



# Cardiovascular disease

## What an optometrist should know

Bill Harvey summarises some of the terminology used to discuss cardiovascular disease and its variants

In the Western hemisphere cardiovascular disease (CVD) is responsible for around 50 per cent of deaths. This is mainly due to ischaemic heart disease while around 10 per cent of deaths are directly attributable to hypertension. Knowledge of the controllable risk factors for these diseases, such as poor diet, smoking, obesity, along with regular screening for the diseases are making significant inroads in reducing this death toll.

All optometrists are aware of the great significance of cardiovascular disease. Changes in the appearance of blood vessels or obvious signs of their dysfunction, such as haemorrhages, are among the commonest reasons for referral. Furthermore, the percentage of patients found to be taking anti-hypertensive drugs when questioned during an eye examination is striking.

The close association between nerve and blood vessel functioning in the eye can lead to dramatic visual consequence if blood perfusion is disrupted, whether by disease of the vessels or the blood.

Changes in the appearance of the retinal blood vessels may indicate the presence of systemic cardiovascular disease in completely asymptomatic patients. This is often the case with systemic hypertension and, when one considers that hypertensives are seven times more likely to develop stroke, four times more likely to develop congestive heart failure, three times more likely to

have coronary heart disease and have twice the risk of total and cardiovascular mortality than the normotensive, the important role of the optometrist in screening for pathology becomes clear. Optometrists are distributed well throughout communities, including those with an ethnicity bias to groups known to have a higher risk of developing cardiovascular disease and who may not necessarily attend their local medical practice without any symptoms. They will go to their optometrist when vision continues to change in their 40s and beyond and this underlines further the potential usefulness of the optometrist in screening for insidious disease processes. Indeed in Lambeth, Lewisham and Southwark borough in London, optometrists are funded to take blood pressure and refer anyone to their GP falling outside given boundaries.

### Cardiovascular disease

The term cardiovascular disease (CVD) may refer to any disorder of the heart, blood vessels and blood circulation. CVD includes coronary heart disease (CHD, around 50 per cent of CVD), stroke (around 25 per cent) and circulatory problems ranging from vessel shut down, to inflammatory disease and problems with the blood itself. Underlying changes to vessels and circulatory system tissues predispose to these diseases. Before looking at these in a little more detail it is worth just clarifying a few terms that relate to CVD.

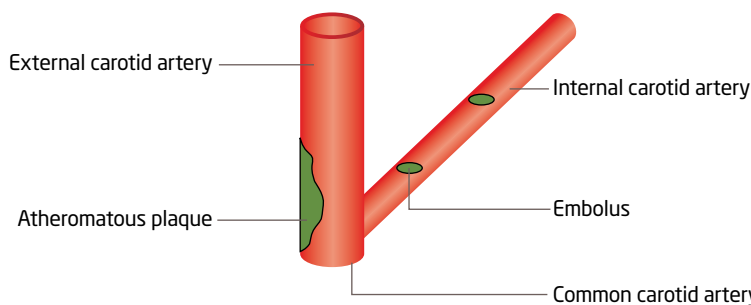


Figure 1 The origin of the internal carotid artery is a common site for atheromatous plaque formation

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### Arteriosclerosis

Arteriosclerosis is a general term for a group of disorders that cause thickening and loss of elasticity of artery walls. Atherosclerosis (see below) is the commonest type, other types including medial arteriosclerosis (in which muscle and elastic fibres from the larger arterial walls are replaced by fibrous tissue) and Monckeberg's arteriosclerosis (in which calcium deposits form within the arterial lining). Arteriosclerosis occurs to some degree in most adults with increasing age and the presence of arteriosclerotic vessel changes in the retinal vasculature is evidence of a long-standing cardiovascular problem such as systemic hypertension. The loss of elasticity of the vessel wall results in raised blood pressure.

