General Optical Council Approved CET for Optometrists
General Optical Council Approved CET for Dispensing Opticians

Diagnosis and management of red fundus lesions

Sam Khandhadia and **Richard Newsom** discuss common red fundus lesions, how to identify them and the most appropriate clinical management. Module C8569, two general CET points suitable for optometrists and dispensing opticians

Red fundus lesions are a common cause for anxiety, as they sometimes herald blinding eye disease. However, most are relatively benign and require little or no active ophthalmic management. Separating the severe from the benign takes time, experience, and courage of conviction. This article gives pointers on which types of red fundus lesions can be monitored in the primary care setting and which should precipitate referral to the Hospital Eye Service (HES).

This article examines the classic red-coloured fundus lesions in order of their location, starting in the vitreous, working backwards to the choroid, and ending with the optic disc. Pointers will be given on how to identify each lesion type. The pathogenesis, likely causes (common and rare), and suggested management for each lesion type will also be discussed. This article was written with information referenced from several ophthalmology textbooks, and readers are encouraged to refer to these for further information.[1-5]

Examination of red fundus lesion

It is best to examine the fundus using stereo-biomicroscopy and a dilated pupil. The authors' choice is a non-contact Volk lens – a 'Superfield'/'Widefield' lens for extramacular lesions and a 66D/'High Mag' lens for the macula. Use of biomicroscopy is essential for accurate assessment as it gives a stereoscopic 3D view of the retina, essential to gauge the depth of the lesion within the retina.

A reasonable level of illumination should be used, since using the lowest level on the slit lamp further reduces the ability to detect retinal thickening. Many patients find the full beam uncomfortable, so a smaller slit – 3mm in height and 1mm in width – can be used. Care must be taken when assessing the macula that photic damage is not incurred, so a relatively short macular examination is recommended. Using the red-free filter on the slit lamp will also help to highlight any abnormal red lesions.

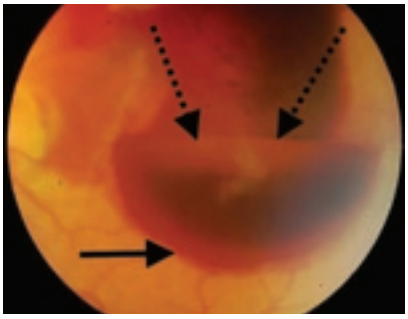

Figure 1 More prominent subhyaloid haemorrhage in front of the macula. Note the crescent-shape (solid black arrow), and horizontal blood level (dashed black arrows)

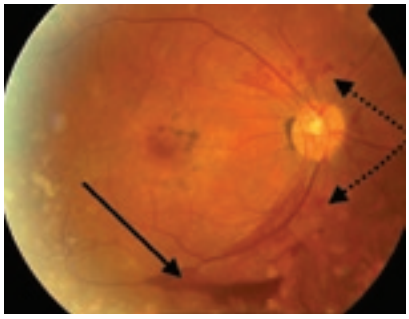

Figure 2 Proliferative diabetic retinopathy with a crescent-shaped sub-hyaloid haemorrhage inferiorly (solid black arrow). New vessels are present at the optic disc (dashed black arrows). Also note the peripheral laser scars (from previous pan-retinal photocoagulation)

Lesions anterior to the retina

Pre-retinal/Sub-hyaloid haemorrhage (Figures 1 and 2)

The term pre-retinal/sub-hyaloid refers to the potential space between the retina and the posterior vitreous face, where blood can collect. Pre-retinal haemorrhage appears as a red, round-shaped lesion, lying anterior to the retina and obscuring the retinal vessels. With time, red blood cells settle and form a fluid level, producing the characteristic crescent, or 'boat-shape' appearance (Figure 1). Occasionally the blood in this space may break through the hyaloid into the vitreous itself, causing vitreous haemorrhage.

The most common cause is bleeding from retinal/disc neovascularisation. In turn, the most common causes of neovascularisation are proliferative diabetic retinopathy (Figure 2) and ischaemic retinal vein occlusion.

Other less common causes include:

- Ruptured retinal artery macroaneurysm
- Trauma
- Valsalva retinopathy (enquire about a previous history of excess exertion, for example weight lifting, blowing up balloons, excessive coughing/straining)
- Terson's syndrome (due to increased intracranial pressure).

A patient with a pre-retinal/sub-hyaloid haemorrhage should be referred immediately to the HES.

Neovascularisation (new vessels) (Figures 3 and 4)

New vessels can arise from the retina or from the optic disc. Retinal new vessels usually begin from veins as a collection of multiple fine vessels on the surface of the retina. Initially these vessels are flat. With time, these new vessels grow towards ischaemic retina, and become elevated, extending into the vitreous. These new vessels often form an intricate network which resembles a carriage wheel – the vessels radiate spoke-like from a point on the retina, and are joined by a circumferential vessel. Peripheral retinal neovascularisation often takes ▶

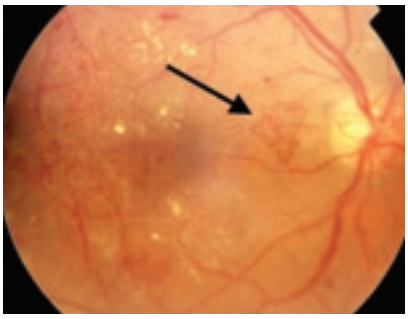

Figure 3 Retinal new vessels (solid black arrow) in proliferative diabetic retinopathy

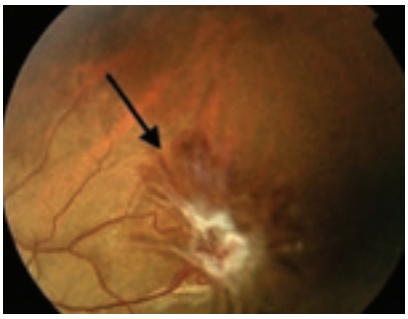

Figure 4 Retinal new vessels (solid black arrows) in SLE

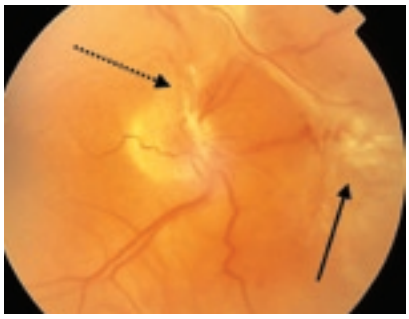

Figure 5 A fibrosed retinal new vessel (solid black arrow) in proliferative diabetic retinopathy. Note also the fibrosed new vessel from the optic disc (dashed black arrow)

