Year 2 MBChB

Clinical Skills Session

Cranial Nerve Examination

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Cranial Examination

**Learning objectives**

- To know the basic anatomy and function of cranial nerves.
- To be able to understand and carry out a bedside assessment of cranial nerve function.
- To adhere to waste disposal policies including sharps and clinical waste.

**Theory and Background**

There are twelve pairs of cranial nerves which arise directly from the brain; the first two pairs arise from the cerebrum the rest from the brain stem. The cranial nerves are numbered using roman numerals from I-XII as listed below:

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<table>
<thead>
<tr>
<th>Roman Numeral</th>
<th>Name</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Olfactory</td>
</tr>
<tr>
<td>II</td>
<td>Optic</td>
</tr>
<tr>
<td>III</td>
<td>Oculomotor</td>
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<tr>
<td>IV</td>
<td>Trochlear</td>
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<td>V</td>
<td>Trigeminal</td>
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<tr>
<td>VI</td>
<td>Abducent</td>
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<tr>
<td>VII</td>
<td>Facial</td>
</tr>
<tr>
<td>VIII</td>
<td>Acoustic (auditory &amp; vestibular)</td>
</tr>
<tr>
<td>IX</td>
<td>Glossopharyngeal</td>
</tr>
<tr>
<td>X</td>
<td>Vagus</td>
</tr>
<tr>
<td>XI</td>
<td>Accessory</td>
</tr>
<tr>
<td>XII</td>
<td>Hypoglossal</td>
</tr>
</tbody>
</table>

There are a number of mnemonics for remembering the cranial nerves, one example is:

I  On
II  Our
III Outing
IV To
V  The
VI Airport
VII Fatty
VIII Arbuckle
IX Gave
X  Vicky
XI  A
XII Hamburger
Indications for cranial nerve examination

Cranial nerve assessment is incorporated within a number of neurological examinations.

There are several indications for cranial nerve examination. The following list is by no means exhaustive;

- Sudden paralysis or changes in sensation
- Unexplained muscle weakness
- Trauma
- Malignancies
- Epilepsy
- Glaucoma
- Multiple Sclerosis
- Perforated tympanic membrane

Procedure

It is unlikely that all 12 cranial nerves would be examined at once. Deciding which nerves need testing will be dependent upon the history and the signs and symptoms that the patient presents with.

Patient safety

Prior to any clinical examination a detailed history should be taken from the patient, this will enable you to tailor the examination to the patients presenting complaint and additional symptoms the patient may elude to when you elicit a full history. For guidance on history taking please click MBCHB students – Year 2 – History taking.
**Cranial Nerve I, Olfactory**

The olfactory nerve is responsible for the sense of smell. Smell is an important component of the appreciation of taste (which may be the principal complaint of a patient). It is only tested in specialist areas.

It is important to test one nostril at a time by occluding the other nostril. Different familiar test smells are used e.g. coffee or orange. The patient needs to sniff and signal detection with a prompt response (otherwise the smell can be picked up via the opposite olfactory bulb). Be aware that strong smells like ammonia are detected through nasal pain fibres, so should not be used. A patient with loss of the olfactory nerve should still be able taste sugar, salt, sour, unless other nerves are damaged.

Potential causes of dysfunction may include: Age, URTI, Malignancies, Chemical Exposure, Facial trauma, Head injury including stroke, Epilepsy (may sense smells prior to or post fitting), Parkinson’s, Alzheimer’s (Odour memory).

**Cranial Nerve II, Optic**

There are various tests that may be performed to fully assess the integrity of the optic nerve(s). These include:

- ophthalmoscopy (See separate study guide)
- pupillary reflexes
- visual acuity
- visual fields

However if vision is severely affected then not all of them may be performed.

**Inspection and pupillary reflexes**

Visually check the size and shape of the pupils, the regularity in outline and equality of both sides. Pupils should be round but the size will vary depending on surrounding light. The size of a normal adult pupil varies from 2-4 mm in diameter in a bright light and 4-8 mm in the dark. On the side of some pen torches is a scale of pupil sizes that can be used as a reference.

Note if there are any defects in the iris or foreign bodies in the anterior chamber. Does the patient have any obvious cataracts?

Assess the pupillary light reflexes are present by asking the patient to look at a distant object. Then shine a light onto one eye by bringing it in from the side, or switch the light on from in front. Ensure that the stimulus is abrupt, and shield the other eye from the light as there are two responses being assessed – direct and consensual.

A **direct response** is when there is constriction of the pupil when light is shone into that eye.

