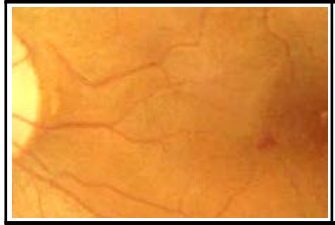
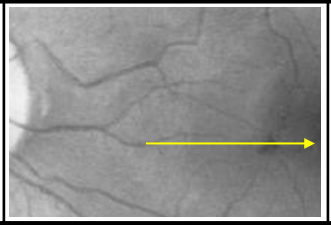
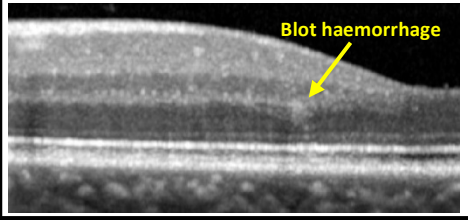
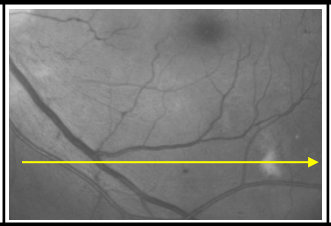
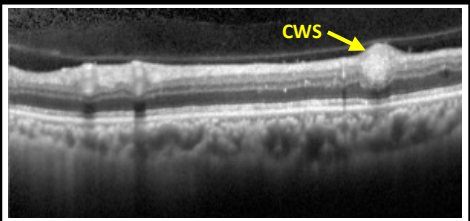
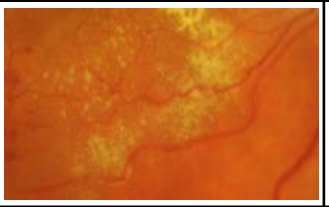
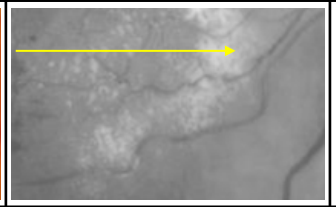
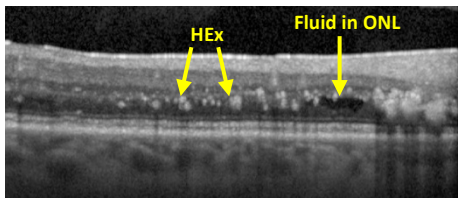
Centre for Eye Health

Chair-side Reference: Diabetic Retinopathy

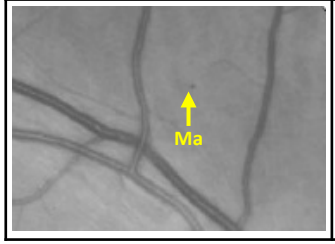
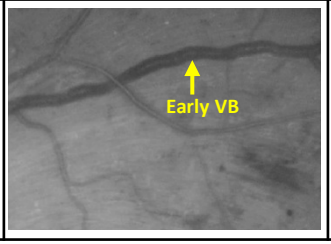
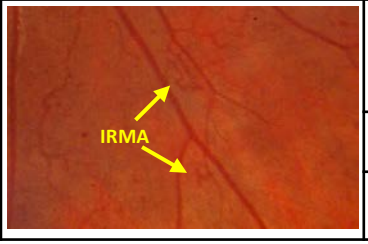
Optometry NEW SOUTH WALES AUSTRALIAN CAPITAL TERRITORY

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 (see table below). Risk factors include duration of diabetes, hyperglycaemia, systemic hypertension, renal disease, hyperlipidaemia, sudden lowering of glycaemic levels, pregnancy, ethnicity and genetic factors. The International Clinical Diabetic Retinopathy and Diabetic Macular Edema Disease Severity Scales (overleaf) provide a clinically useful scale for grading the level of DR and macular oedema.