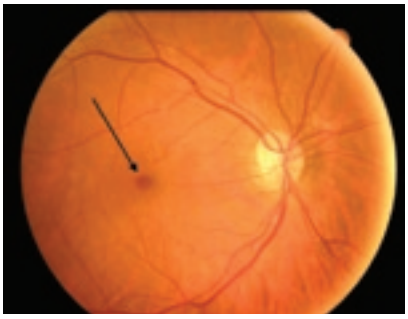

Figure 6 A macular pseudohole (solid black arrow) within an epiretinal membrane (note surrounding wrinkled appearance of retina)

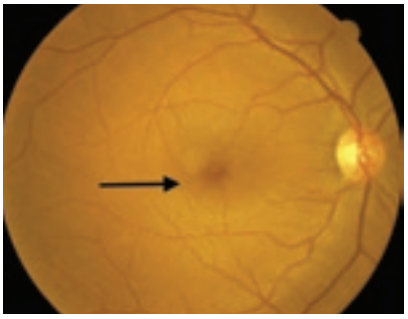

Figure 7 Single red dot, probably a microaneurysm, in a patient with diabetes and normal vision. No signs of leakage. This is graded as M0, or not requiring referral, according to the UK National Screening Committee

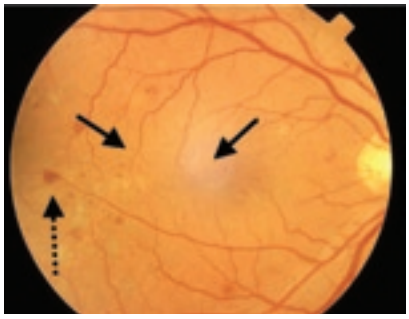

Figure 8 Red dots (solid black arrows) and blots (dashed black arrow) in background diabetic retinopathy. Red dots are more likely to be microaneurysms when surrounded by hard exudates at the macula. Since there are multiple hard exudates at the macula, this patient is graded as M1 according to the UK NSC, and should be referred

on a 'seafan' appearance.

New vessels lack a basement membrane and are prone to bleed, especially if the blood pressure is elevated. Sub-hyaloid or vitreous haemorrhage can occur, adversely affecting the vision. There may be greyish fibrous tissue within the new vessels (fibrovascular neovascularisation). This fibrous tissue can contract, pulling the retina away, causing a traction retinal detachment. This can cause significant visual loss if occurring at the macula

New retinal vessels develop in ischaemic retinal conditions, where there is reduced blood supply to the retina. This produces a host of growth factors, vascular endothelial growth factor (VEGF), which can encourage compensatory new vessel growth.

Common causes include:

- Proliferative diabetic retinopathy (Figure 3): New vessels are associated with features of preproliferative diabetic retinopathy, which include dot/blot/flame haemorrhages, intraretinal microvascular abnormalities (IRMA), venous changes including beading, tortuosity and looping. The patient usually has a known diagnosis of diabetes, but occasionally this may be undiagnosed
- Ischaemic retinal vein occlusion: Features of retinal vein occlusion include a dilated tortuous retinal vein, and haemorrhages in the distribution of the blocked vein. Signs of ischaemia include an RAPD, darker blotchy haemorrhages and cotton-wool spots – see below. The vision may be reduced, with a visual field defect.

Rarer causes include:

- Sickle-cell retinopathy: The patient is usually of Afro Carribean or Mediterranean descent, and has known sickle-cell anaemia
- Previous retinal artery occlusion: Associated features include narrowing of the retinal artery, an RAPD, and a history of sudden reduction of vision
- Ocular ischaemic syndrome: Associated features include dilated veins (not tortuous, as in retinal vein occlusion), narrowed retinal arteries, and cotton- wool spots. The vision may be reduced, associated with pain
- Radiation retinopathy: There will be a previous history of radiotherapy around orbit
- Retinal vasculitis: There will be white inflammatory areas lining the retinal vessel walls, associated with uveitis. The patient may already have a diagnosis of a systemic inflammatory condition, for example systemic lupus erythematosus (SLE) (Figure 4).

Patients with new vessels require urgent HES referral for retinal laser treatment.

Premature babies requiring oxygen therapy can develop a condition called retinopathy of prematurity, which may need laser treatment.

Regressing new vessels (Figure 5)

New vessels can regress, usually following treatment, but can also do so spontaneously. The intricate carriage-wheel appearance will gradually regress, to be replaced by fibrous tissue, until a greyish fibrous stump remains.

Pseudohole (Figure 6)

A pseudohole is a hole in a membrane growing on the surface of the retina, and not within the retina itself. This epiretinal membrane is also called preretinal macular fibrosis, macular pucker or cellophane maculopathy. Look for a sheen over the macula, wrinkling of the retina, and straightening of the surrounding retinal vessels. The pseudohole appears redder than the surrounding retina, since there is less obscuration of the underlying retina at this point by the epiretinal membrane.

An epiretinal membrane is often

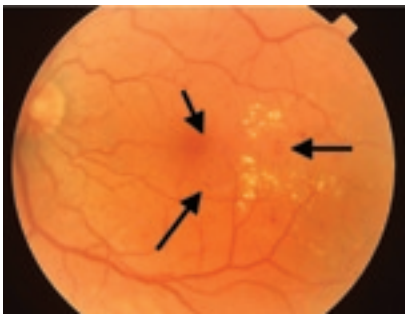

Figure 9 A patient with diabetic maculopathy. There are clusters of microaneurysms (solid black arrows) with secondary hard exudates (dashed black arrow) resulting from leakage. This is potentially more sight-threatening. Again the patient is graded as M1 and should be referred

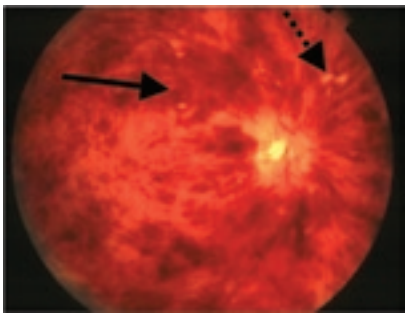

Figure 12 Ischaemic central retinal vein occlusion. There are extensive dark blotchy haemorrhages (solid black arrow). Note also cotton-wool spots (dashed black arrows)

idiopathic. Other causes include:
- Branch retinal vein occlusion
- Retinal laser
- Retinal cryotherapy
- Chronic intraocular inflammation.

