Year 2 MBChB
Clinical Skills Session
Ophthalmoscopy

Reviewed & ratified by:
  o  Mr M Batterbury – Consultant Ophthalmologist
**Learning objectives**
- To understand the anatomy and physiology of the external and internal eye and apply it to the practical skill.
- To understand the basic use of an ophthalmoscope and be able to identify a basic structure in your partner’s eye.
- To be able to recognise common abnormalities found in the eye.

**Theory and Background**

**Indications for Ophthalmoscopy**

Ophthalmoscopy is performed for a number of reasons including:

- trauma around or of the eye itself
- as part of a health check or as part of a neurological examination
- deteriorating vision or symptoms associated with visual problems e.g. headaches or dizziness
- pain and possible foreign body

It also facilitates examination of the external and internal eye, especially allowing the visualisation of changes to the retina due to hypertension & diabetes.

**The Ophthalmoscope**

On one side of the ophthalmoscope is a mask dial which interposes various sized and shaped masks or apertures. There is a small circle which will allow a small disc of light to shine on the pupil; this setting is used for looking at the fovea/macula. There is a larger setting which is used for general viewing. Additionally there are coloured filters which may also be included to look for foreign bodies or corneal abrasions.

On the other side of the ophthalmoscope there is a viewing aperture, for you to look at the patient’s eye through a lens wheel. This can be operated from either edge of the ophthalmoscope, altering the lens you are looking through and therefore bringing vessels of the eye into focus. A lens indicator will change as the focus wheel is turned, the number reflecting the degree of focus (the selected lens) is displayed at the centre of the ophthalmoscope. Finally there is a rheostat, which enables you to turn on the light source and dim or brighten it as necessary. When turning the rheostat some ophthalmoscopes have a lock switch which has to be depressed at the same time.
**Holding the Ophthalmoscope**

If you are looking in the patient’s right eye, you need to hold the instrument in your right hand and hold it to your right eye and vice versa for the left eye. You should hold the instrument with the index finger resting on the focusing wheel and the thumb on the rheostat, this will give you control of the ophthalmoscope and allow you to manipulate the focus and intensity of the light.

**Procedure**

**Patient safety**

**Patient Safety**

- Introduce yourself
- Check the patient’s identity
- (including allergies)
- Explain what you want to do
- Gain informed consent from the patient
- Consider an appropriate chaperone
- Adequate exposure maintaining dignity
- Position the patient appropriately
- Wear Personal Protective Equipment as required.
- Wash your hands before and after you touch the patient

**Considerations**

Whilst explaining the procedure to the patient, consider that a mydriatic agent (drug resulting in pupil dilation) may be required or the lights will need to be dimmed to dilate the pupils.

At the start of the examination, you will be inspecting the anterior segment of the eye, and therefore you will rotate the lens wheel to magnify your view. The lens value will
change; to give a positive dioptre (magnified view, like reading glasses) the lens value should be green. Once you have finished examining the anterior segment, you will rotate the focus wheel to return to “0”. Select a wide mask and adjust the rheostat to limit the brightness of the beam using your thumb if the light is too bright it can be too uncomfortable for the patient. The instrument MUST be held close to your eye nestled against the supraorbital ridge or against glasses if you wear them. You should then look through the aperture with one eye and close the other, or leave it open if you prefer.

**Inspection of external structures**

To inspect the external eye ask the patient to fix their gaze on a distant object. You should place your free hand on the forehead of the patient as this sets the distance from which to approach and avoids a clash of heads as you get nearer. Also the thumb can be used to hold the patient’s upper eyelid open.

Use the viewing eye to direct the beam of light onto the patient’s eyes from 0.5 - 1 metre away (an arm’s length) and inspect peri-orbital tissues, eye lashes, and anterior segment for any abnormalities.

The anterior segment refers to the cornea and the anterior chamber of the eye.

When examining the anterior chamber and cornea position yourself at an oblique angle relative to the patient. This enables you to see the anterior chamber in profile as well as see any corneal abrasion.

You should identify the red reflex and use this to guide you as you move closer to the pupil. As you get close to the eye, use the focusing wheel to fine tune your focus on the retinal structures.

**Direction of approach & examination of the posterior chamber.**

You should approach the patient’s eye from an angle of 15-20° to the line of gaze, on the same level as the equator of the patient’s eye. This approach directs the beam towards the optic disc, an important landmark on the retina.
**Optic disc (Blind spot) & Optic cup**

To view the rest of the structures move the area of illumination by adjusting head-eye-instrument inclination. If you still have difficulty seeing structures, try and find a blood vessel and turn the focus wheel until the lines of the vessel become clear. If you miss or lose the optic disc look for any branching of vessels which form a “V”, the point of the “V” always points towards the optic disc.

Veins are uniform and burgundy in colour whereas arteries have a central pale line and two outer red walls.

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**Examination of the vessels**

The retinal vessels branch into the 4 quadrants of the eye; the superior nasal and temporal and the inferior nasal and temporal. You should use the quadrants when describing any abnormalities of the retina. Once at the optic disc, you should follow vessels, as far as possible, into each quadrant to look for any abnormalities.
The macula and the fovea

The macula is located lateral to the optic disc (about 1½ disc diameters of light away) and there are only a few blood vessels that are seen here. To view the macula move your light beam in the direction of the temples, the macula can be seen circled in the adjacent image.

