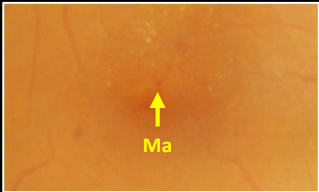
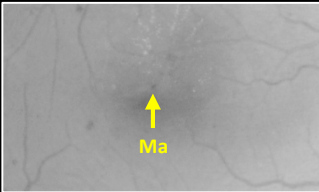
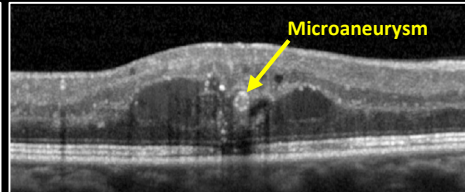
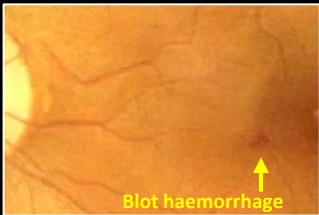
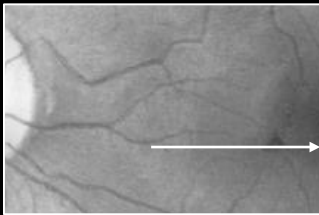
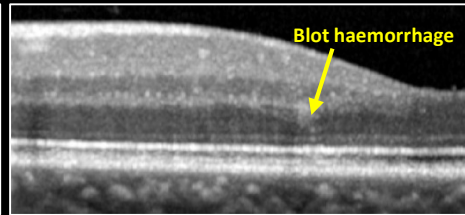
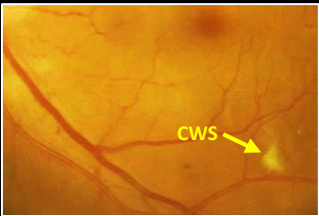
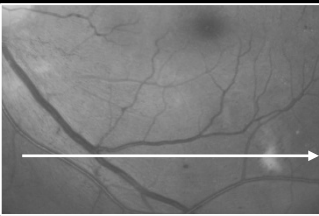
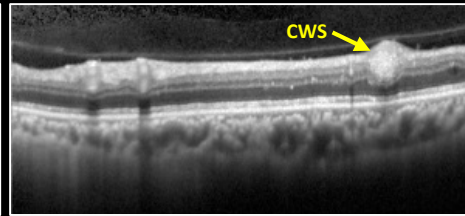

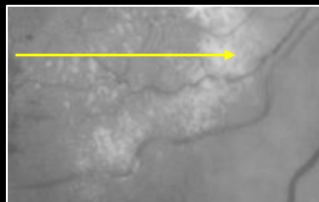
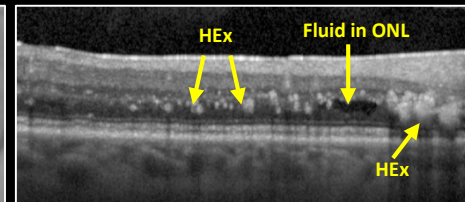


# CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

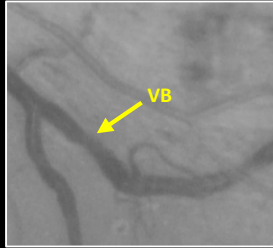
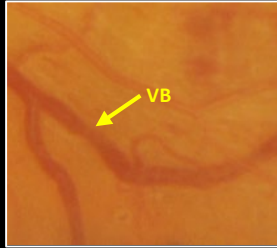
Diabetic retinopathy (DR) is a retinal microvascular disease which occurs in an individual with diabetes. Typical retinal microvascular lesions display a characteristic evolution and progression (see table below). Risk factors include duration of diabetes, hyperglycaemia, systemic hypertension, renal 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			
Optomap/Retinal Photo	Red-free image	Optical coherence tomography (OCT)	Description
<b>Microaneurysms</b>			<p><b>Microaneurysms</b> are the earliest clinical sign of DR. They are outpouchings of the capillary wall, due to pericyte loss, which can rupture and leak leading to intraretinal haemorrhage, oedema or hard exudate.</p> <p>Clinically, they appear as isolated, round red dots of varying size which can resolve spontaneously.</p> <p>They may be undetectable on OCT or, if visible, typically appear as small round or oval lesions, usually within the inner nuclear layer, fully or partially capsulated in 56 per cent of cases.</p>
			
