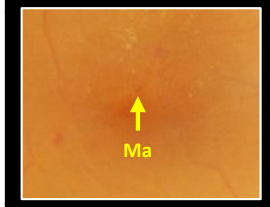
Centre for Eye Health

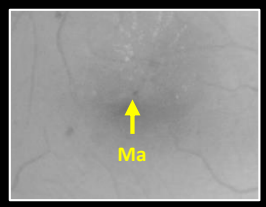
CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

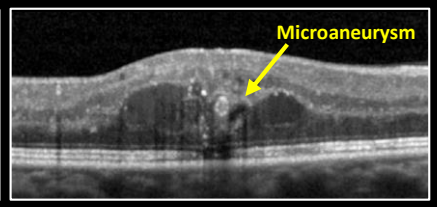
Diabetic retinopathy (DR) is a retinal microvascular disease which occurs in an individual with diabetes. Typical retinal microvascular lesions display a characteristic evolution and progression (below). The most significant risk factor regarding the incidence and progression of diabetic retinopathy is elevated HbA1c. Duration of diabetes also increases the risk of incidence. Other notable risk factors include suboptimal control of hypertension (specifically for type 2 diabetes), hyperlipidaemia, renal disease, pregnancy, sudden lowering of glycaemia, ethnicity and genetic factors.

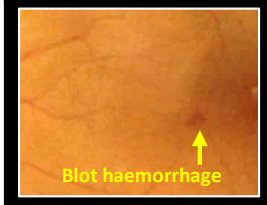
NON-PROLIFERATIVE DIABETIC RETINOPATHY AND MACULAR OEDEMA

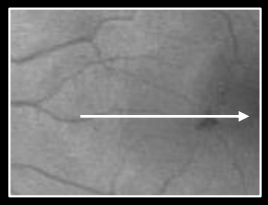
Colour photo	Red-free image	Optical coherence tomography (OCT)	Description
Microaneurysms			• The earliest clinical sign of DR. • **Funduscopy: I**solated, round red dots of varying size. • **OCT:** May be detectable on OCT as small round or oval lesions, usually within the inner nuclear layer (INL), fully or partially capsulated. • **Pathophysiology:** Outpouchings of the capillary wall due to pericyte loss/damage. • **Natural history**: They can resolve spontaneously or rupture and leak leading to the presence of intraretinal haemorrhages, oedema or hard exudates.
Dot/blot haemorrhages			• Occur in various vascular conditions frequently associated with diabetes, such as hypertensive retinopathy, retinal vein occlusion and ocular ischaemic syndrome. • **Funduscopy:** Dot haemorrhages lie deeper in the retina than blot haemorrhages and can be difficult to distinguish from microaneurysms. • **OCT:** May be undetectable on OCT or present as an area of hyper-reflectivity. • **Pathophysiology:** Usually caused by a ruptured or leaking microaneurysm/retinal capillary, typically within the INL or outer plexiform layer (OPL). • **Natural history**: longer resolution time compared to more superficial flame-shaped haemorrhages.
Cotton wool spots (CWS)			• Occur in various vascular conditions including DR. • **Funduscopy:** Slightly elevated, yellow-white or grey-white, cloud-like lesions. Typically found in the posterior pole and less than 1/3 disc diameter in size. • C-shaped simultaneous occurrence of CWSs along the arcades and nasal to the disc are thought to represent a pre-proliferative or pre-severe NPDR state. • **OCT:** Elevated, hyper-reflective RNFL lesion. May distort the underlying retinal layers. • **Pathophysiology:** Focal disruption of axoplasmic flow in the RNFL. • **Natural history**: Resolves 6-12 weeks (longer in DR). Ischaemic RNFL defect may follow.
Hard exudates (HEx) and intraretinal oedema			• Occur in various vascular conditions including DR, hypertensive retinopathy, retinal arterial macroaneuysm, Coats disease and choroidal neovascularisation. • **Funduscopy:** Discrete, yellow-white lipid deposits and may be isolated, diffuse, circinate, or star-shaped. May have concurrent intraretinal oedema shown as retinal thickening clinically or as cystic spaces in outer retinal layers on OCT. • **OCT:** Hyper-reflective deposits in the OPL or ONL • **Pathophysiology**: Increased vascular permeability & breakdown of the blood retinal barrier causes leakage of lipids, proteins and serous fluid into the retina. • **Natural history**: Macular oedema frequently require treatment, although small pocket of fluid may resolve spontaneously, hard exudates may persist after fluid resolution