A **consensual response** is when there is constriction of the pupil to light shone in the opposite eye.

The next part of the assessment is to assess for accommodation. Accommodation is an adjustment of the eye for near vision. You need to ask the patient to focus on a distant object and then focus when an object is brought into view and held at about 10 cm from their face (a pen torch / finger etc.).

It is important to keep the pen or finger at a high level or the patient’s eyelids may obscure the pupil. If accommodation is intact the patient’s eyes should converge and the pupils should constrict equally, when focusing on the object close to their eyes.

**P.E.R.L.A** (Pupils Equal and Reactive to Light and Accommodation) can be documented in the patient records when all of the above responses are normal. The acronym PERLA can also help remind you what tests should be performed. When documenting, it is permissible to write PERLA in the case notes as it signifies that all elements
were checked and functioning normally. However, if any of the tests were negative you would need to write this in long hand you cannot just omit the letter e.g. if accommodation was not present you cannot write PERL you need to write each element individually.

Another test that can be performed if clinically relevant is the swinging light test. The test compares direct and consensual response to stimulation. Light stimulus is quickly moved from one pupil to the other repeatedly every 3 – 4 seconds. The examiner observes for pupils which dilate and constrict during the procedure. The test may detect abnormalities of the retina and the optic nerve up to the optic chiasm. An abnormal finding is when light is shone into the affected eye and both pupils dilate slightly, instead of constricting as would be expected if normal.

Abnormal pupillary reflexes may be due to: Age, Macular degeneration, Glaucoma, Retinopathies, Corneal, iris or lens conditions, Optic neuritis including MS, Malignancies, Head injury including stroke or Drugs.

**Visual Acuity**

Visual acuity is the ability to see objects clearly. To assess visual acuity we use a Snellen’s chart. A Snellen’s chart has a series of different sized characters, which are viewed from a distance of 6 metres away, (half sized charts are available and should be viewed at 3 metres). For each line there is a number below it that represents the distance in metres from which that size letter would be visible to someone with normal eyesight. For example a line with a small 9 should be readable from 9 metres by someone with normal vision.

The patient should cover each eye in turn and determine the smallest print size that can be read comfortably. If they are unable to see any of the characters at 6 metres they can move forward 1 metre at a time until they can see a character clearly e.g. if they could only read the 60 print size from 3 metres then the documentation would be recorded as 3/60.

Each eye is recorded separately and charted with the distance from the chart followed by the size of the smallest letters they can read e.g. R = 6/6 L = 6/9, these results would indicate that this patient can read the smallest text with their right eye and therefore has normal vision. However, with their left eye from 6 metres they can only read what people with normal vision are able to read at 9 metres.

If the patient is short-sighted their glasses should be worn (their lens prescription should be documented), if their glasses are not available reading through a pin-hole will help to compensate as we are assessing a sudden deterioration in vision.

For patients unable to read the chart as close as 1 metre acuity is recorded based on their ability to: Count fingers (CF) at 0.5 metre, perceive hand movement (HM), perceive light (PL) or document NPL if the patient has no perception of light.

For patients and children who cannot recognise the alphabet there are charts showing shapes or pictures rather than letters.

It is difficult to determine in the optic nerve is the root cause for visual acuity problems but causes may include: Age, Macular degeneration (The receptor sites for central acute vision), Glaucoma (increased pressure within the eye), Retinopathies (affecting the light sensitive cells), Corneal, iris or lens conditions (affecting the passage of light
or the ability to focus), Optic neuritis including Multiple Sclerosis (affecting the transmission of information), Malignancies (within the eye, CN II or the brain), Head injury including stroke.

**Visual Field**

The visual field refers to the total area in which objects can be seen in the side (peripheral) vision as you focus your eyes on a central point. If there is damage to the nerve fibres then your vision may alter.

Assessing visual fields is a simple “bedside” test to assess a patient’s peripheral vision and evaluate their blind spot. To carry out this test you should face the patient at a distance of about 1 metre. Keep the patient’s visual background uncluttered, with light behind the patient. To test the right eye close or cover your right eye and ask the patient to cover their left eye and ask them to look at the bridge of your nose, this ensures you are both looking at the same visual fields.

Ensuring the patient doesn’t look away from your nose and keeping a white pin in a plane midway between you and the patient, bring the white pin head from the extreme of vision (arm’s length) in towards the midline. A white pin head is used due to rods being in abundance on the periphery of the retina hence a light / dark colour is used. As the pin head is moved in ask the patient to indicate when they first see it entering their visual field and compare this to your own detection.