<b>Dot/blot haemorrhages</b>			<p><b>Dot and blot haemorrhages</b> 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.</p> <p>Dot/blot haemorrhages take longer to resolve than more superficial flame-shaped haemorrhages.</p> <p>They may be undetectable on OCT or present as an area of hyper-reflectivity.</p> <p>Dot/blot haemorrhages can also occur in other conditions frequently associated with diabetes, such as hypertensive retinopathy, retinal vein occlusion and ocular ischaemic syndrome.</p>
			
<b>Cotton wool spots (CWS)</b>			<p><b>CWS</b> result in DR from retinal ischaemia however other factors responsible for focal disruption of axoplasmic flow in the RNFL may result in a similar presentation. They appear as slightly elevated, yellow-white or grey-white, cloud-like lesions, are typically found in the posterior pole and less than 1/3 disc diameter in size.</p> <p>OCT imaging shows an elevated, hyper-reflective lesion in the retinal nerve fibre layer (RNFL) which may distort the underlying retinal layers.</p> <p>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.</p>
			
<b>Hard exudates (HEx) and intraretinal oedema</b>			<p><b>Hard exudates</b> and oedema in DR both result from increased vascular permeability/ breakdown of blood retinal barrier causing leakage of lipids, proteins and serous fluid into the retina. They present clinically as discrete, yellow-white lipid deposits and may be isolated, diffuse, circinate (circular), or star-shaped.</p> <p>With OCT, they appear as hyper-reflective deposits in the outer plexiform layer (OPL) or outer nuclear layer (ONL). Intraretinal oedema can present, both clinically and with OCT, as retinal thickening or as cystic spaces in the outer retinal layers.</p> <p>Differential diagnoses include conditions such as hypertensive retinopathy, retinal arterial macroaneurysm, Coats disease and choroidal neovascularisation.</p>
			

# CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

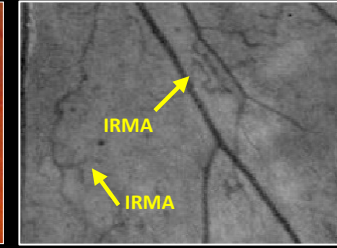
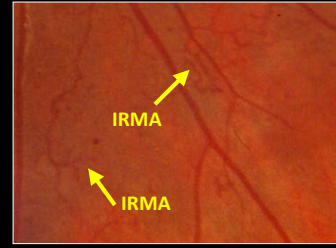
## OTHER NON-PROLIFERATIVE DR LESIONS