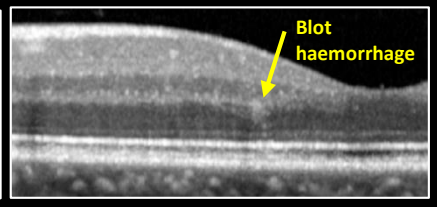


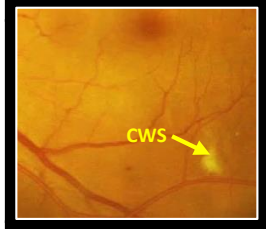


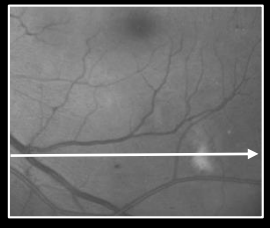


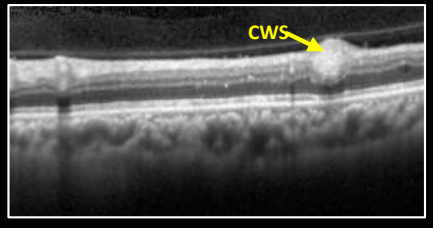


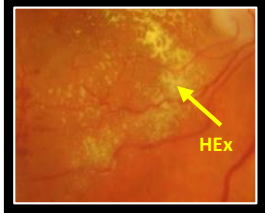


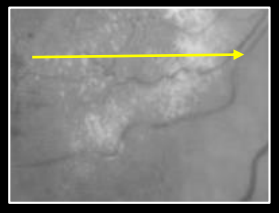


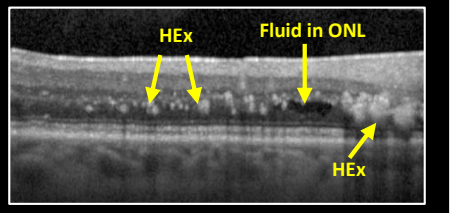








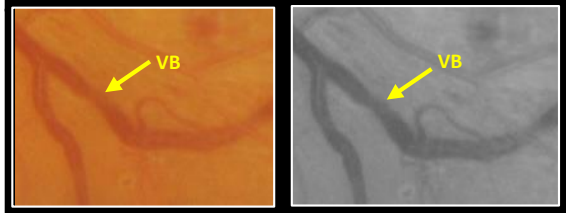
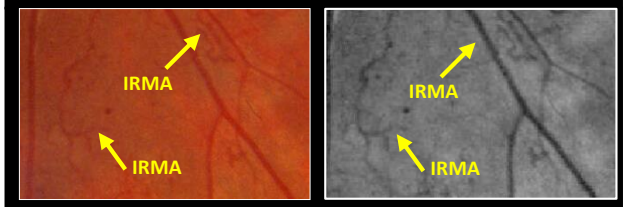