The fovea is a depression in the centre of the macula and is the point of central vision, with maximum concentration of cones. This is best viewed at the end of the examination. You should reduce the intensity of the light and ask the patient to look directly into the light. You may see a small flash of light, this is the fovea.

Once you have completed the examination on 1 eye repeat the entire process for the other eye. Remember to swap the ophthalmoscope to your other hand and look with your other eye.

The retina - what to note

On examination of the eye it is important that you document all findings clearly and ensure all abnormalities are reported to your supervisor. You need to remember to document your inspection of the external as well as inner eye. With regard to the optic disc you should make note of the sharpness, colour and the appearance of the optic cup.

Check the arteries and veins to see if they are tortuous or straight, check the width and colour and the appearance of the AV (arteriovenous) crossing (where a small artery, crossing a vein results in venous compression and bulging on either side of the crossing.

If you are the patient and you are being examined, you may “see” a reflection of your own retina projected in front of your eye.

Peripheral fundus

When examining the four main vessels you should check for haemorrhages, exudates (nerve / vascular accidents) and choroidal changes (vascular area of that name between the retina and sclera). Look for any scarring or new vessel formation.
Culturally based variability in the colour of the iris and in retinal pigmentation – darker irises correlate with darker retinas.

**Papilledema**

Papilledema is usually a bilateral swelling of the optic disc as a result of increased intracranial pressure. In the image below image ‘A’ shows a grade II papilledema with a diffuse halo effect around the optic disc, image ‘B’ shows a grade III papilledema showing loss of major vessels as they leave the disc shown by the arrow. Amongst others, papilledema can be caused by a brain tumour, malignant hypertension, respiratory failure and altitude sickness. If the underlying cause is not treated it may result in blindness.

![Image A](image1.png) ![Image B](image2.png)

**Age Related Macular Degeneration (ARMD)**

Macular degeneration causes vision loss in the centre of the field of vision. There are two types dry and wet macular degeneration.

Dry macular degeneration (the more common of the two forms of ARMD) is marked by deterioration of the macula. Seen on this image as a series of dark patches, this is caused by the accumulation of drusen (comprised of extracellular degenerative material) between the retina and the choroid causing atrophy and scarring to the retina.

![Image Left Eye](image3.png)
Wet macular degeneration is characterised by blood vessels that grow under the retina (arising from the choroid, a choroidal neovascular membrane) in the back of the eye, leaking blood and fluid. This can be seen on image ‘A’ as pale patches of hard exudates and on image ‘B’ as a large pool of blood and lipids.

**Retinopathy**

This is a process whereby inflammation and vascular remodelling occurs over a period of time. There are three types:

1. Retinopathy of Prematurity (ROP) which is when the retinal blood vessels have not developed completely as a result of prematurity. Abnormal blood vessels may grow out of the retina and cause scarring which will affect vision.
2. Diabetic retinopathy is associated with type 1 and 2 diabetes
3. Hypertensive retinopathy associated with high blood pressure
The image on the left is of a patient with diabetic retinopathy. Non-proliferative retinopathy is where blood vessels in the retina deteriorate. They can become blocked or leak fluids, fats and proteins from the vessels. Fluid can collect in the retina and the swelling may impair sharp vision, especially when it affects the macula.

Proliferative retinopathy is where new structurally unstable vessels grow on the surface of the retina. They can cause frequent minor bleeding causing floaters which may be visualised and also may cause the separation of the layers of the retina (fractional retinal detachment).

Diabetic retinopathy – focal maculopathy. In the next image we can see where blood vessels near the macula have leaked fluid composed of protein (lipids) onto the macula which will affect vision.

Hypertensive retinopathy

This results from the damage that occurs to blood vessels in patients suffering from hypertension. Abnormalities include thickening of the small arteries, blockages of retinal blood vessels and bleeding. In acute cases it may cause swelling of the optic nerve.
Terms used in ophthalmology

- Maculopathy - damage to the macula, the part of the eye which provides us with central vision.
- Exudates are either hard or soft and are present in many conditions, they do not usually affect vision.
- Soft exudates (more accurately cotton wool spots) appear softer (ill defined) greyish-white with fluffy margins; tend to be around the optic disc.
- Hard exudates are the accumulation of lipid in or under the retina secondary to vascular leakage these crystalline granules have defined edges.

Video https://stream.liv.ac.uk/6rakbzzt

References
Images kindly donated by Mr Mark Batterbury Consultant Ophthalmologist at the Royal Liverpool NHS Trust

www.eyerounds.org

Mayo Clinic www.mayoclinic.org

Cataract and Laser Institute www.stlukeseye.com

Glossary

- Arteriovenous crossing or Nipping – where a small artery, crossing a vein results in venous compression and bulging on either side of the crossing.
- Choroid – The pigmented vascular layer of the eyeball between the retina and the sclera.
- Dioptre – A dioptre is a unit measuring a lens’s refractive power (its ability to bend light passing through it).
- Drusen – yellow deposits under the retina which are made up of lipids and fatty protein.
- Hard exudates are the accumulation of lipid in or under the retina. The lipid layer builds up and becomes visible as discrete yellowish deposits. It is commonly seen in diabetic retinopathy.
- Mydriatic – A drug that causes pupillary dilatation, aiding eye examination, e.g. atropine/ phenylephrine drops.
- Soft exudates are nerve fibre layer infarcts or pre-capillary arterial occlusions. It is an ischemic event of a small amount of tissue. Seen in hypertensive and diabetic retinopathy.