Test each quadrant moving diagonally bisecting each quadrant. Establish rough boundary then define areas of loss with slower target movements (see Fig. 1&2) thus producing a more detailed “map” of a defect.

The field of vision is limited superiorly by the supra-orbital ridge and medially by the nose. Any defect to the patient’s vision should be assessed formally.

![Fig 1](image1.png)

![Fig 2](image2.png)

**Blind spot**

As the optic disc contains neither cones nor rods it is an area of the retina which is unable to perceive light and therefore creates a blind spot in which a visual field deficit is present. This is found at an angle of approximately 15 – 20 degrees lateral to forward gaze and is perceived only when one eye is closed.

For this test sit opposite the patient ensuring you are both at the same eye level. As with peripheral vision you are comparing your right eye with the patient’s left eye and vice versa closing one eye at a time. You need to use a 1cm red pin / object, this is because we are assessing central vision and there are more cones, which pick up colour, than rods present. Move the pin head slowly from the midline outwards. Ask the patient to report any distortion of the pinhead or when it disappears and reappear due to the blind spot. The pinhead should disappear and reappear within approx 1cm (width of the pin head).
A scotoma is a small visual field deficit due to conditions which affect the passage or perception of light within the eye.

**Interpretation of Visual Field**

The following images show the possible areas of damage to the nerve and how this would affect the patient's vision along with the name of the visual loss. The arrows at the top indicate the passage of light (light travels in a straight line) and it is important to note that images perceived by the temporal pathway are traveling from the nasal area i.e. the green and purple arrows and conversely images perceived from by the nasal pathway are travelling from the temporal area i.e. the blue and red arrows.

It is important to remember that visual loss can be partial or complete for a variety of reasons and the most typical patterns of damage are listed below.

In this first image there is damage to the optic nerve on the left hand side. If you follow the green and blue pathway they both lead to the left eye, so in this condition the patient would not be able to see anything from their left eye. This would be the same for the right eye if the damage was to the nerve on the right side.

In this second image there is damage to the optic chiasm. If you follow the red and blue pathways it will show that the patient’s right eye will not be able to perceive images from the temporal region - as the left side of the retina (red in the image) is picking up images from the temporal region. Similarly the patient will not be able to see to the left side with their left eye (again the temporal side). This will give them a bi-temporal hemianopia.
The third image shows damage to the optic radiation on the right side (blue and purple lines). These fibres come from the right side of each eye (purple from the right eye and blue from the left eye). As the damage affects the right side of each eye, the patient would not be able to see anything to the left side. This is called a left homonymous hemianopia. If the damage had been to the opposite side of the optic radiation then the result would be a right homonymous hemianopia.

Homonymous hemianopia – visual loss on the same side of both eyes i.e. if it were a right sided hemianopia there would be visual loss in the right side halves of both eyes. This can be caused by strokes, traumatic brain injury, tumours, aura phase of migraine (although this would be transient).

The final image is damage to the optical cortex. In the image the damage has occurred at the red and green line so the patient would not be able to see anything from the right side. However, due to the collateral blood supply in this area central vision is preserved.
Causes of an abnormally large blind spot, the presence of scotoma or loss of visual field may include: CN II Lesions, Optic neuritis (affects the passage of information), Glaucoma, Diabetes (affects the retina), Macular degeneration, Arteriosclerosis or tumour.

**Cranial Nerve III, IV and VI (Oculomotor, Trochlear and Abducens)**

Eye movements are controlled by cranial nerves III, IV and VI. Read through your HARC notes to learn more about the anatomy and physiology of eye movements.

**Which nerves govern which muscles?**

A way to remember which muscle is controlled by which nerve is **SO⁴ LR⁶ & EE³**.

- **SO⁴** means that the superior oblique muscle is controlled by the 4th nerve which is the trochlear nerve, this muscle also goes through a bony prominence called a trochlear.
- **LR⁶** means that the lateral rectus muscle is controlled by the 6th nerve which is the abducens to abduct means to move away from the body.
- **EE⁶** means that everything else is controlled by the 3rd nerve which is the oculomotor.

Homonymous hemianopia with macular sparing – The lesion or damage is in the occipital region, this results in preservation of central vision due to collateral blood supply to the relevant area of the visual cortex. This can be caused by, for example, occipital stroke due to posterior arterial occlusion / trauma.
Testing eye movements

Known as the double ‘H’. Hold a pen or similar object 50 cm from the patient in the midline and on a level with the patient’s eyes. Ask the patient to follow the object (“with their eyes”), keeping their head still, and to tell you if they experience any double vision (diplopia).