A macular hole is a small full-thickness hole in the retina formed by excess vitreous traction on the fovea. The main cause is idiopathic, usually in older females in their 60s or 70s. Other causes include high myopia and blunt ocular trauma. The vision is usually reduced, and the Watzke-Allen test is usually positive (the patient will notice a gap in the middle of a narrow vertical beam of light shone over the hole). There may also be a cuff of intraretinal fluid around the hole.

Tips to help differentiate a pseudohole from a true macular hole include:
- Vision – usually 6/6 or better with a pseudohole
- Watzke test – will be negative with a pseudohole.

Sometimes, the only way of definitely being able to tell the two apart, is with an optical coherence tomogram. The patient should be referred to the HES if this is a new finding, or the vision is worsening.

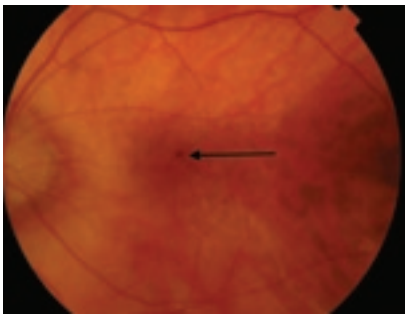

Figure 10 A myopic patient with a single red dot at the centre of the fovea – a Fuch's spot. Note the peripapillary atrophy, which is associated with high myopia

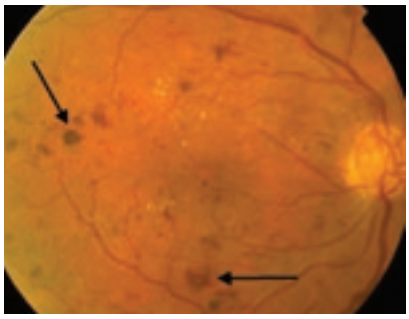

Figure 11 Preproliferative diabetic retinopathy. There are large darker blotchy haemorrhages (solid black arrows). In addition there are dot and smaller blot haemorrhages, with hard exudates

Intra-retinal lesions

Red Dots and blots (Figures 7 to 10)

Small, round, bright-red dots (up to 60 microns – about half of the diameter of the retinal artery at the edge of the optic disc) are typically retinal microaneurysms. These are sac-like dilations of capillaries in the middle layers of the retina. The mechanism for their formation is unknown, but is probably due to basement membrane absorption (by macrophages) and endothelial cell proliferation, triggered by the release of VEGF. If a cluster of microaneurysms form, retinal oedema and exudates can result from active leakage.

Red dots may also represent small intra-retinal haemorrhages from capillaries in the deeper retinal layers, and may be difficult to separate from microaneurysms. However dot haemorrhages are generally larger, more irregular, and do not leak. Both single microaneurysms and intraretinal haemorrhage are relatively transient phenomena within the retina, and a single lesion may not indicate serious retinal disease.

Red blots are larger haemorrhages which originate from bleeding from the deep retinal capillaries. They are darker than dot haemorrhages since they spread across the whole retina (dot haemorrhages are more superficial).

The commonest cause of red dots/small blots is background diabetic retinopathy (Figures 7 to 9). Associated features include hard exudates. Diabetes may or may not have been previously diagnosed. In a patient with known diabetes, referral to the HES is recommended by the National Screening Committee (NSC)[6] if the following are noted:
- Red dots/blots within one disc diameter of the centre of the macula in association with decreased vision (6/12 or worse)
- Associated retinal thickening or hard exudates within one disc diameter of the macular centre
- A group or circinate pattern of exudates anywhere within the macula.

A patient without these features is graded M0 (Figure 7), does not require referral, and can be reviewed annually. If any of these features are present, then the patient is graded as M1 (Figure 8) and should be referred to the HES.

Other causes of red dots/blots include:
- Retinal vein occlusion
- Age-related macular degeneration: The patient will be over 50, and may have reduced central vision with distortion. Associated signs include subretinal and sub-RPE haemorrhages, bilateral drusen, macular pigment changes – including both atrophy and hyperpigmentation. The patient needs referral to the HES soon to rule out choroidal neovascular membrane – see below
- High myopia: The patient will have a red or pigmented spot at the centre of the fovea, called a Fuchs' spot (Figure 10). The patient may have reduced central vision with distortion. Associated with peripapillary myopic crescent, optic disc tilt, chorioretinal atrophy. The degree of myopia is usually in excess of 8 dioptres. The patient needs referral to the HES soon to rule out choroidal neovascular membrane
- Ocular ischaemia syndrome
- Radiation retinopathy
- HIV retinopathy. This is usually associated with cotton-wool spots, and other viral retinitis.

