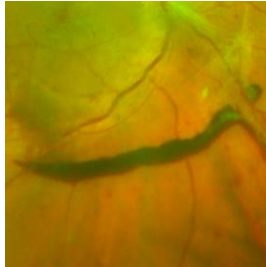

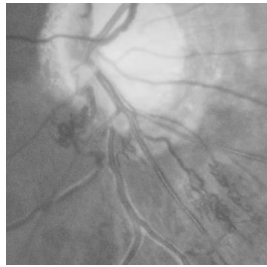
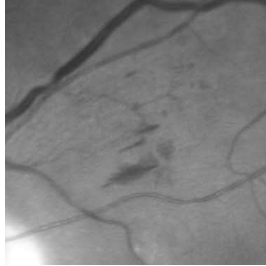
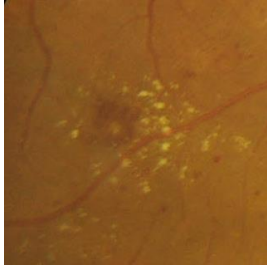
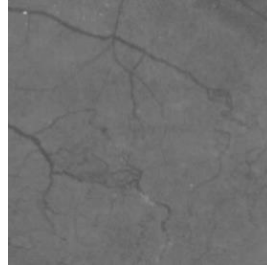
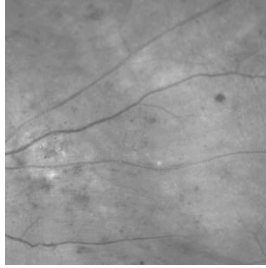
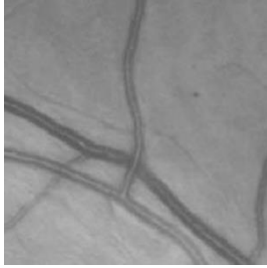


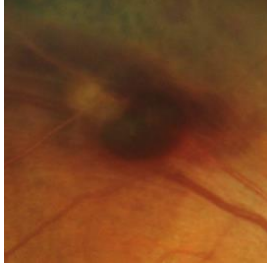
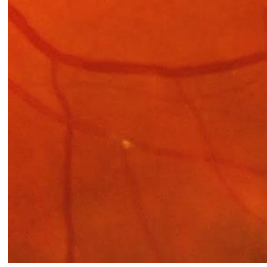