### Atherosclerosis

The main type of arteriosclerosis, atherosclerosis, is responsible for more deaths in the UK than any other condition. Narrowing of the blood vessels is due to the development of raised patches or plaques in the inner lining of arteries consisting of a substance called atheroma. Atheroma (from the Greek word *athere* meaning 'porridge') is a mixture of low density lipoproteins, decaying muscle cells, fibrous tissue, platelets, cholesterol and sometimes calcium. Atheromatous plaques will tend to form in regions of turbulent blood flow such as the origin of the internal and external carotid



arteries (Figure 1).

An increase in number and thickness of plaques with age results in loss of the smooth lining of the blood vessels, often resulting in the formation of an abnormal blood clot (thrombus). Material from a thrombus or a plaque may break off, enter the blood stream and lodge further along the vascular tree to cause an occlusion or blockage. Such material fragments are called emboli (Figure 2). Certain risk factors, including hypertension and hyperlipidaemia, increase the probability that atherosclerosis will occur (Table 1).

In relation to the eye, atherosclerosis is a cause of transient ischaemic attacks (interrupted perfusion of blood), amaurosis fugax (transient losses of vision), retinal artery occlusion and non-arteritic anterior ischaemic optic neuropathy (damage to the optic nerve head due to a reduced blood supply by a cause other than arteritis). Atherosclerotic interference with the blood supply to the brain causes stroke and subsequent visual pathway lesions, which may be characterised by homonymous visual field defects, and possible neuropsychological conditions such as visual discrimination disorders or visual agnosia. Transient ischaemic attacks to other parts of the body result in temporary loss or interference with normal function. In the brain such an event is often termed a 'mini-stroke'.

### Hypertension

This refers to raised blood pressure. Blood pressure, as usually measured by a sphygmomanometer (inflatable cuff with stethoscope and pressure gauge) is recorded by giving the systolic (subsequent to ventricular contraction) and diastolic (after ventricular relaxation) pressures in millimetres of mercury. Changes in the diastolic pressure are often considered more significant as they suggest alteration of the baseline pressure.

A healthy young adult has a blood pressure reading of about 110/75mmHg, usually rising with age (and arteriosclerotic changes) to about 130/90mmHg in a 60-year-old. Abnormally high readings are referred to as hypertension, low readings as hypotension (which is increasingly believed to also adversely affect ocular structures). Raised blood pressure in the absence of any identified contributory disease is known as essential hypertension. In around 10 per cent of cases the raised blood pressure can be attributed to another disease process, such as a kidney disease. In these cases the condition is termed secondary hypertension. Hypertension is usually symptomless

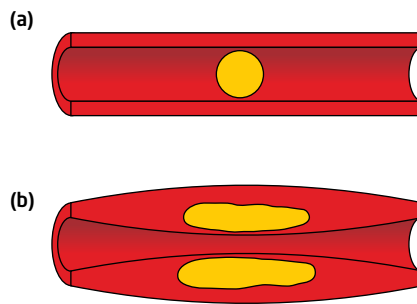


Figure 2 Embolus (a) as opposed to plaque (b)

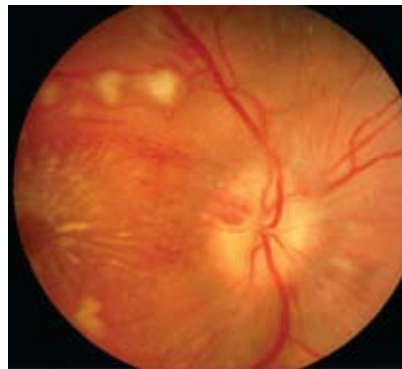


Figure 3 Malignant hypertensive retinopathy

unless the rise is very severe. A diastolic pressure greater than 140mmHg is often referred to as malignant or accelerated hypertension and requires urgent treatment. Malignant hypertension may show as swelling of the optic nerve head and vision may be adversely affected (Figure 3). The primary response of retinal arterioles to hypertension is narrowing or attenuation.