In patients with an isolated single dot or small blot haemorrhage and good vision, referral to the HES is probably not indicated. The patient needs referral to their GP for diagnosis and management of any underlying diabetes, hyper-

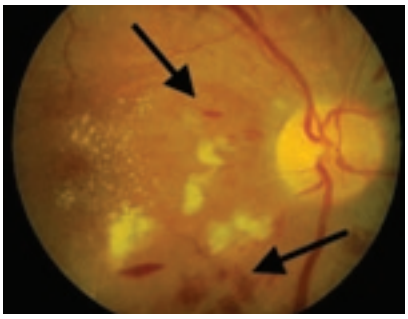

Figure 13 The patient has multiple flame haemorrhages (solid black arrows) with dilated veins, cotton wool spots, and a macular star, due to hypertensive retinopathy

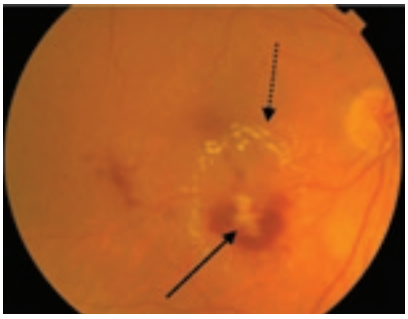

Figure 16 A macroaneurysm (solid black arrow) originating from the inferotemporal retinal artery. Note the centre of the macroaneurysm here appears yellow – this may be due to coagulation of the macroaneurysm, or reabsorption of red blood cells from a chronic haemorrhage. There is surrounding haemorrhage and hard exudates (dashed black arrow) extending to the centre of the macula, which may affect the patient's central vision

tension, and cardiovascular disease. If, however, there are any associated signs (as described above), or the vision is reduced, then the patient should be referred.

Large blotchy intraretinal haemorrhage (Figures 11 and 12)

Large blotchy intraretinal haemorrhages usually indicate deep retinal ischaemia. The most common causes are:

- Pre-proliferative diabetic retinopathy (Figure 11)
- Ischaemic retinal vein occlusion (Figure 12).

Large blotchy haemorrhages should be referred to the HES, since they indicate more severe retinal ischaemia.

Flame-shaped/splinter haemorrhages (Figures 13 to 15)

These are haemorrhages in the superficial retinal nerve-fibre layer, and are bright red in colour. They follow the nerve fibres, the anterior edge being serrated or 'flame-shaped'. Typically they occur in groups, usually spreading from the optic nerve (where the nerve fibre layer is thickest).

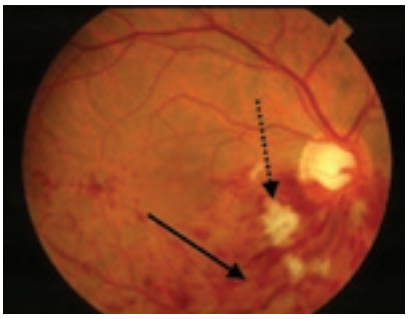

Figure 14 Inferotemporal branch retinal vein occlusion. There are extensive flame haemorrhages (solid black arrow), as well as cotton wool spots (dashed black arrow)

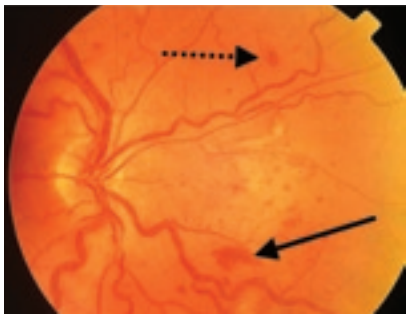

Figure 15 A patient with preproliferative diabetic retinopathy. There is a large flame haemorrhage at the inferior macula (solid black arrow). Other associated signs include blot haemorrhages (dashed black arrow) and dilated, tortuous veins

Common causes include:

- Hypertensive retinopathy (Figure 13): Associated with arteriolar narrowing, arteriovenous nipping, copper/silver wiring of the artery due to arteriosclerosis, and cotton-wool spots. Blood pressure will be greater than 140/90
- Retinal vein occlusion (Figure 14)
- Pre-proliferative diabetic retinopathy (Figure 15).

Less common causes include:

- Retinal vasculitis.

Flame haemorrhages also form around the optic disc. If a flame haemorrhage is seen, a dilated fundus examination should be carried out looking for any other retinal pathology. If only one flame haemorrhage is seen with normal vision, then a GP referral for assessment of hypertension, diabetes and cardiovascular disease can be made. If more than one flame haemorrhage is seen, or if the vision is reduced, then referral to the HES is indicated as well.

Localised peripheral retinal haemorrhage

Isolated peripheral haemorrhage may be due to diabetic retinopathy or retinal vein occlusion. However other specific causes should be considered:

- Posterior vitreous detachment: The patient will present with sudden onset of floaters and flashing lights. Associated signs include vitreous condensation and a Weiss ring. The vitreous may pull on a blood vessel, causing localised haemorrhage. Occasionally the blood vessel may be pulled away from the retina and a retinal tear can form. The patient should be referred urgently to the HES to rule out a retinal tear
- CMV retinitis: This is a rare finding, and occurs in immunosuppressed patients, for example in AIDS. There will be retinal necrosis (death) associated with haemorrhages, the so-called 'pizza' appearance. Urgent HES referral is indicated.

Widespread peripheral retinal haemorrhages

If widespread peripheral retinal haemorrhages are seen, consider the following diagnoses:

- Diabetic retinopathy
- Central retinal vein occlusion
- Hypertensive retinopathy
- Ocular ischaemia syndrome
- Radiation retinopathy
- Leukaemia (this can be associated with cotton-wool spots, Roth's spots, vein occlusion, and choroidal/retinal/vitreous infiltrates)
- Shaken baby syndrome (in a child)

HES referral is indicated in all cases.

Retinal artery macroaneurysm (Figure 16)

A retinal artery macroaneurysm appears as localised dilatation of a retinal artery, within the first three orders of branching of the arterial tree. It may be large, even several times larger than the associated retinal artery. There may be associated surrounding hard exudates and haemorrhage due to leakage. The vision may be affected if leakage of blood or serous fluid occurs at the macula – a large haemorrhage may cause a sudden drop in vision. Haemorrhage can be subretinal, intraretinal, preretinal, or can break into the vitreous; this may mask the view of the macroaneurysm. The condition is uncommon, and usually occurs unilaterally in elderly females with systemic hypertension. It usually occurs as an isolated finding, but is occasionally associated with previous retinal artery or vein occlusion. The patient should be referred to the HES, and to the GP for blood pressure control.

Telangiectasia (Figures 17 and 18)

The word telangiectasia literally means dilated end of a vessel. They appear as irregular dilated flat capillaries within the retina.

