

Examination Of The Cranial Nerves

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General

Introduce yourself to the patient. Explain to the patient what you are about to do by asking them “I would like to examine the nerves in your head and neck, do I have your permission to do this?”

In order to examine the cranial nerves the patient should be sitting up. You will need the following equipment:

1. Snellen chart
2. hatpin
3. ophthalmoscope
4. cotton wool
5. tuning fork

In general you examine the cranial nerves in numerical order. The only exception to this is considering cranial nerves 2,3,4 and 6 together as these nerves pertain to the eyes.

I. Olfactory Nerve

In medical finals it is sufficient to ask the patient “*have you noticed any change in your sense of smell?*” If they report a change in their sense of smell you should turn to the examiner and say “*I would like to test olfaction formally with scented bottles.*”

It is very unlikely that the examiner will want you to proceed with testing the olfactory nerve. If the examiner does want you to go on, ask the patient to close their eyes and present each bottle to one nostril and ask the patient “*is this the same smell as before or a different one?*”

Patients should not be able to recognise smells, but should be able to discriminate one smell from another.

Causes of anosmia are:

- upper respiratory tract infection (by far the most common)
- fracture of the skull base
- frontal meningioma.

II. Optic Nerve

In order to examine the optic nerve, you must perform the following tests:

- visual acuity
- visual fields
- pupillary light reaction (this is strictly speaking cranial nerves II and III)
- accommodation reaction (this is strictly speaking cranial nerves II and III)
- fundoscopy

Visual Acuity

Ask the patient “*do you have any difficulty with your vision?*” If they reply by saying that they wear glasses ask them “*is this for long or shortsightedness?*”

When formally testing visual acuity, let the patient wear their glasses. Take a mini Snellen chart and holding it 1 metre away from the patient, ask them *“could you please cover your right eye and read as far as you can down the chart”*

Encourage the patient to try their best on the line that they struggle with. Record visual acuity as {6/the number under the smallest print line that they can read minus the number of letters that they misread} e.g. 6/18-2. If they cannot read even the biggest letter on the chart, record vision in the eye as counting fingers (CF), hand movements (HM) perception of light (PL) or no perception of light (N PL).

Now ask the patient *“could you now please cover your left eye and repeat the test?”*

If you do not have a mini Snellen chart to hand, you could ask the patient to read the print of a magazine beside the bed.

Visual fields

This is tested for by **confrontation**. Sit opposite the patient 1 metre away from them and cover your left eye. Say to the patient *“I would like to test how far you can see out the corners of your eyes. Could you please cover your right eye with your right hand (pause to let them do this) Thank you, now I would like you to fix your gaze on the bridge of my nose. Please tell me when you see my finger wagging.”*

Move your finger inwards from the limits of the four quadrants and note when the patient sees it. Test the other eye in a similar way.

The following **field defects** should be memorised:

- **unilateral blindness** occurs if one eye or its optic nerve is destroyed.
- **bitemporal hemianopia** is due to damage at the optic chiasm (pituitary tumour) and results in tunnel vision
- **homonymous hemianopia** means both eyes cannot see one half of the visual field. The lesion is in the contralateral optic tract. For example, if a patient cannot see stimuli presented to their right, the defect lies in the left optic tract

Now test for **sensory inattention** by holding both your arms outstretched between you and the patient and saying to them *“please could you continue to look at the bridge of my nose and tell me which fingers am I moving”* Waggle the fingers of your left hand, then your right hand and then both together. Sensory inattention often follows a lesion to the dominant parietal lobe. The patient may see a stimulus presented in the contralateral field when presented in isolation but not when there is also a stimulus in the ipsilateral field.

Now attempt to map the **blind spot**. Cover your left eye and tell the patient *“Could you please cover your right eye with your right hand (pause to let them do this.) Thank you, could you fix your gaze on the bridge of my nose again. I am going to slowly move a red pin in front of you. You will see the pin disappear and then reappear again. Please tell me when you first notice it go and then when you see it again .”*

Now bring the pin slowly across your visual field **midway** between you and the patient. Compare the size of your blind spot to the patient’s. Test the other eye similarly

A **central scotoma** occurs with defects in the retina or optic nerve. An **enlarged blind spot** occurs in papilloedema.

