How to examine the visual system

Part 2: Accommodation, pupils, fundoscopy and additional tests

BY E LINTON AND A FOTAKAKIS

Examining the visual system can be a tricky skill for medical students to master, yet it is a task that is frequently tested in examinations. This is the second of a two-part series of articles, which together aim to improve understanding of the individual components of the visual exam and then provide a structure which links them together in a methodical way. The previous article focused on the first three aspects of examination: visual acuity, visual fields and eye movements. This article will focus on the remaining components: accommodation, pupils, fundoscopy and additional tests.

Accommodation

(Cranial nerve III)

Testing for the accommodation reflex follows nicely on from eye movements. Ask the patient to keep focusing on the tip of your index finger and slowly move it towards them, aiming for the tip of their nose. You need to be watching their pupils to make sure you see them constrict as your finger gets closer.

Pupils

(Cranial nerves II and III)

The next step on the visual system test is the pupils. If you have not already made a comment about their size and shape then you can do so now. It is easier for this part for you to leave your chair and crouch / stand just to one side of the patient with your pen torch in hand.

Ask the patient to look ahead at a specific point that you give them, e.g. a curtain hook or the corner of a door. Explain that you are going to shine your small light in to each of their eyes twice in turn, and that they should continue to look forward at their point during this test.

Approaching from, for example, the patient's left side, shine your light once in to their left eye. When you do this you need to be looking at the left eye and making sure the pupil constricts in response to the light. Next, shine your light back in to the left eye again, but this time you need to look at the right eye and make sure that the pupil on the right also constricts when you shine light in to the left pupil. The first light is checking for the direct reflex, i.e. the response of the pupil directly affected by the beam of light. The second light is checking for the consensual reflex, i.e. the response of the right eye when you shine light in to the left eye. In a normal patient, the eyes will work together so that they both respond equally to a light source, even if only one of the eyes is exposed to it.

People classically find this a difficult topic to grasp but if you break it down and get to grips with it, the test can be quite useful in clinical situations. Consider the following scenarios:

1. You shine light in to right eye. Right eye constricts but left eye does not. We know that the right eye has no problem in sensation because we have seen it react to the stimulus, and this also tells us the right eye has normal motor responses. Therefore, we can deduce that there is a problem with the motor pathway in the left eye because it has not reacted to the stimulus.
2. You shine a light into the right eye. Both pupils constrict. You shine a light into the left eye and neither constrict. This indicates the defect is sensory in the left eye, because you already know from the response to light shone in the right eye that the motor pathways to each eye are working.

The last test for the pupils is looking for a relative afferent pupillary defect (RAPD), using the swinging light test. To do this you now shine your light on each eye in turn moving back and forth between them. This highlights to you if there is a problem with one of the eyes that is not obvious enough to be picked up on the direct and consensual reflex tests. The concept here is that if you shine a light in to both eyes one after the other in a normal individual, the pupils will constrict equally to both light sources, thanks to the direct and consensual reflex pathways.

The pathological response we are looking for in this test is that on moving the light from one eye to the other, the pupils will appear to dilate when light is shone in the affected eye. This is because the direct reflex in the affected eye is disturbed in some way, causing the source of light to be determined as weaker than that shone in the good eye. The pupils still constrict, but to a lesser degree, so that on swinging a light from one eye to the other, the pupils will actually appear to dilate. Let's put this theory in to practice: A patient with optic neuritis on the right eye undergoes a swinging light test. When you shine the light in the left eye, both eyes constrict. When you move the light across to the right eye, both pupils appear to dilate, and then on moving the light back to the left eye, the pupils constrict again. In this example, a defect in the right eye means that the direct reflex is impeded, so that in comparison to the light perceived by the left eye, the right eye's source seems inferior, and thus the pupils do not constrict as much.

This is a complicated test to get to grips with but try and focus on the basic principles and hopefully with practice it will become clearer.

"The key point is to get the patient comfortable and relaxed."

Fundoscopy
(Cranial nerve II)

At this point you have almost completed your examination of the visual system from far out, right to the back of the eye. The fundus is the final step. If you are asked to examine all of the cranial nerves, this part of the examination is often passed on to save time. However, it can come up as a station by itself and it is a very useful skill to have as a junior doctor as well as later in life if you want to work in acute medicine or general practice.

If you are pressed for time, make sure you explain that ideally you would like to complete your examination by visualising the fundus using a direct ophthalmoscope. At this point the examiner may tell you that this is not necessary and you can breathe a sigh of relief.

If you are asked to continue, the key point is to get the patient comfortable and relaxed. Place them on a chair in a space which allows you plenty of room to stand on both sides of them. Explain to the patient that you are going to use a light to look in to the back of their eye. Ask the patient to focus on a specific point in the distance (the curtain rail or corner of the door from earlier). Request that they keep focusing on this point even if you get in the way.

It is nice to warn the patient that you will need to get quite close to their face in order to be able to see inside the very small pupils to the back of the eye, and reassure them that you will place your hand on their forehead so they do not have to worry about you knocking heads. As a courtesy, and to show your examiner that you are thinking about the patient's comfort you should warn the patient that the bright light may cause them some discomfort, and if at any time they feel as though they need a rest from the light they should let you know. Lastly, make sure the patient is happy for you to dim / switch off the lights for you to get a better view of the eye with your torch.

In most exam situations the patient will have already had their pupils dilated by the examiner, or sometimes dilatation will not be an option. Either way, it is worth mentioning to the examiner that you would ideally dilate the eyes with mydriatic drops, e.g. tropicamide if the patient has not previously had any adverse effects and if they were not known to be at risk of acute angle closure glaucoma. To really show you are thinking you should ask the patient how they are planning on travelling home after the examination, as it will not be safe for them to drive themselves for hours after their pupils have been dilated.