<b>Pre-retinal haemorrhage</b>  <ul style="list-style-type: none"> <li>Between the internal limiting membrane and the posterior hyaloid of the vitreous</li> <li>Can be boat-shaped secondary to gravity, linear or arcuate</li> <li>Mechanisms can include neovascular vessels prone to bleeding, normal vessels that rupture under stress (e.g. trauma or posterior vitreous detachment), or extension from an adjacent source</li> <li>Can cause a scotoma corresponding to the affected area</li> </ul>	<b>Cotton wool spot (CWS)</b>  <ul style="list-style-type: none"> <li>Appear clinically as a yellow-white or grey-white, slightly elevated cloud-like lesion</li> <li>Usually found at the posterior pole and less than 1/3 disc diameter in size</li> <li>Caused by ischaemia of the nerve fibre layer due to arteriolar obstruction or other causes of focal disruption of axoplasmic flow</li> <li>May be ischaemic, immune, inflammatory, infective, embolic, neoplastic, traumatic, idiopathic or related to medication</li> <li>Resolves in 6-12 weeks but can persist longer in diabetic retinopathy</li> </ul>	<b>Collateral</b>  <ul style="list-style-type: none"> <li>Develop within existing vessel networks close to areas of non-perfusion to redistribute vascular flow</li> <li>Typically cross the horizontal raphe and do not leak on fluorescein angiography</li> <li>Occur between occluded and unoccluded retinal veins (e.g. vein occlusions) between retinal and choroidal veins or on the surface of the optic nerve</li> <li>Can also occur with optic nerve sheath meningiomas, compressive lesions, disc drusen, high myopia and diabetic retinopathy</li> </ul>
<b>Flame haemorrhage</b>  <ul style="list-style-type: none"> <li>From the superficial or radial capillary system</li> <li>Have a feathered, splinter or flame-shaped appearance as the blood spreads within the nerve fibre layer</li> <li>May form in areas of ischaemia or secondary to high capillary pressure</li> <li>Can be associated with any condition affecting the superficial retinal vessels (e.g. hypertensive retinopathy, glaucoma, vein occlusion, anterior ischaemic optic neuropathy)</li> <li>Reabsorption usually occurs over 2-3 months</li> </ul>	<b>Hard exudate</b>  <ul style="list-style-type: none"> <li>Discrete yellow-white lipid deposits in the outer retinal layers</li> <li>May be isolated, circinate, diffuse or star shaped</li> <li>Associated with increased vascular permeability or breakdown of the blood retinal barrier and resulting oedema</li> <li>Can be seen in conditions such as diabetic retinopathy, hypertensive retinopathy, retinal arterial macroaneurysm, and choroidal neovascularisation</li> </ul>	<b>Intraretinal microvascular abnormality (IRMA)</b>  <ul style="list-style-type: none"> <li>Intraretinal shunt vessels that act to supply areas of retinal non-perfusion in diabetic retinopathy</li> <li>Appear either as abnormal branching or dilation of existing capillaries within the retina</li> <li>Have a similar appearance to neovascularisation, however, with a slightly larger vessel caliber</li> <li>Neovascularisation may form in close proximity to IRMA</li> </ul>
<b>Dot/blot haemorrhage</b>  <ul style="list-style-type: none"> <li>Located within the inner nuclear layer or outer plexiform layer, which determines the shape of the haemorrhage</li> <li>Caused by compression of vessels in the prevascular deep capillary bed, or a ruptured microaneurysm or capillary</li> <li>Associated with retinal oedema and venous stasis (e.g. diabetic retinopathy, vein occlusion, retinal telangiectasia, ocular ischaemic syndrome)</li> </ul>	<b>Microaneurysm</b>  <ul style="list-style-type: none"> <li>Originate from the deep capillary bed</li> <li>Due to hypoxia, hyperglycaemia or venous stasis weakening the capillary wall causing a subsequent small (50-100µm) out-pouching, pericyte loss and proliferation of endothelial cells</li> <li>Typically cluster at the margins of zones of capillary non-perfusion</li> <li>Have a tendency to leak causing intra-retinal oedema</li> </ul>	<b>Retinal neovascularisation</b>  <ul style="list-style-type: none"> <li>Occurs secondary to hypoxia and subsequent vascular endothelial growth factor (VEGF) release</li> <li>Develops from the pre-existing vascular bed, typically at the border of an area of hypoxia</li> <li>Prone to leakage, causing pre-retinal haemorrhages, vitreous haemorrhages and/or fibrosis</li> </ul>
<b>Sub-retinal haemorrhage</b>  <ul style="list-style-type: none"> <li>Beneath the retinal pigment epithelium (RPE) or sensory retina</li> <li>Arise from the retinal or choroidal circulation</li> <li>Appear red or grey-green (sub-RPE)</li> <li>Photoreceptor damage is caused by the release of toxins or fibrosis creating a barrier to retinal perfusion</li> <li>Commonly occur secondary to choroidal neovascularisation but can also arise from choroidal rupture, breaks in Bruch's membrane or a vascular abnormality causing break-down of the outer blood-retinal barrier</li> </ul>	<b>Macroaneurysm</b>  <ul style="list-style-type: none"> <li>Focal dilated area of the large arterioles of the retina</li> <li>Caused by localised damage to the vessel wall</li> <li>Typically unilateral, large (~280 µm) and have no associated microvascular changes</li> <li>Can traverse the full thickness of the retina and cause oedema, haemorrhage and exudation</li> <li>Often associated with systemic hypertension and can follow a central retinal vein occlusion</li> </ul>	<b>Embolism</b>  <ul style="list-style-type: none"> <li>Material from endogenous or exogenous sources causing arterial occlusion, most commonly at a bifurcation</li> <li>Commonly cholesterol (Hollenhorst plaques), calcific (cardiac valve disease) and platelet-fibrin emboli</li> <li>Rarely, they can be talc emboli (injected drug use), fat emboli (bone fractures), septic emboli (infective endocarditis) or secondary to trauma, sickle cell disease, pregnancy, infection, inflammation, connective tissue disorders or oral contraceptives</li> </ul>