In the eye, such hypertensive narrowing in its purest form is only to be seen in young patients where

### ADVICE TO REDUCE RISK OF CVD

- Be more physically active
- Lose weight if you are overweight
- Stop smoking
- Eat a healthy, balanced diet
- Take your medication as prescribed by your doctor
- Control blood glucose levels: between 4 and 6mmol/l before meals and less than 10mmol/l two hours after
- Blood pressure should be treated if it is above 130/80mmHg
- Blood fats - total cholesterol below 4mmol/l, low-density lipoprotein cholesterol (LDL - often known as 'bad cholesterol') below 2mmol/l, high density lipoprotein cholesterol (HDL - often known as 'good cholesterol') 1.0mmol/l or above if you are a man and 1.2mmol/l or above if you are a woman, triglycerides 1.7mmol/l or below
- It may be beneficial to take a small amount of aspirin - check with your doctor
- Have a medical examination at least once a year

TABLE 1

### Risk factors for atherosclerosis

- Cigarette smoking
- Hypertension
- Male gender
- Obesity
- Physical inactivity
- Diabetes mellitus
- Heredity
- Aggressive personality

arteriosclerotic changes are less of an influence. The degree of hypertensive vascular changes is an indication of the severity of hypertension. So a rapid increase in systemic blood pressure may show as arteriolar narrowing, subsequent leakage, ischaemia and sometimes optic disc swelling (all 'pure' hypertensive changes); a long-standing hypertension is likely to be linked to arteriosclerotic changes visible as brighter arteriolar reflex and crossing changes. Generally, a combination of both hypertensive and arteriosclerotic changes is likely, the contribution of the latter increasing with the age of the patient.

### Hyperlipidaemia

This term applies to a group of metabolic disorders characterised by high levels of lipids within the blood. Lipid is carried in the blood in several forms, mainly cholesterol, triglycerides, lipoproteins and chylomicrons (microscopic fat droplets). Lipoproteins consist of fat and cholesterol bound to protein and the relative proportion of fat to protein allows classification.

It is elevation within the blood of one of the six classes of lipoprotein which determines the six types of hyperlipidaemia. For example, elevation of low-density and very low-density lipoproteins is found in type IIb hyperlipidaemia. This is also characterised by raised cholesterol and triglyceride levels and is found to cause, in addition to increased risk of atherosclerosis and heart disease, arcus of the cornea and xanthelasma around the eyelids.

### Vasculitis

This term applies to a group of disorders in which there is an inflammatory response within a vessel, possibly as a response to antigen lining the wall, leading to narrowing and possible occlusion. Inflammation within arteries (arteritis) is a significant factor in anterior ischaemic optic neuropathy (the arteritic form as opposed to the non-arteritic form resulting from atherosclerosis), and many forms of uveitis may have



Figure 4 Branch retinal vein occlusion

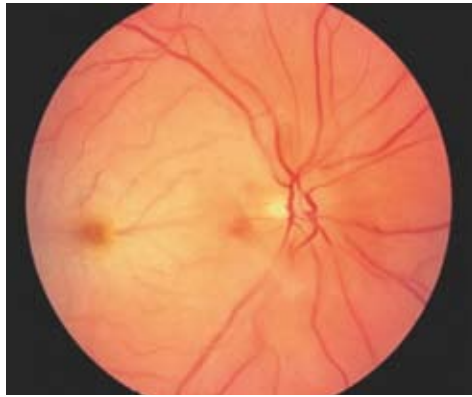


Figure 5 Central retinal artery occlusion



Figure 6 Typical 56-year-old retina

an associated vasculitis, such as the venous inflammation (phlebitis) seen in sarcoidosis or pars planitis.

### Conclusion

It should already be clear that cardiovascular disease has no single definition and that the expression of ocular disease may relate to a wide range of combinations of systemic disorders. A hypertensive retinopathy of long-standing, for example, may show signs relating to hypertensive changes and atherosclerotic changes (hypertension being one risk factor of atherosclerosis) in a patient with an inherited predisposition to hyperlipidaemia (a strong association with atherosclerosis).