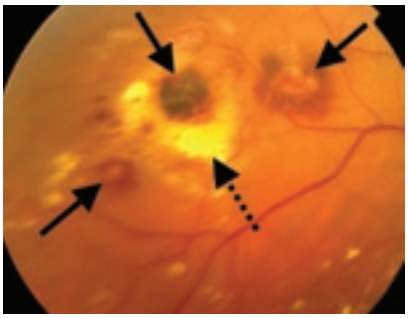

Figure 17 Coat's disease. There are abnormal dilated retinal vessels (solid black arrows) with secondary exudation (dashed black arrow)

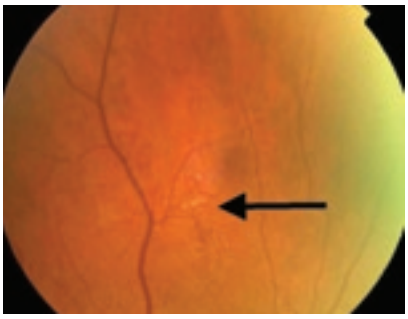

Figure 18 IRMA in preproliferative diabetic retinopathy, present in the peripheral fundus (solid black arrow)

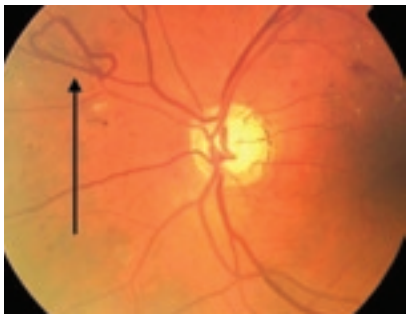

Figure 19 A prominent omega-shaped venous loop (solid black arrow) in the retinal peripheries in preproliferative diabetic retinopathy

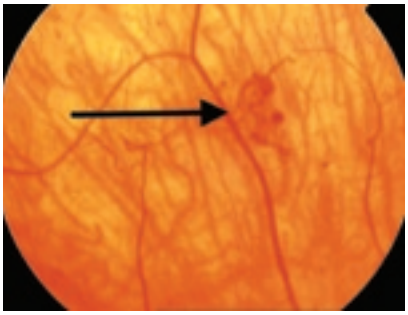

Figure 20 Raspberry-like abortive neovascular outgrowths in proliferative diabetic retinopathy (solid black arrow)

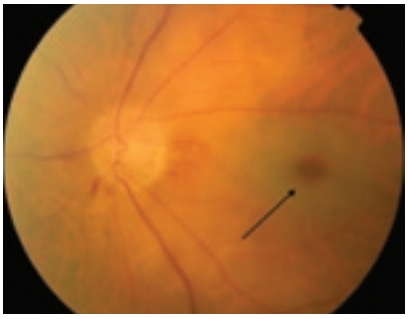

Figure 21 Cherry-red spot (solid black arrow) in central retinal artery occlusion. Note also the attenuated retinal arteries and optic disc haemorrhages

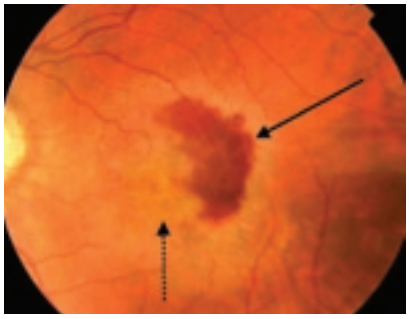

Figure 22 Subretinal haemorrhage (solid black arrow) secondary to exudative age-related macular degeneration. Note surrounding yellow-greyish area (dashed black arrow) probably indicating elevated / thickened retina

Commoner causes include:

- Diabetic retinopathy
- Retinal vein occlusion: 'collateral'/'shunt' vessels – these are thought to be dilated pre-existing vessels which help drain blood away from the blocked vein into another vein.

Rarer causes of telangiectasia include:

- Radiation retinopathy
- Coats' disease (Figure 17): A rare condition which occurs in boys/young men. Dilated retinal vessels are present unilaterally. There is usually secondary exudation, which can be severe)
- Leber military aneurysm. This is thought to be a milder form of Coats' and is typified by light bulb-shaped dilated vessels in the temporal peripheries
- Idiopathic juxtafovealar telangiectasia. This rare condition tends to be associated with symmetrical bilateral telangiectasia temporal to fovea, involving area less than 1 disc diameter. The patient is typically 50-60 years old.

A patient with previously undiagnosed telangiectatic vessels should be referred to the HES.

Intra retinal microvascular anomalies/abnormalities (Figure 18)

IRMA are a feature of preproliferative diabetic retinopathy. They appear as tortuous, irregular, fine small vessels within the retina, within/adjacent to areas of retinal ischaemia. They develop as a compensatory response to retinal ischaemia, in an effort to try to replenish the reduced blood supply. They have been termed IRMA, since it is uncertain if they are dilated pre-existing dilated capillaries, or early intra-retinal (non-elevated) new vessels.[7] Note that IRMAs, unlike definite neovascularisation, are present within the retina and do not cross the major retinal blood vessels. Sometimes, fluorescein angiogram may be the only way of differentiating the two – definite new vessels will leak profusely, whereas there will be an absence of leakage from IRMA.

Venous looping (Figure 19)

A retinal vein may form an 'omega'-shaped loop. This is a feature of ischaemic retinal conditions, such as preproliferative diabetic retinopathy.

Abortive neovascular outgrowths (Figure 20)

These are small raspberry-like lesions lying on the retina, typically associated with proliferative diabetic retinopathy in the presence of a posterior vitreous detachment. The lack of vitreous architecture, leads to an abortive outgrowth of blood vessels. These should be referred for HES assessment.

Roth's spots

Roth's spots are haemorrhages with a central white area. They are uncommon, and can occur in diabetic retinopathy, leukaemia, infective endocarditis, and HIV retinopathy. The cause of the white centre varies according to the condition. In infective endocarditis, it may represent a tiny abscess due to septic emboli, given off by diseased heart valves, which then lodge in retinal arteries. This damages the capillary wall, resulting in focal haemorrhage. In leukaemia, the white centre may be a collection of abnormal leukaemic white blood cells. In other conditions, a Roth's spot may be a cotton-wool spot or a platelet/fibrin plug (resulting from damage to a capillary wall), surrounded by haemorrhage. A Roth's spot can also be formed from central reabsorption of a previous haemorrhage. The patient needs same-day referral to eye casualty and medical work up for infectious endocarditis.