Pupillary light reaction and accommodation

First of all, look at the pupils to check that they are equal in size. Now say to the patient *“I would like to shine a light into your eyes”* Place your hand just in front of the patient’s nose so that light shining into one eye doesn’t end up shining in the other one as well. Shine the light into the lateral corner of the patient’s eye and check for pupil constriction both in that eye (**direct response**) and in the opposite eye (**consensual response**). Test the other eye similarly.

To test accommodation, place the pen torch about 15 cm away from the patient's nose and ask them "*please could you look at the curtain hooks (or some other distant object) and then when I say now, shift your gaze to the pen torch*" A normal response is for both the pupils to constrict and to converge on the new target.

Fundoscopy

Turn to the examiner and say "*I would now like to perform fundoscopy*" It is unlikely that the examiner will get you to proceed with this unless there is an abnormality in the patient's retina. For the purpose of medical finals you should be able to recognise the following pathologies:

- diabetic retinopathy
- hypertensive retinopathy
- laser burns in the treatment of retinopathy
- optic atrophy

III, IV and VI. Oculomotor, Trochlear and Abducens Nerves

Ask the patient "*I would now like to test your eye movements. Please could you follow my finger and tell me if you see double?*"

Move your fingers slowly in the shape of a "H", looking for **nystagmus** and **diplopia**. If the patient does see double ask them "are the two images side by side or is one image diagonally higher than the other?" Now ask the patient "could you please cover your right eye up. Which image disappears, the one farther out or the one closer in?"

The **peripheral image** comes from the eye with the defect. It is displaced in the **normal direction of action** of the muscle.

The 3rd nerve supplies all the muscles of the eye with the exception of the superior oblique (which turns the eye down especially when it is adducted) which is supplied by the 4th nerve, and the lateral rectus (which abducts the eye) and is supplied by the 6th nerve.

This table summarises the normal actions of the muscles:

nerve	muscle	action
oculomotor	medial rectus	adduction
	inferior rectus	inferior movement with eye abducted
	superior rectus	superior movement with eye abducted
	inferior oblique	superior movement with eye adducted
trochlear	superior oblique	inferior movement with eye adducted
abducens	lateral rectus	abduction

The following **defects in eye movement** should be memorised:

- **3rd nerve palsy** may be caused by a posterior communicating artery aneurysm or mononeuritis multiplex (e.g. diabetes mellitus or vasculitis). Its features are:
 1. complete ptosis
 2. dilated pupil
 3. eye turned down and out
- **6th nerve palsy** may be caused by raised intracranial pressure. There will be a failure to abduct the affected eye.
- **4th nerve palsy**. This is **rare**. Patients get diplopia when looking downwards and inwards and often complain of double vision when going downstairs.

V. Trigeminal Nerve

The trigeminal nerve is a mixed sensory and motor nerve. Start off by testing sensation with a piece of cotton wool say to the patient...

"I would like to test the sensation in your face. I am going to touch your face a number of times with a piece of cotton wool. I would like you to tell me whether I am touching your forehead, cheek or chin and whether this is on the left or the right side of your face."...

Demonstrate this to the patient by placing the cotton wool on one area and telling them *"for example, if I touched you here you would say left forehead, now please close your eyes"*

Make sure you put a **variable time delay** in before each stimulus so the patient cannot anticipate what the next stimulus would be.

Test the motor component of the nerve saying to the patient *"could you please open your mouth (give them time to do this). Now please stop me from closing your mouth"* Ask the patient to *"clench your teeth"* and feel over the masseter and temporalis muscles.

Now turn to the examiner and say *"I would also like to test the corneal reflex."* As this is an unpleasant procedure for the patient, it is unlikely the examiner will get you to proceed.

If there is a **5th nerve palsy**, there may be **ipsilateral sensory loss** and the jaw will deviate **towards** the side of the lesion. An isolated 5th nerve palsy is unusual and in an exam you are more likely to be given a patient with a mixed deficit (e.g. nerves 3,4,5a and 6 in a cavernous sinus lesion or 5, 7, 8 ±9, with cerebellar signs in an acoustic neuroma at the cerebellopontine angle.)

VII. Facial Nerve

When you look at a patient with a 7th nerve palsy, it should automatically be apparent as the muscles on the affected side will tend to droop.