### Sudden loss of vision - some clinical notes

#### General points

- Sudden loss of vision in older patients are very likely to be related to vascular incident. In younger patients this is less likely and might instead be related to an inflammatory concern
- Transient fluctuations in vision, especially if described as a temporary curtain across the vision, need to be investigated as they may suggest temporary slowing of perfusion, possibly due to aggregations of atheromatous or thrombotic material, and act as a warning of a future possible occlusion
- Loss of vision is often not total, and instead a patient, on questioning, may be able to describe areas of loss
- Sudden loss might be a subfoveal haemorrhage subsequent to choroidal neovascularisation, a retinal vein occlusion, a retinal artery occlusion, or a short posterior ciliary artery occlusion (or anterior ischaemic optic neuropathy)
- All of the following may cause acuity loss, a relative afferent pupillary defect and variable field loss, often altitudinal.

#### Retinal vein occlusion

- A central or branch retinal vein

occlusion is the most common of the vascular occlusions and is easily identified by the spread of flame shaped haemorrhages over the fundus (Figure 4)

- A number of common predisposing factors exist and the cause needs to be identified. These include high blood pressure, high blood lipids, high blood sugar levels and, don't forget, high intraocular pressure
- When deciding on your management, remember what the underlying causes might be. Always measure the IOP. If it is over 30mmHg, then many hospitals are happy to see the patient straight away
- Find out what your local protocol is for this
- If pressures are below 30mmHg, then the most appropriate course of action is to get the cardiovascular health checks undertaken and the most likely route for this is via the GP
- Some vein occlusions have a significant drop in acuity related to extensive macular oedema and this is known to respond well to anti-VEGF intervention. Also some vein occlusions are ischaemic and may result in neovascular response in months ahead. For this reason, an ophthalmologist must be consulted and ideally this is within one to two weeks of the initial event. Cotton wool spots and a significant drop in acuity are useful indicators of ischaemic occlusion

#### Retinal artery occlusion

- Often preceded by transient fluctuations, artery occlusions are much rarer than vein occlusions. For a blockage to cause sight loss, the embolus is typically a hard lump of calcium. This is most likely to have sloughed off from an atheroma or, more likely, an aggregation at the valves of the heart.
- Calcific emboli from the heart may cause further occlusion elsewhere, such as pulmonary, cerebral or cardiac, and so artery occlusions must always be treated as medical emergencies even if not ophthalmic emergencies

- Immediate referral for assessment is recommended

● The cherry red spot seen within the now pale fundus is simply the choroidal perfusion showing through the thinner parafoveal retina (Figure 5).

#### Anterior ischaemic optic neuropathy

- This represents occlusion of bloodflow to the optic nerve head
- It may be caused by inflammatory cell build up (an arteritic AION) which represents a much greater threat to the other eye
- As with any artery occlusion this should be treated as an emergency referral
- Arteritic causes include temporal arteritis and the patient may be complaining of jaw pain and temporal tenderness
- Though appearance may vary, unilateral disc swelling is to be looked out for.

#### Hypertension

- Dramatic and sudden rises in systemic blood pressure result in changes that include bilateral disc oedema, cotton wool spots, exudates that may assume a star pattern around the macular area, and haemorrhages
- Such dramatic rises in blood pressure may indicate significant systemic concerns such as renal failure and emergency referral is recommended
- Arteriosclerosis is a change that happens throughout life, exaggerated by factors such as smoking, stress and poor diet.
- One would therefore expect to see some arteriosclerotic changes in a 90-year-old (reflex changes, calibre changes, crossing changes) but not in a 20-year-old (Figure 6 shows a typical 56-year-old retina)
- Everyone over 40 years should have regular blood pressure checks
- Premature birth may result in excessive retinal vessel tortuosity and is not a concern when presenting for an eye examination later in life. ●