Retinal capillary haemangioma

This is a rare finding. It is a benign tumour of the retinal blood vessels. It appears as a spherical berry-like red lesion, with a prominent, dilated, tortuous feeder artery and draining

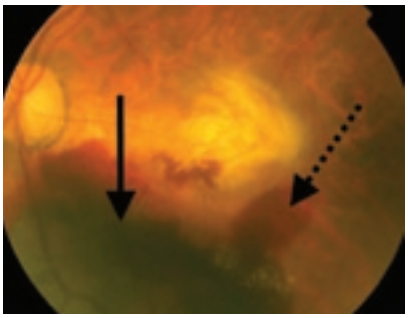

Figure 23 Extensive sub-RPE haemorrhage inferior to the macula (solid black arrow), in exudative age-related macular degeneration. Note the brighter adjacent subretinal haemorrhage (dashed black arrow) and subretinal fibrosis at the macula

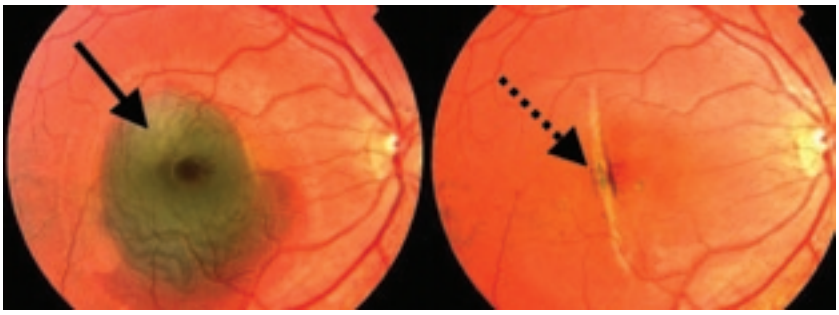

Figure 24 Dark subchoroidal haemorrhage at the macula (solid black arrow) secondary to trauma. Underlying choroidal rupture visible after resorption of haemorrhage (dashed black arrow)

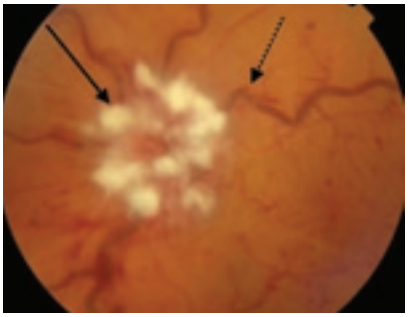

Figure 25 Prominent optic disc swelling due to central retinal vein occlusion. Note the cotton-wool spots and splinter haemorrhages surrounding the optic disc (solid black arrow). Also note the dilated tortuous veins (dashed black arrows), and the peripheral retinal haemorrhages due to the vein occlusion

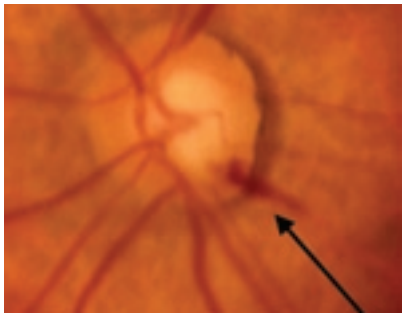

Figure 26 A splinter disc haemorrhage (solid black arrow) in glaucoma. Note the cupped optic disc

vein. It can also occur at the optic disc. Patients with multiple haemangiomas in both eyes are likely to have a rare genetic condition called Von Hippel-Lindau syndrome, which is associated with kidney tumours. HES referral is indicated.

Cherry-red spot (Figure 21)

A cherry-red spot is essentially a normal appearing fovea surrounded by abnormally pale retina. As a result the fovea stands out more. The most common cause is acute central retinal artery occlusion (Figure 21). This is associated with sudden loss of vision, an RAPD, attenuated retinal arteries, and pale swollen oedematous retina. The retina becomes pale and swollen from sudden ischaemia. However the retina at the fovea is much thinner, so does not swell up much. Of course the patient should be referred urgently to the eye casualty department.

Rarer causes of a cherry-red spot include the 'storage diseases', in which abnormal material builds up within the retinal layers, giving a paler appearance, for example Tay-Sachs disease. Again, since the fovea is thinner than the surrounding retina, it tends to retain a relatively normal appearance.

Sub-retinal lesions

Sub-retinal haemorrhage (Figure 22)

These large, bright red haemorrhages lie under the retina between the neural retina and the retinal pigment epithelium (RPE) layer. The retinal blood vessels can be seen overlying the haemorrhage, and give a vital clue to its level within the retina. They tend to have indistinct borders, since the neural retina is not tightly bound to the underlying RPE, and usually occur at the macula. If blood collects, then the area may be elevated.

The most common cause is choroidal neovascular membrane (CNV). These are abnormal fragile blood vessels, which originate from the choroid. A CNV appears as a grey-green/pink-yellow, slightly elevated area at the macula, associated with retinal thickening, hard exudates, haemorrhagic PED, and occasionally vitreous haemorrhage. The most common cause of CNV is exudative AMD (Figure 22).

Other more rare causes of CNV include:

- High myopia
- Trauma: Associated features include a previous history of severe ocular blunt trauma, and presence of choroidal rupture – a yellow-white crescent at the posterior pole, usually around the optic disc
- Previous macular laser (Look for laser scars)
- Presumed ocular histoplasmosis syndrome (POHS): This is associated with round yellow-white punched out spots in the retina, and peripapillary atrophy
- Angioid streaks: These appear as bilateral reddish-brown/grey bands radiating spoke-like from the optic disc, and are associated with rare conditions such as pseudoxanthoma elasticum.

Other causes of sub-retinal haemorrhage include:

- Ruptured retinal artery macroaneurysm
- Coat's disease
- Sickle cell retinopathy.

Sub-retinal pigment epithelium (RPE) haemorrhage or haemorrhagic pigment epithelial detachment (Figure 23)

These haemorrhages are brown/dark red, well demarcated and appear elevated; retinal blood vessels overlie the blood. They appear darker than sub-retinal haemorrhages (since they lie under the pigmented RPE), and usually occur at the macula. A sub-RPE haemorrhage usually originates from CNV.

