



Master the NEURO TORCH.

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Most nurses working in critical care, neurology, and acute care units carry neuro torches.

We use them as part of our neurological examination and for ongoing 'neuro obs' to assess pupil response to light.

But what are we really doing here? And how should we document it? Let's look a little closer at this particular skill.

First up, the pupil isn't actually anything at all.

A hole at the centre of the iris that controls the amount of light entering the eye. The size of this hole is controlled by 2 muscles within the iris.

The pupilloconstrictor (controlled by the parasympathetic nervous system) and the pupillodilator (controlled by the sympathetic nervous system).

So, I guess what we are really assessing here is the iris response.

Pupil contraction (parasympathetic response):

When a light intensity increases across the rods and cones of the retina, impulses travel via the optic nerve to the pretectal nucleus of the upper midbrain.

From here impulses travel to the Edinger-Westphal nucleus, and onwards via the III cranial nerve (oculomotor) to the pupilloconstrictor muscle of the iris... causing contraction (miosis).

Pupil dilation (sympathetic response):

When light intensity decreases, impulses travel from the retina via the optic nerve to neurones on the hypothalamus where it takes a convoluted neuronal journey through the lateral brainstem to the spinal cord, down across the apex of the lung, back up alongside the internal carotid into the skull, through the inferior orbital fissure. Finally, it travels along the V cranial nerve (trigeminal) that innervates the pupillodilator muscle of iris... causing dilation (mydriasis).

How to assess pupillary reflexes.

Ideally, pupillary reflexes should be examined in a dim environment.

If the patient is conscious, ask them to fix their gaze on a target some distance behind you (If they re-focus on you or your torch, there may be pupil constriction as a result of accommodation).

Use a neurotorch or cheap penlight torch. This is for 2 reasons:

1. Using a super bright concentrated light will not be appreciated by a conscious patient.

2. Doctors do not (as a rule) carry neuro torches. They borrow the nurses.
They forget to give them back.
Don't get me started.

Size and Equality.

The pupil size is documented as the diameter in millimetres.

Tools to help you estimate this size include pupil gauges located on most Glasgow Coma Scale records and many neuro torches.

You may also find it useful in your written documentation to include descriptors such as: pinpoint, small, midposition, large, dilated.

Anisocoria: Up to 20% of the population have a slight difference in pupil size and is considered a normal variant. This difference should not be greater than 1mm and pupil reactivity should be normal.

Shape.

The pupil shape can be documented as round, irregular, oval or keyhole. Causes of irregular pupils include cataract surgery or the implantation of intra-ocular lenses. Oval pupils may be a result of compression of the III cranial nerve as a result of raised intracranial pressure (ICP).

As ICP increases, the pupil will continue to dilate and eventually become non-reactive to light.

Keyhole pupils are seen in patients post iridectomy (a common part of cataract surgery). They may still react to light but usually the reactivity is sluggish.

Reactivity:

The pupil response to light is assessed by shining a neuro torch (or low powered penlight torch) separately into each eye.

Tip: shining the torch onto the pupil from directly above may make assessment difficult due to 'glare' reflected off the cornea. Instead, position yourself in front of the eye and shine the beam from slightly off to one side.

Document pupil reactivity to light separately. Reactivity may be:

- Brisk
- Sluggish
- Non-reactive.

At the same time look for the normal pupillary constriction response in the opposite eye. This is called the **consensual pupillary response**.

Accommodation:

This is the normal constriction of the pupil that occurs when a conscious patient is asked to shift their focus from a distant object, to a close one.

Causes of abnormal pupils:

UNEQUAL PUPILS:

Mydriasis: One pupil is dilated and non-reactive whilst the other is normal.

May be caused by compression of the III cranial nerve, compression of the posterior communicating artery or by direct damage to the nerve endings in the iris sphincter muscle. Following a traumatic brain injury an increase in intracranial pressure can lead to the uncus (part of the temporal lobe) squeezing against the tentorium and pressing against the III cranial nerve resulting in a dilated pupil (mydriasis) on the affected (ipsilateral) side.

If pressure continues to increase, contralateral dilation will also occur.

Horner's Syndrome: One pupil is smaller than the other and has a decreased response to light and accommodation. There is ptosis of the eyelid on the affected side.

Caused by loss of sympathetic intervention to the pupil due to a lesion in the brainstem of spinal cord, or damage to the hypothalamus. There is also decreased sweating (Anhidrosis) of some or all of the face.

Causes of Horner's syndrome include carotid artery dissection, nasopharyngeal tumours, brachial plexus injury.

DILATED PUPILS:

Drug induced mydriasis: bilateral dilation as a result of drugs including antihistamines, hallucinogens, amphetamines, anticholinergics, dopamine or barbiturates.

May be caused by medication used for ophthalmic examination such as atropine, scopolamine, or by anoxia or brain death.

Mental or emotional stimulation: Dilation may also be caused by sexual arousal or increased mental effort.

CONSTRICTED PUPILS

Miosis: Bilateral pinpoint pupils (usually too small to figure out if they are responding to light or not).

May be caused by disruption to the sympathetic pathway due to intraocular inflammation or direct trauma, a pontine haemorrhage, or due to the effect of drugs such as opiates, pilocarpine or acetylcholine.

EQUAL PUPILS:

Hippus: Initially react to light but then alternate between dilated and constricted. May indicate early compression of III cranial nerve.

May indicate injury to the midbrain or barbiturate toxicity.

Relative Afferent Pupillary Defect (RAPD): When light is shone into the effected eye there is a sluggish reaction. There is a normal consensual reaction when light is shone into the opposite eye, but when the light is quickly shone back to the effected

eye it will dilate.

This is known as the swinging flashlight test and may indicate optic neuritis, retinal detachment or infection or direct optic nerve damage.

In conclusion.

Use of a neuro torch to perform a pupil assessment is a quick but important skill that can give a great deal of information.

The eyes may indeed be the windows to the soul.

But the pupils are the manholes to the ongoing neurological status of your patient.



Ian Miller