### Venous beading (VB) - colour and red-free photography



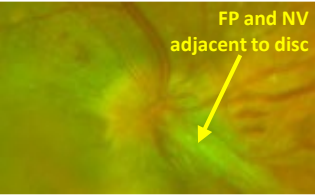
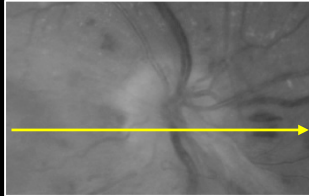
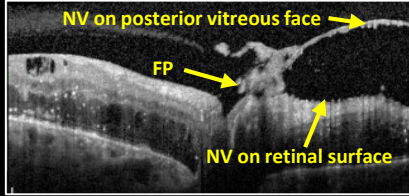
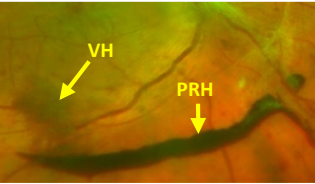
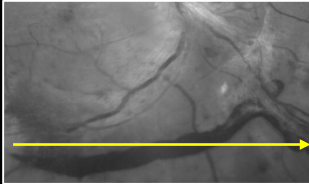
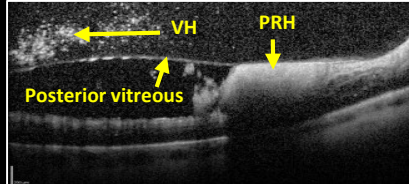
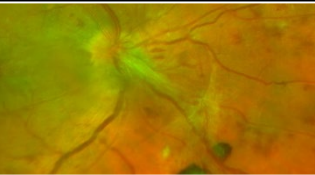
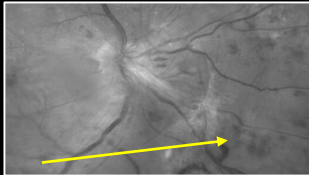
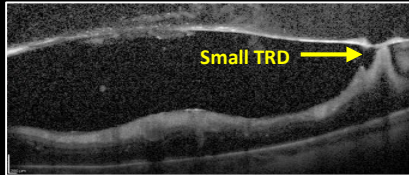
Venous Beading is a venous calibre irregularity which occurs in areas of severe retinal hypoxia. A sausage-link appearance occurs in severe cases. Other calibre changes include dilation, reduplication and loops.

### Intraretinal microvascular abnormalities (IRMA) – colour and red-free photography



Intraretinal microvascular abnormalities (IRMA) are abnormal intraretinal shunts which appear as branching or dilation of capillaries within the retina in areas of poor retinal perfusion. They have a similar appearance to NV but with slightly larger vessel calibre. They are a precursor to NV which may form in close proximity.

## PROLIFERATIVE DIABETIC RETINOPATHY

Optomap/Retinal Photo	Red-free image	Optical coherence tomography (OCT)	Description
<b>Neovascularisation (NV) and fibrous proliferation (FP)</b>			
			<p>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 internal limiting membrane (ILM) or posterior hyaloid face of the vitreous and occur at the border between healthy retina and areas of capillary non-perfusion (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 pre-retinal or vitreous haemorrhage 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).</p>
<b>Pre-retinal haemorrhage (PRH) and vitreous haemorrhage (VH)</b>			
			<p>PRH or VH can occur when new vessels bleed. This may occur when the new vessels proliferate along the posterior surface of the relatively mobile vitreous, causing traction on the new vessels, particularly where there is a 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 may appear linear, blot-like 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).</p>
<b>Tractional retinal detachment (TRD)</b>			
			<p>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.</p>



# CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

OCT angiography is a non-invasive technology that detects the movement of red blood cells through the retinal and 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 increased FAZ has been shown to be a predictor of the severity and progression of diabetic retinopathy.

