform scarring).

**Figure 6.4** – Fundus photograph of the left eye showing a large area of fibrosis involving fovea (disciform scarring).

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#### Further reading

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## MCQs

**Age-related macular degeneration - an overview****Please note there is only ONE correct answer****1. Vision loss in age-related macular degeneration (AMD) is:**

- a. slow, progressive, painless
- b. slow, progressive, painful
- c. rapid, progressive, painful
- d. none of the above

**2. The clinical signs of AMD usually include:**

- a. superficial haemorrhages throughout the peripheral retina
- b. soft drusen at the macula
- c. cotton wool spots
- d. atrophic retinal holes

**3. Symptoms of AMD usually include:**

- a. transient total loss of vision
- b. metamorphopsia
- c. flashes and floaters
- d. photophobia

**4. Non-exudative or dry AMD is usually characterised by:**

- a. cotton wool spots
- b. macular drusens
- c. both of the above
- d. none of the above

**5. Exudative AMD is MOST OFTEN characterised by:**

- a. development of choroidal neovascular membrane beneath the retina
- b. development of choroidal neovascular membrane beneath the choroid
- c. both of the above
- d. none of the above

**6. The age group most at risk of AMD is:**

- a. 10-20 years
- b. 20-40 years
- c. 40-50 years
- d. 55 years and above

**7. One of the risk factors for development of AMD is:**

- a. excessive alcohol consumption
- b. smoking
- c. excessive reading
- d. all of the above

**8. A 75-year old patient with disciform macular degeneration in one eye and confluent drusen with pigment dispersion and 6/12 vision in the fellow eye is best managed by:**

- a. initiation of systemic vitamin E therapy
- b. repeat FFA on tri-monthly bases to detect CNVM
- c. self-monitoring with Amsler grid chart
- d. protection from UV light

**9. The most common cause of blindness in the working age group is:**

- a. AMD
- b. diabetic retinopathy
- c. trauma
- d. none of the above

**10. The hazards of cigarette smoking include:**

- a. lung problems
- b. eye problems
- c. cardiac problems
- d. all of the above

**11. Radiotherapy for dry AMD is:**

- a. the subject of a recent MRC trial
- b. readily available
- c. uses magnetic resonance technology
- d. none of the above

**12. Lutein is:**

- a. absorbed from dietary fruits and vegetables
- b. best usually given by slow intravenous injection
- c. both of the above
- d. none of the above

An answer return form is included in this issue. It should be completed and returned to:

CPD initiatives (C4346),  
OT, Victoria House,  
178-180 Fleet Road, Fleet, Hampshire,  
GU51 4DA by March 19, 2003.

Under no circumstances will forms received after this date be marked – the answers to the module will have appeared in our March 21 issue and scores sent electronically to the accrediting bodies. A letter showing your results will be sent for information purposes only.

Enter your answers online at [www.otcpd.co.uk](http://www.otcpd.co.uk) for an immediate result. Credits gained will be sent electronically to the accrediting bodies.