Demonstrate the loss of muscle power by asking the patient *"I would like to test the movements of your face, for this I will ask you to perform a number of different tests"*

First of all examine movement in the lower 2/3 of the face by asking the patient to *"show me your teeth"* and *"puff your cheeks, stop me from pressing the air in your cheeks out"*

Now examine power in the upper 1/3 of the face by asking them to *"screw up your eyes as much as you can (give the patient time to do this and observe for equal burying of the eyelashes) now, stop me from opening them"* (attempt to prise the eyelids open)

It is important to be able to distinguish between upper motor neurone and lower motor neurone defects. There is a bilateral representation of the muscles that move the upper 1/3rd of the face in the cerebral cortex, so:

- in an UMN defect, the upper 1/3rd of the face is relatively spared
- in a LMN defect all the movements of one side of the face are affected

There is a wide differential diagnosis of a 7th nerve palsy:

- in an UMN defect, think of stroke and tumour
- in a LMN defect the cause could be infection (e.g. Ramsay Hunt syndrome, HIV, TB), brainstem lesions (e.g. stroke, tumour or MS), acoustic neuroma and systemic disease (e.g. diabetes mellitus, sarcoidosis). An idiopathic LMN 7th nerve palsy is called Bell's Palsy, it is a diagnosis by exclusion.

VIII Vestibulocochlear Nerve

For medical finals, all that is necessary is to ask the patient to repeat numbers as you whisper them in one ear and cover the other ear up.

Now turn to the examiner and say *“I would also like to perform **Rinne’s** and **Weber’s** tests”*

If the examiner wants you to perform these tests, you will need a tuning fork. Start off with **Rinne’s test**. Explain to the patient *“I would now like to do some more tests on your hearing. This is number one (take the vibrating tuning fork and place the base on the patients mastoid process) and this is number two (now place the free end of the tuning fork in front of the patient’s ear.) I shall do that again, which is louder, number one or number two?”*

If air conduction (number two) is better than bone conduction (number one) this is **normal** or there is a **sensorineural hearing loss**. However, if bone conduction (number two) is better than air conduction (number one) there is a **middle ear conduction defect**.

This is most clearly recorded as AC>BC or vice versa rather than Rinnes positive or negative.

Now perform **Weber’s test** by placing the base of the vibrating tuning fork on the centre of the patients forehead and asking the patient *“where do you hear the sound?”* If they hear the sound on one side there is either a **conduction defect** on that side or a **sensorineural hearing loss** on the opposite side.

VIII Glossopharangeal Nerve and X Vagus Nerve

Ask the patient to open their mouth wide and shine the pen torch into the back of the patient’s mouth. Ask the patient to say *“aah”* while you observe the patient’s palate. The uvula will deviate **away** from the side of the lesion.

Ask the patient to swallow as a crude test of the vagus nerve

Now turn to the examiner and say *“I would also like to test the gag reflex.”* The sensory limb of this reflex arc is the glossopharangeal nerve and the motor limb is the vagus nerve. However, as this is an unpleasant procedure for the patient, it is unlikely the examiner will get you to proceed.

XI Accessory Nerve

Ask the patient *“could you please shrug your shoulders? (give them time to do this) Now I would like to test how strong your shoulders are, stop me from pushing them down.”*

Push down on the patient’s shoulders firmly and assess the strength of the patient’s trapezius muscles.

Now tell the patient *“I would like to test the strength of you neck muscles. Please turn you head slightly to the **right** (give them time to do this), now I would like you to try and keep your head in that position while I try to move it back.”*

Try and turn the patients chin back towards the midline while palpating the **left** sternocleidomastoid muscle. Test the other sternocleidomastoid muscle in a similar way.

An isolated lesion in the accessory nerve is extremely unusual. A differential diagnosis includes polio, strokes, syringomyelia, tumours near the jugular foramen and bulbar palsy.

XII Hypoglossal Nerve

With the pen torch, observe the tongue while in the mouth for **fasciculation** and **muscle bulk**. If wasting is present, the tongue will be thinner and more wrinkled on the affected side. Wasting and fasciculation only occur in lower motor neurone lesions.

Ask the patient to pull out their tongue and waggle it from side to side. If the tongue deviates towards one side, this is the side of the lesion.

An isolated 12th nerve lesion is rare. The 9th, 10th and 12th nerves may be damaged as a group in trauma, brainstem lesions and tumours of the head and neck.

Finishing off the examination

It is now very important to turn to the patient and say “*Thank-you that completes my examination*”