## DIABETIC RETINOPATHY FEATURES DETECTABLE ON OCT ANGIOGRAPHY

### Red-free image

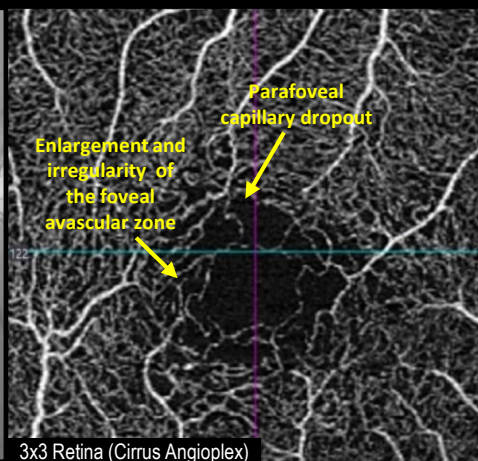
### OCT Angiography

### Red-free image

### OCT Angiography

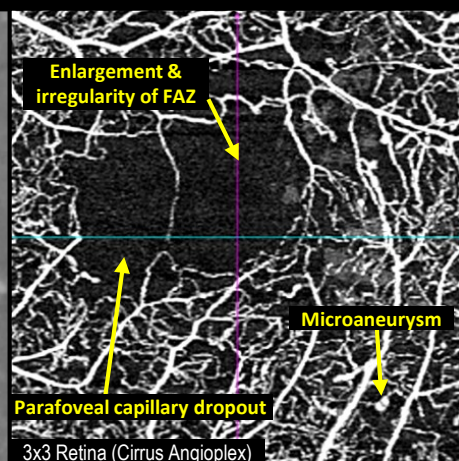
#### Early macular ischaemia

Red-free photo



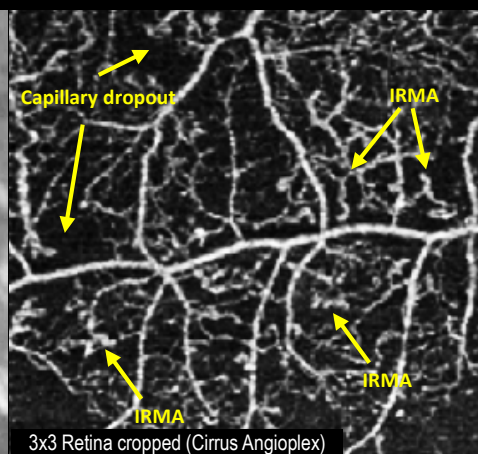
#### Severe Macular ischaemia

Red-free photo



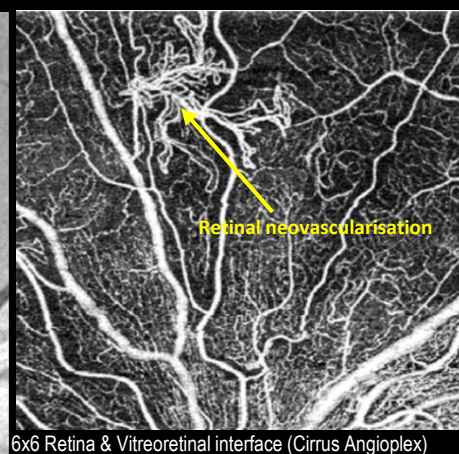
#### IRMA

Red-free photo



#### Retinal neovascularisation

Red-free photo





## CHAIR-SIDE REFERENCE: DIABETIC RETINOPATHY

### International Clinical Diabetic Retinopathy Disease Severity Scale

DIABETIC RETINOPATHY STAGE	OPHTHALMOSCOPY FINDINGS
<b>No apparent retinopathy</b>	No abnormalities
<b>Mild NPDR</b>	Microaneurysms only
<b>Moderate NPDR</b>	More than just microaneurysms but less than severe NPDR
<b>Severe NPDR</b>	Any one of the following (and NO signs of PDR): <ul style="list-style-type: none"> <li>• More than 20 intraretinal haemorrhages in each of 4 quadrants</li> <li>• Definite VB in 2+ quadrants</li> <li>• Prominent IRMA in 1+ quadrant</li> </ul>
<b>Proliferative DR</b>	One of the following: Neovascularisation, vitreous/pre-retinal haemorrhage

### International Clinical Diabetic Macular Edema Disease Severity Scale

MACULAR OEDEMA STAGE	OPHTHALMOSCOPY FINDINGS
<b>Absent</b>	No retinal thickening or hard exudates in the posterior pole
<b>Mild (non-centre involving*)</b> <i>Can occur at any level of DR</i>	Some retinal thickening or hard exudates in posterior pole but distant from the macula
<b>Moderate (centre approaching*)</b> <i>Can occur at any level of DR</i>	Retinal thickening or hard exudates approaching the centre of the macula but not involving the centre
<b>Severe (centre involving*)</b> <i>Can occur at any level of DR</i>	Retinal thickening or hard exudates involving centre of the macula

\*Modified by CFEH to reflect International Council of Ophthalmology guidelines (2017) which define centre-involved macular oedema as thickening within the central 1000µm of the macula