NON-PROLIFERATIVE DIABETIC RETINOPATHY AND MACULAR OEDEMA

Colour photo	Red-free photo	Optical coherence tomography (OCT)	Description
Dot/blot haemorrhages			
			Dot and blot haemorrhages are usually caused by a ruptured or leaking microaneurysm or retinal capillary, typically within the inner nuclear layer (INL) or outer plexiform layer (OPL). Dot haemorrhages lie deeper in the retina than blot haemorrhages and can be difficult to distinguish from microaneurysms. Dot/blot haemorrhages take longer to resolve than more superficial flame-shaped haemorrhages. They may be undetectable on OCT or present as an area of hyper-reflectivity. Dot/blot haemorrhages can also occur in other conditions frequently associated with diabetes, such as hypertensive retinopathy, retinal vein occlusion and ocular ischaemic syndrome.
Cotton wool spots (CWS)			
			CWS appear as slightly elevated, yellow-white or grey-white, cloud-like lesions. They are typically found in the posterior pole and are less than 1/3 disc diameter in size. OCT imaging shows an elevated, hyper-reflective lesion in the retinal nerve fibre layer (RNFL) which may distort the underlying retinal layers. In DR, CWS result from ischaemia in the retinal nerve fibre layer (RNFL) however other factors responsible for focal disruption of axoplasmic flow in the RNFL may result in a similar presentation. Differential diagnoses include ischaemic, immune, infectious or inflammatory conditions as well as embolic, neoplastic, medication, traumatic, idiopathic and other miscellaneous causes. They may resolve in 6-12 weeks but can persist longer in DR.
Hard exudates (HEx) and intraretinal oedema			
			Hard exudates present clinically as discrete, yellow-white lipid deposits in the OPL (Henle's layer in the macula) and may be isolated, diffuse, circinate (circular), or star-shaped. With OCT, they appear as hyper-reflective deposits in the outer retina. Intraretinal oedema can present, both clinically and with OCT, as retinal thickening or as cystic spaces in the outer retinal layers. In DR, both result from increased vascular permeability/ breakdown of blood retinal barrier causing leakage of lipids, proteins and serous fluid into the retina. Differential diagnoses include conditions such as hypertensive retinopathy, retinal arterial macroaneuysm, Coats disease and choroidal neovascularisation.

Changes not typically visible on OCT

Microaneurysm (Ma)	Venous beading (VB)	Intraretinal microvascular abnormalities (IRMA)	
			**Microaneurysms** are the earliest clinical sign of DR. They appear as isolated, round red dots of varying size which can resolve spontaneously. They are outpouchings of the capillary wall, due to ischaemia and subsequent pericyte loss, which can rupture and leak leading to intraretinal haemorrhage, hard exudate or oedema. They may be undetectable on OCT or present as a small area of hyper-reflectivity in the inner retinal layers. **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. **IRMA:** Abnormal, intraretinal branching or dilation of capillaries within the retina in areas of ischaemia/non-perfusion. Similar appearance to NV but with slightly larger vessel calibre. NV may form in close proximity.