Choroidal haemorrhage (Figure 24)

These are dark red haemorrhages which are frequently extensive. They ▶

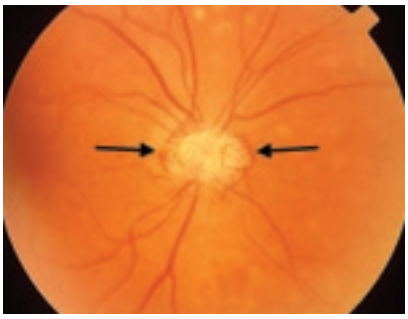

Figure 27 New vessels growing forwards into the vitreous from the optic disc (solid black arrows) in proliferative diabetic retinopathy

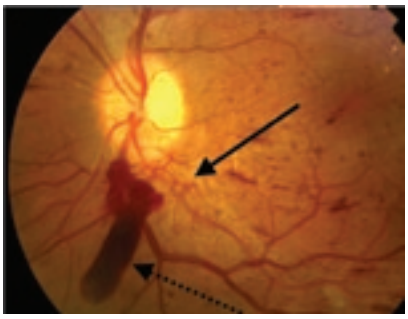

Figure 28 Another patient with proliferative diabetic retinopathy and new vessels from the disc (solid black arrow), bleeding into the vitreous (dashed black arrow)

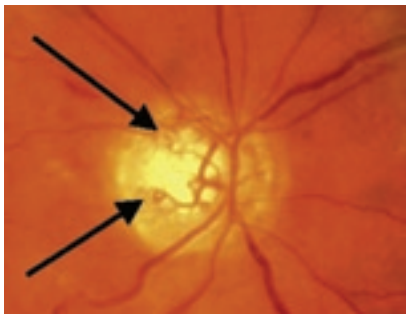

Figure 29 Optic disc collateral vessels in old central retinal vein occlusion

are rare, and occur due to blunt ocular trauma (look for an associated choroidal rupture – Figure 24), or as a complication of retinal detachment surgery during drainage of subretinal fluid.

Optic disc lesions

Optic disc haemorrhages (Figures 25 and 26)

Optic disc haemorrhages usually appear as splinter/flame haemorrhages on/around the disc due to the thick nerve fibre layer present here. It is important to rule out optic disc swelling. Associated signs of disc swelling include: blurring of the disc margin, elevation of the disc, obscuration of the retinal blood vessels, peripapillary cotton-wool spots.

The more common causes of optic disc swelling include:

- Papilloedema: This is bilateral optic disc swelling due to raised intracranial pressure. Associated features include central visual field defect, reduction in colour vision, and loss of spontaneous venous pulsation at optic disc. The patient may experience transient visual loss, headaches, and be systemically unwell. Causes include intracranial space-occupying lesions, and meningitis
- Optic nerve ischaemia: Damage occurs when there is sudden reduction in the optic nerve blood supply. There will be associated optic disc pallor and an RAPD. The patient will present with unilateral reduction in vision. Causes include giant cell arteritis, hypertension
- Papillitis: This is inflammation of the optic nerve and is associated with a hyperaemic swollen optic disc, unilateral reduction in vision, and pain on eye movement. Causes include multiple sclerosis, diabetes, and SLE
- Central retinal vein occlusion (Figure 25).

Optic disc swelling needs urgent referral to the HES.

Other causes of optic disc haemorrhage include:

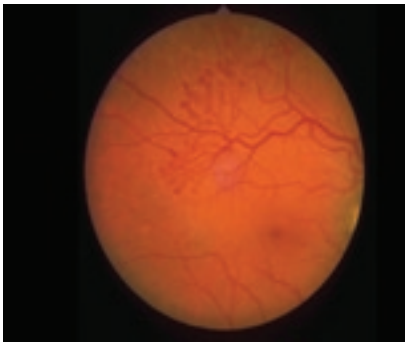

Figure 31 'Seafan' of new vessels in sickle-cell retinopathy

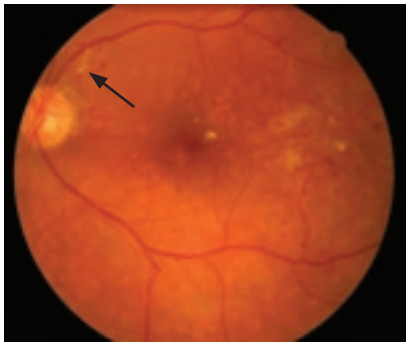

Figure 32 New vessels at the disc in regression after laser treatment

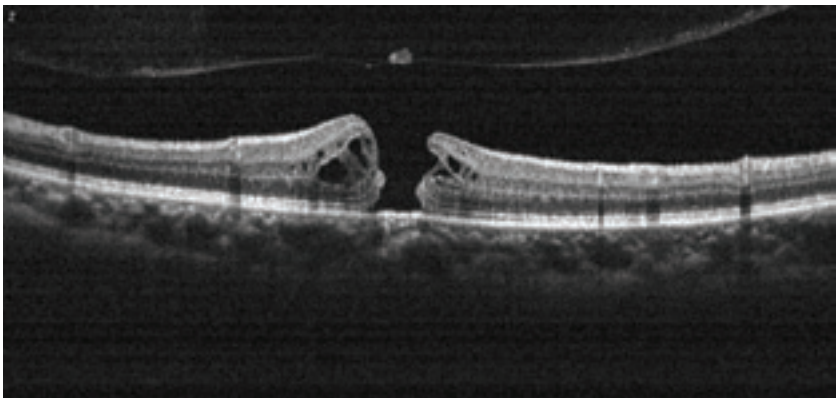

Figure 33 OCT image of a full-thickness macular hole

- Glaucoma (Figure 26): There is usually elevated intraocular pressure, but be aware of low tension glaucoma. The optic disc will be cupped, with a thin neuroretinal rim at the site of haemorrhage). If glaucoma has not been previously diagnosed, then refer routinely to the HES. A patient with previously diagnosed glaucoma and stable intraocular pressures does not need to be referred
- Acute posterior vitreous detachment: needs urgent referral to the HES to rule out a retinal tear/detachment
- Optic nerve drusen (the optic disc will appear lumpy). It is important to differentiate this from optic disc swelling. If this is unclear then refer urgently to the HES to rule out papilloedema.