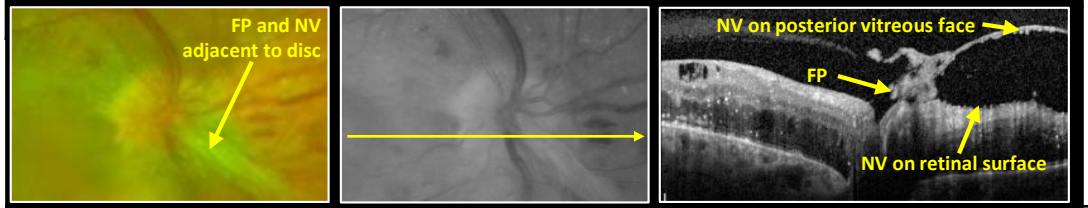
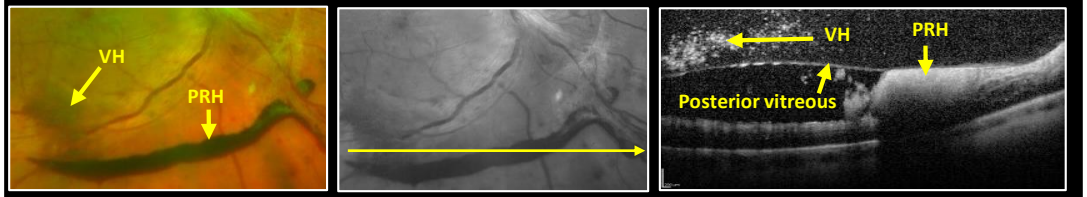
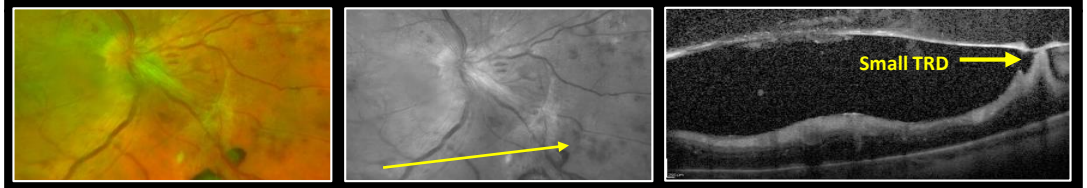
Centre for Eye Health

CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

OTHER NON-PROLIFERATIVE DR LESIONS

Colour photo and red-free image	Description	Colour photo and red-free image	Description
Venous beading 	Venous Beading is a venous calibre irregularity which occurs in areas of severe retinal hypoxia. A sausage-link appearance occurs in severe cases. Other calibre changes include dilation, reduplication and loops.	**Intraretinal microvascular abnormalities (IRMA)** 	IRMA are abnormal intraretinal shunts which appear as branching or dilation of capillaries within the retina in areas of poor retinal perfusion. They are a precursor to NV which may form in close proximity.

PROLIFERATIVE DIABETIC RETINOPATHY

Widefield Image	Green separation image	OCT	Description
Neovascularisation (NV) 			• **Funduscopy**: New vessels that loop back around or form a disorganised net. Occur at the border of healthy retina and areas of capillary non-perfusion (retinal ischaemia). • **OCT**: Vessels located on ILM surface or posterior hyaloid face of the vitreous. • Dynamic interaction between NV and the vitreous can lead to an inflammatory response and subsequent fibrous proliferation (FP). • **Terminology:** NV of the disc (NVD) describes new vessels on or within 1 disc diameter of the disc as opposed to NV elsewhere (NVE).
Preretinal haemorrhage (PRH) and vitreous haemorrhage (VH) 			• **Funduscopy:** PRH may present as a D-shaped or boat-shaped haemorrhage, or may appear linear, blot-like or arcuate. VH will appear as a reddish or greyish area of haze obscuring the underlying retinal detail. • **OCT:** Helps identify the location of the haemorrhage (appears hyper-reflective). In PRH, this is between the ILM and posterior hyaloid face of the vitreous. In VH, it is in the vitreous. • **Pathophysiology**: NV proliferates along the posterior surface of the relatively mobile vitreous which results in traction on the new vessels, making them prone to damage and bleeding (PRH or VH). Any PRH/VH should be considered as NV until proven otherwise.
Tractional retinal detachment (TRD) 			• **Funduscopy:** TRD is associated with NV and FR and appears elevated. More likely to occur along the major vascular arcades. • **OCT**: Traction and separation of neurosensory retina from RPE. • **Pathophysiology**: Retinal folds TRD can occur if the vitreous is adherent to the retina in an area of fibrovascular scar formation. • **Natural History**: Usually progress slowly, however a hole can form in the detached retina leading to a combined TRD and rhegmatogenous retinal detachment.