# Retinal Vascular Signs

	Haemorrhages						Cotton wool spot	Intra-retinal oedema	Hard exudate	Microaneurysm	Macroaneurysm	Telangiectasia	Collateral	Shunt	Intraretinal microvascular abnormality	Neovascularisation	Arteriovenous nipping	Arterial attenuation	Calibre changes	Vessel tortuosity	Sheathing/Vasculitis	Lipemia retinalis	Embolism	Cherry red spot	Retinal whitening (ischaemia)
	Pre-retinal haemorrhage	Flame haemorrhage	Dot/blot haemorrhage	Sub-retinal haemorrhage	Vitreous haemorrhage	Roth spot																			
Anaemias	X	X	X	X	X	X	X	X	X	X						X			X	X					
Behçet's disease		X	X		X			X	X							X		X	X		X				
Branch retinal artery occlusion								X					X										X		X
Branch retinal vein occlusion		X	X				X	X	X	X			X	X		X	X			X	X				
Central retinal artery occlusion								X															X		X
Central retinal vein occlusion		X	X				X	X	X	X	X		X	X		X				X	X				
Coats' disease/Leber's miliary aneurysm			X	X					X		X		X	X					X	X	X				
Cytomegalovirus		X	X				X	X										X	X						X
Diabetes	X	X	X		X	X	X	X	X	X			X		X	X				X			X		
Dysproteinemias		X	X				X	X	X	X										X					
Eales disease			X		X					X		X				X			X	X	X				
Endocarditis	X	X	X			X	X																		
Familial exudative vitreoretinopathy	X		X		X				X	X						X					X				
Foetal alcohol syndrome			X																	X					
Glaucoma		X																	X						
Human immunodeficiency virus		X	X			X	X			X		X				X		X	X		X				
Hyperlipidaemia/hyperproteinaemia		X																	X			X			
Hypertension	X	X	X		X	X	X	X	X	X	X						X	X	X	X	X		X		
Ischaemic optic neuropathy		X	X				X									X	X	X	X						
Neovascular macular degeneration	X		X	X	X			X								X									
Leukaemias	X	X	X	X		X	X			X						X			X		X				
Systemic lupus erythematosus	X	X	X	X	X		X		X	X				X		X		X		X	X				
Macular telangiectasia type 2			X	X				X	X			X		X		X			X						
Multiple myeloma			X			X	X			X															
Multiple sclerosis		X	X		X											X					X				
Neuroretinitis		X	X				X	X	X																
Ocular ischaemic syndrome		X	X			X	X	X		X		X				X		X	X					X	
Oral contraceptives		X	X																X				X		
Papillitis		X	X				X		X								X	X	X		X				
Papilloedema		X	X				X		X					X			X	X	X						
Papillophlebitis		X	X				X											X	X		X				
Periphlebitis		X	X		X													X	X		X				
Posterior vitreous detachment	X	X	X		X																				
Racemose haemangioma		X	X		X														X	X	X				
Retinopathy of prematurity	X		X		X											X			X	X	X				
Sarcoidosis			X				X				X					X	X	X	X		X				
Toxoplasmosis			X					X											X		X				X
Trauma	X	X	X	X	X	X																			X
Valsalva manoeuvre	X		X	X	X			X																	
Von Hippel-Lindau angiomatosis			X		X			X	X										X	X	X				

Please note that this table is designed as a general reference tool and needs to be utilised in conjunction with clinical results, observations and other resources. Not all vascular signs for a particular condition listed may be present at the time of examination and in some circumstances, a condition may exhibit other vascular signs and non-vascular associations may co-exist. Vascular signs from more than one disease process may be present at the same time.