Optic disc neovascularisation (Figure 27 and 28)

New vessels can grow from the optic disc due to severe retinal ischaemia – the appearance, pathogenesis and causes are similar to that for retinal neovascularisation.

Optic disc neovascularisation usually indicates significant retinal ischaemia. The patient should be referred urgently to the HES.

Optic disc collaterals (Figure 29)

Optic disc collateral vessels suggest a previous central retinal vein occlusion (CRVO), and appear as dilated, flat vessels that begin and end at the disc. HES referral is probably necessary only if no previous diagnosis of CRVO has

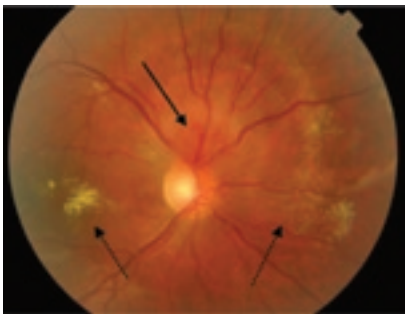

Figure 30 A rare capillary haemangioma growing at the optic disc (solid black arrow), with surrounding hard exudates from chronic leakage (dashed black arrows)

been made, or if there is difficulty in ruling out disc new vessels.

Optico-ciliary shunts

Rarely seen, these appear as dilated vessels which extend from the centre of the optic disc, to the edge of the optic disc. They suggest an optic nerve sheath meningioma, but can occur in chronic papilloedema.

Optic disc capillary haemangioma (Figure 30)

See retinal capillary haemangioma, above.

Conclusion

Red-coloured lesions are among the more common forms of pathology seen in the fundus. It is important to be able to ascertain the pathology of the lesion, at what level of the retina it exists, any associated findings, and consider a differential diagnosis. This will then help the examiner to decide when and how urgently to refer the patient to the local eye unit, and also request appropriate investigations from the patient's GP.

Typically, routine referral is reasonable for lesions that are few in number and peripheral to the macula. However those with multiple or complex lesions affecting the macular area, especially if associated with visual loss or metamorphopsia, demand more urgent attention.

Acknowledgements

The authors thank Dr Ann Clover and Dr Shabeeba Hannan from Southampton Eye Unit for their help in providing images.

References

1 Kanski JJ, Nischal KK, Milewski SA. *Ophthalmology : Clinical Signs and Differential Diagnosis*. Philadelphia: Mosby, 1999.

2 Kanski JJ. *Clinical Ophthalmology : A Systematic Approach*. 6th ed. Edinburgh : Butterworth-Heinemann Elsevier, 2007.

3 Kunimoto DY, Kanitkar KD, Makar M, Friedberg MA, Rapuano CJ. *The Wills Eye Manual:Office and Emergency Room Diagnosis and Treatment of Eye Disease*. 4th ed Philadelphia : Lippincott Williams & Wilkins, 2004.

4 Ryan SJ. *Retina*. 4th ed. Philadelphia, Pa: Elsevier/Mosby, 2006.

5 Yanoff M, Duker JS, Augsburger JJ. *Ophthalmology*. 2nd ed. London: Mosby, 2003.

6 UK National Screening Committee. *Essential Elements in Developing a Diabetic Retinopathy Screening Programme*. Workbook 4. 2007.

7 Richard G, Soubrane GI, Lieb WA. . 2nd rev. and expanded ed. Stuttgart ; New York: Thieme, 1998.

● **Sam Khandhadia** is research registrar and **Richard Newsom** consultant ophthalmologist at the Southampton Eye Unit

MULTIPLE-CHOICE QUESTIONS

1 Which of the following would be most useful for examination of early maculopathy?
A Superfield lens
B 90D lens
C 66D lens
D Widefield lens

2 Which of the following is the commonest cause of pre-retinal haemorrhage?
A Retinal artery macroaneurysm rupture
B Trauma
C Proliferative retinopathy
D Terson's syndrome

3 From where do new vessels grow?
A Arterioles
B IRMA
C Venous system
D Capillaries

4 Which of the following is most likely to indicate ischaemia in a central retinal vein occlusion?
A Flame haemorrhages
B Obscuration of the macula
C Paler haemorrhage colouration
D Cotton-wool spots

5 Which of the following is indicative of a macular hole rather than a pseudohole?
A Acuity of 6/6
B Positive Watzke test
C Patient age of 20 years
D No apparent elevation or cuff around lesion

6 What is the typical diameter of microaneurysms?
A Up to 30 microns
B The same as the retinal artery at the disc
C The same as the retinal vein at the disc
D Up to 60 microns

7 Which of the following would be gradeable as M0?
A Multiple dot and blot haemorrhages in the mid-periphery
B Cotton-wool spots
C Exudates within 1 disc diameter of the fovea
D Red dot haemorrhage 1 disc diameter from fovea with 6/6 acuity

8 Of what is a Weiss ring indicative?
A Posterior vitreous detachment
B CMV retinitis
C Hypertensive retinopathy
D Leukaemia

9 Which of the following is true about Coats' disease?
A It is mainly found in females
B Bilateral vessel dilation is found
C Secondary exudation is rare
D Telangiectasia are charateristic

10 In which of the following might one see Roth's spots?
A Papilloedema
B Chorioretinitis
C HIV retinopathy
D Coats' disease

11 Which systemic condition has a strong association with angioid streaks?
A AIDS
B Hypertension
C Leukaemia
D Pseudoxanthoma elasticum

12 A patient has a unilateral vision loss,unilateral disc swelling, altitudinal field defect and an RAPD. Which of the following is most likely?
A Papillitis
B Anterior ischaemic optic neuropathy
C Papilloedema
D Disc drusen

To take part in this module go to **opticianonline.net** and click on the Continuing Education section. Successful participation in each module of this series counts as two credits towards the GOC CET scheme administered by Vantage and one towards the Association of Optometrists Ireland's scheme. **The deadline for responses is March 27**