Centre for Eye Health

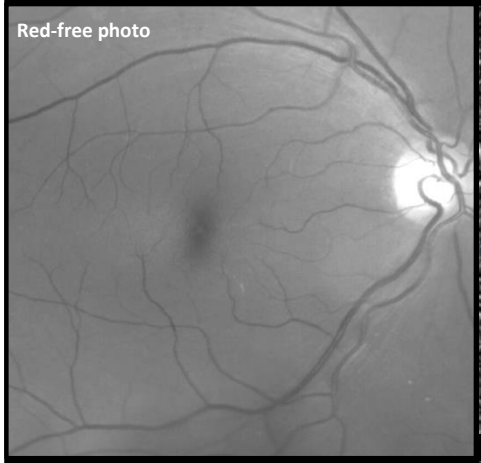
CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

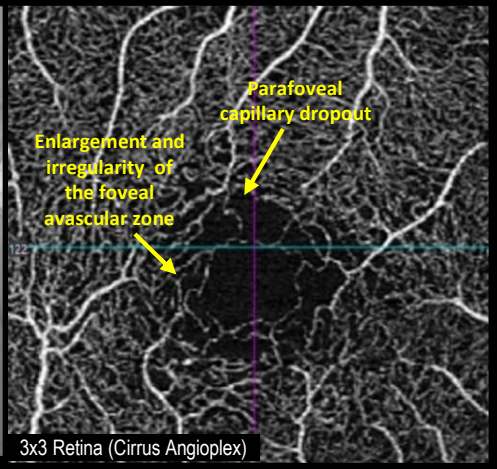
OCT angiography is a non-invasive technology that detects the movement of red blood cells through the retinal vessels to produce an image of the vasculature without the injection of dye. In diabetes, OCT angiography can show features of macular or retinal ischaemia including foveal avascular zone (FAZ) enlargement, parafoveal capillary dropout, IRMA and neovascularisation. Microaneurysms can be detected in some cases, but not others where there is poor blood flow through the microaneurysm. An increase in FAZ size and reduction in parafoveal capillary density have been shown to be a predictors of the severity and progression of diabetic retinopathy.

DIABETIC RETINOPATHY FEATURES DETECTABLE ON OCT ANGIOGRAPHY

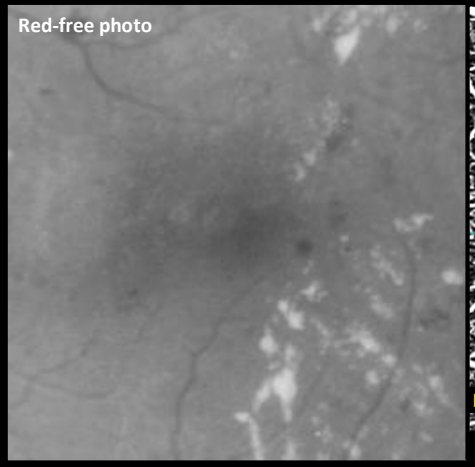
Red-free photo	OCT Angiography	Red-free photo	OCT Angiography