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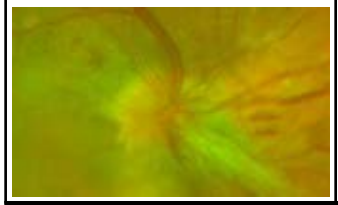
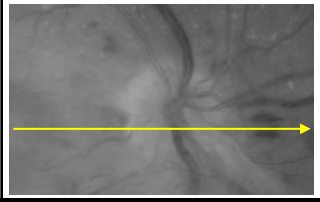
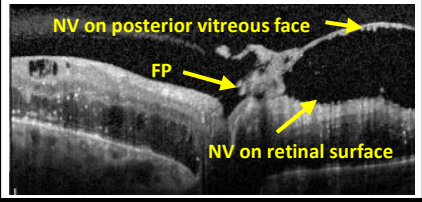
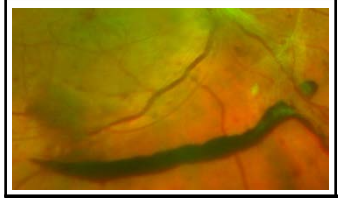
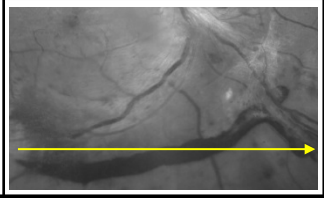
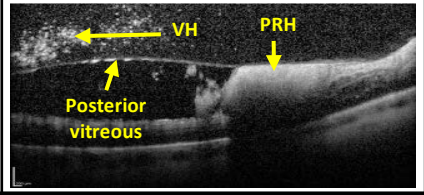
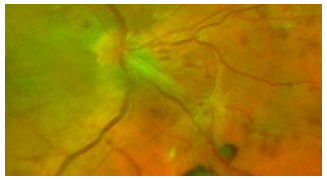
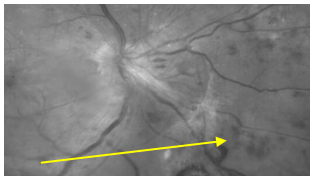
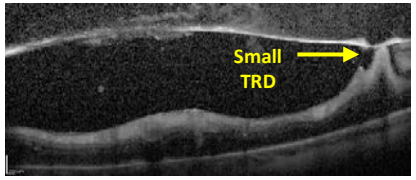
Optometry NEW SOUTH WALES AUSTRALIAN CAPITAL TERRITORY

PROLIFERATIVE DIABETIC RETINOPATHY

Colour photo	Red-free photo	Optical coherence tomography (OCT)	Description
Neovascularisation (NV) and fibrous proliferation (FP)			
			Neovascularisation (NV) appears as new vessels which loop back around or form a disorganised net, distinguishing them from normal capillaries. They are on the surface of the RNFL, internal limiting membrane (ILM) or posterior hyaloid face of the vitreous and occur at the border between healthy retina and areas of capillary occlusion (retinal ischaemia). They are prone to bleeding, resulting in pre-retinal (PRH) or vitreous haemorrhage (VH). Dynamic interaction between NV and the vitreous can lead to an inflammatory response and subsequent fibrous proliferation (FP). Any bleeding from IRMA or loop formation should be considered as NV until proven otherwise. NV of the disc (NVD) describes new vessels on or within 1 disc diameter of the disc as opposed to NV elsewhere (NVE).
Pre-retinal haemorrhage (PRH) and vitreous haemorrhage (VH)			
			PRH or VH can occur when fibrous scars contract and new vessels become elevated off the surface of the retina. This is especially true if there is strong adherence between the vitreous and the retina at the area of NV or FP. PRH may present as a D-shaped or boat-shaped haemorrhage trapped between the ILM and the posterior hyaloid face of the vitreous, although they can appear almost blot-like, linear or arcuate. VH will appear as a reddish or greyish area of haze obscuring the underlying retinal detail. OCT assists in identifying the location of the haemorrhage (which appears hyper-reflective).
Tractional retinal detachment (TRD)			
			Retinal folds or tractional retinal detachment (TRD) can occur if the vitreous is adherent to the retina in an area of fibrovascular scar formation. These changes are more likely to occur along the major vascular arcades. TRDs are concave and usually progress slowly, however a hole can form in the detached retina leading to a combined TRD and rhegmatogenous retinal detachment. Clinically, TRD will be associated with NV and FP and appear elevated.

International Clinical Diabetic Retinopathy and Diabetic Macular Edema Disease Severity Scales

RETINOPATHY STAGE	OPHTHALMOSCOPY FINDINGS
No apparent retinopathy	No abnormalities
Minimal NPDR	Microaneurysms only
Mild-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

MACULAR OEDEMA	OPHTHALMOSCOPY FINDINGS
Absent	No retinal thickening or hard exudates in the posterior pole
Present Can occur at any level of DR	**Mild –** some retinal thickening or hard exudates in posterior pole but distant from the macula
	Moderate – retinal thickening or hard exudates approaching the centre of the macula but not involving the centre
	Severe – retinal thickening or hard exudates involving centre of the macula