Remember
trOPicamide OPens the eye

When the patient is ready switch on your ophthalmoscope and stand about a metre away from the patient, at a 45 degree angle away from them. If you are starting with their right eye, hold the ophthalmoscope in your right hand and look through it with your right eye at their right eye.

Remember
RIGHT RIGHT RIGHT and LEFT LEFT LEFT

The first thing you are looking for is a red glow over the patient's eye. This is called the Red Reflex. This represents the reflection of your light source off the back of the patient's red-coloured retina. If pathology exists which impedes the journey of the light source through the eye then the red reflex will be diminished or absent. The most common cause of this is a cataract.

After you have established the red reflex slowly move in towards your patient. When you are close enough place your left hand on the patient's forehead to prevent you clashing heads. Move slowly closer to the eye maintaining your 45 degree angle until you are close enough that you can see the retina. Moving in from this angle should place your focus directly on to the optic nerve.

If you can spot the optic nerve you should comment on the 'three Cs': colour, contour and cup-size:

Colour: a healthy optic disc should be pink coloured. If the disc appears to be pale you may worry about pathology such as optic neuritis or glaucoma.

Contour: you should comment on the outline of the disc which should be smooth and well-defined. If the edges are indiscriminate or blurred, this could indicate papilloedema (swelling of the optic nerve head).

Cup-size: the optic nerve head can be thought of as resembling a doughnut: it has an outer edge (called the disc) surrounding an inner ring (the cup). You should comment on the cup:disc ratio, which means the size of the inner cup in relation to the outer disc. This may be more simply considered by thinking of it as a doughnut, and thus the size of the hole in the centre in relation to the doughnut around the edge. The ideal cup:disc ratio is reported to be 0.3, which means that the hole in the centre of the doughnut makes up three tenths of the whole doughnut. The larger the cup in the middle becomes in relation to the disc, the less healthy the optic nerve. In people suffering from glaucoma, there is gradual increase in cup:disc ratio.

If you cannot find the disc initially but you are able to see some blood vessels, these can be useful in helping you to locate the disc. If you consider the back of the eye like a tree, and the optic nerve head is the tree trunk, the blood vessels spread out across the retina from the optic nerve like branches on a tree. This is useful because if you track vessels back towards their main branches you will eventually make it back to the disc.

Once you have taken a look at the optic nerve head, it is important to survey the rest of the retina. You could comment on the vessels themselves, and whether they show signs of proliferative retinopathy (growth of new, friable, tortuous vessels in response to ischaemia), venous nipping (a sign of hypertension) or clots. You may spot retinal haemorrhages, or signs of diabetic retinopathy (cotton wall spots). It is important to check all four quadrants of the retina in a methodical manner to ensure no areas are missed. When you head out to the peripheries you may wish to ask the patient to look up, down, left and right to help you see a bit further. Look out for burn marks from laser therapy on the edge of the retina, which could indicate treatment for proliferative retinopathy.

The final part of your examination of the fundus should assess the macula. You should ask the patient to now look directly in to your light, as this places the macula in direct view of your ophthalmoscope. It is important to leave this part until the end as it is uncomfortable for the patient and it will leave them temporarily dazzled afterwards thus unlikely to be able to focus easily. The macula can be

affected by age-related changes, known as age-related macular degeneration. This comes in two forms, wet and dry. The dry type is associated with drusen – milky white deposits on the macular. The wet type is signified by the leakage of fluid and blood from new fragile blood vessels that form below the macula.

Remember

1. Ophthalmoscopy is a difficult practical skill and one that medical students notoriously struggle to get to grips with. There really is no other way of mastering it than practising as much as you can.
2. It can be very tempting to fabricate what you are seeing when actually you can see nothing at all. Try to remember if you do this that your light may give you away to the examiner as they can see where it is shining. If they can see it shining on the patient's nose while you are beautifully describing the details of the patient's optic disc they will probably not be too impressed.
3. If you really are struggling to see anything, and time is running out, thank your patient and stop examining them. Explain to the examiner that unfortunately you are struggling to visualise this patient's fundus but ideally you would like to examine for... and talk them through all of the above.

Additional tests

There are two additional areas of the examination of the visual system which you may wish to include or mention. The first is the testing of colour vision, which aims to identify patients suffering from various forms of colour blindness. A common tool for testing colour vision in clinical practice is the Ishihara Test, which consists of a booklet in which each page has a number centred on a colourful background. You ask the patient to turn each page and state the number that they see in the centre. The Ishihara Chart may not be provided in your examination in which case you could mention it just after you have tested visual acuity or at the end when you talk about additional things you would like to do if time and resources were available.

The second area you may wish to include or mention during your examination of the visual system is the testing of contrast sensitivity. Contrast sensitivity is the ability to distinguish between dark and light. The tool used in ophthalmic practice is commonly the Pelli Robson Contrast Sensitivity Chart. This is similar in appearance to the Snellen Chart, except all of the letters are the same size, and they differ in contrast so the letters at the top are dark and those at the bottom are light. This test may be included if patients are complaining of falls especially in poor light conditions, or if they are having difficulty with their vision while driving at night. A poor outcome in the testing of contrast sensitivity can indicate underlying pathology of the retina, cataract disease or glaucoma.

Conclusion

The examination of the visual system has multiple components and it can be difficult to remember these and test them in a fluid manner, especially during high pressure situations such as medical school exams. This article was the second of a two-part series and explained the examination of accommodation, pupils, fundoscopy and additional tests. It is hoped that medical students and junior doctors reading this two-part article will have gained a better understanding of the individual components of the visual system examination and how to group them together to form a structured approach.

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