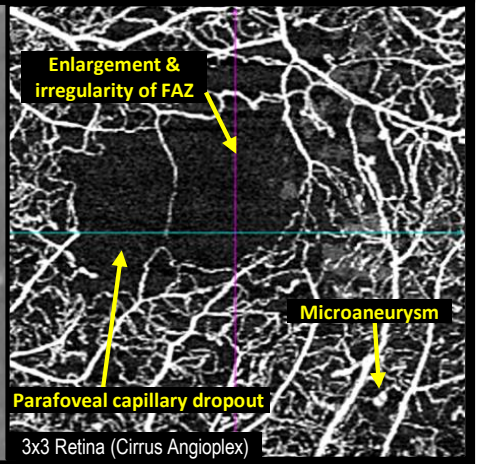
Early macular ischaemia



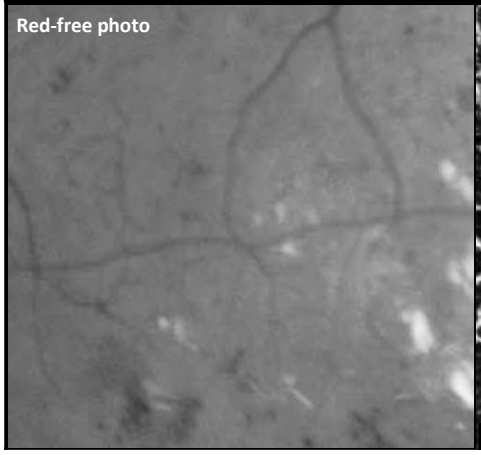


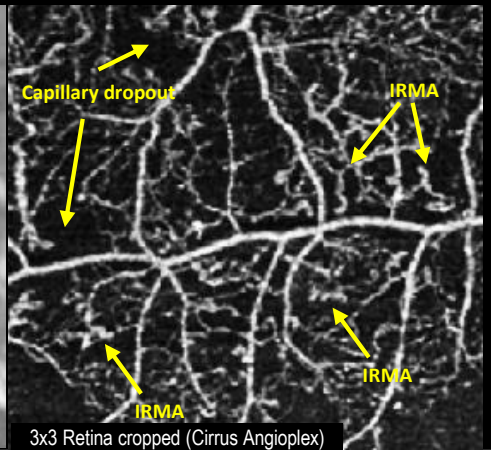
Severe Macular ischaemia



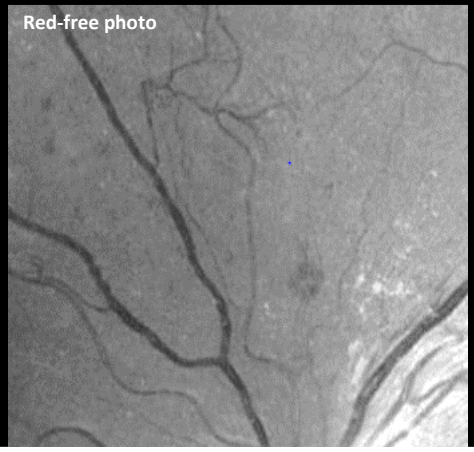


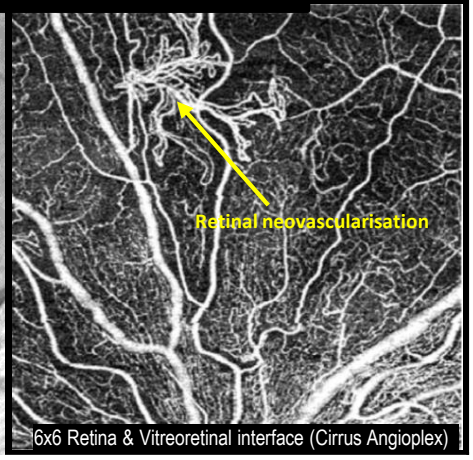
Intraretinal microvascular abnormalities (IRMA)





Neovascularisation





Centre for Eye Health

CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

International Clinical Diabetic Retinopathy Disease Severity Scale

DIABETIC RETINOPATHY STAGE	OPHTHALMOSCOPY FINDINGS
No apparent retinopathy	No abnormalities
Mild NPDR	Microaneurysms only
Moderate NPDR	More than just microaneurysms but less than severe NPDR
Severe NPDR	Any one of the following (and NO signs of PDR): • More than 20 intraretinal haemorrhages in each of 4 quadrants • Definite VB in 2+ quadrants • Prominent IRMA in 1+ quadrant
Proliferative DR	One of the following: Neovascularisation, vitreous/pre-retinal haemorrhage

International Clinical Diabetic Macular Edema Disease Severity Scale *

MACULAR OEDEMA STAGE	OPHTHALMOSCOPY FINDINGS
Absent	No retinal thickening or hard exudates in the posterior pole
Non-centre involved DME *Can occur at any level of DR*	Retinal thickening or hard exudates in the macula that is outside the central subfield zone
Centre-involved DME *Can occur at any level of DR*	Retinal thickening or hard exudates in the macula that involves the central subfield zone

**modified by CFEH to reflect recent OCT-based grading terminology in the literature which describes oedema within the central 1000µm area of the fovea as centre-involved*

CFEH TELEHEALTH
SUPPORTING OPTOMETRISTS

WWW.CENTREFOREYEHEALTH.COM.AU/TELEHEALTH

This reference is based on the current literature and evidence at the time of writing. This reference is designed a guide to aid diagnosis and management decisions however individual cases must be assessed in the context of all available clinical data.

For individual diagnosis or management advice, please make a CFEH telehealth appointment and one of our senior staff optometrists can assist. Consultations are at no charge, thanks to the generous support of Guide Dogs NSW/ACT.