Move the object slowly, side to side, up and down centrally, then at extremes of lateral gaze. The pen should be held vertically for horizontal movements and horizontally for vertical movements.

You need to observe the range, smoothness and speed of the movement, as well as noting whether the eyes move together (conjugate) or if there is a nystagmus present (see 8th nerve for details).
Diplopia – which eye and muscle

If the patient is suffering from diplopia, you will need to establish which muscle(s) is affected.

For each direction of gaze with diplopia you need to establish the position where the images are the widest apart. Cover each eye in turn and confirm binocular diplopia (present only with both eyes looking). If you cover one eye and the image away from the centre of vision disappears the covered eye and the muscle turning it that way are the abnormal ones. This can be cross-checked by covering the other eye, in which case the central image should disappear.

Here are some examples of nerve palsy’s:

**3rd (Oculomotor) nerve palsy**

- **Ptosis**
  - Resting
  - On lifting ptosis, the eye deviated laterally and downwards
- Affected eye (left)
- In complete palsy, pupil dilated and unreactive

**4th (Trochlear) nerve palsy**

- Resting
- Looking to right and downwards
- Affected eye (left)

**6th**

- Resting position
- Look to L
- On command to look to the left the affected eye (LEFT) does not move
- Affected eye
**Cover test for latent squint**

Ask the patient to look with both eyes at your right eye. Cover the patient’s left eye, then uncover the left eye and rapidly cover right eye. You should look to see if the left eye corrects to fix on your eye, repeat for patient’s right eye. If there is no shift in fixation then it can mean the patient has no misalignment, however it needs to be confirmed with the findings of the opposite eye. If the eye does shift in fixation then it is an indication that there is a form of strabismus.

In addition to CN III, IV and VI dysfunction, causes of diplopia may include: Thyroid condition, Diabetes, Myasthenia Gravis, Multiple Sclerosis, Tumour, Trauma including stroke.

**Cranial Nerve V, Trigeminal nerve**

The trigeminal nerve has both sensory and motor supplies. The sensory division supplies three branches of the face the ophthalmic (V1), maxillary (V2) and mandibular (V3) and the Motor division supplies the muscles of mastication.

To test the sensory function you can use light touch or pain. For light touch use a wisp of cotton wool, although fingers are sometimes used instead if cotton wool is not available. For pain use the sharp end of a neuro tip, you can use the blunt end to act as a discriminator if the patient is unable to readily sense pain. You should test in at least two places for each of the regions, more if there is any sensory loss, when you should map out the area of loss. Remember to compare the right side with the left as you go along. Also be careful, when assessing pain, not to rest your fingers on the patients face, or the edge of the neuro tip as this will not give a sharp sensation.

The corneal reflex can also be assessed as it is also governed by the trigeminal nerve. Be aware that it may naturally be dulled in someone who wears contact lenses, which should be removed, if present, before assessment. This reflex is elicited by using a wisp of cotton wool and asking the patient to look up and inwards, as this will remove usual stimuli. Gently touch the lateral cornea and both eyes should blink. Be careful to touch the peripheral cornea and not the conjunctiva and avoid the central cornea. Be careful not to drag the cotton across the cornea. The trigeminal nerve senses the presence of the cotton wool, but it is the 7th cranial nerve (the facial) that closes the eyelid.
To assess the motor function of the trigeminal nerve, place your fingers on the temporalis muscles and then the masseter muscles. Each time you should ask the patient to clench their teeth and you should be able to feel the muscles contracting. Next ask the patient to open their mouth to the left, and stop you trying to gently push the open jaw back to midline. Repeat this for right side; this is testing power of lateral and medial pterygoids, note any weakness.

The jaw jerk is a reflex that is also governed by the trigeminal nerve. You should assess it by asking the patient to relax their jaw so the mouth is slightly open, you then place a finger on their chin and percuss your finger, observe and feel for jaw movement, which will be noticed by the mandible jerking upwards.

In addition to CN V dysfunction potential causes of trigeminal nerve problems may include: Trauma, MS, Arteriovascular Malformation or Tumour. If the patient is displaying signs of sensory loss is it: Loss or increased sensitivity, One of the trigeminal nerves (hemi-facial)?, One of the branches of a nerve (a single dermatome)?, A smaller area within a dermatome? or a Bizarre pattern i.e. Corneal reflex present in a patient with sensory loss in an ophthalmic branch?

Cranial Nerve VII, Facial nerve
(Don’t forget we looked at VI before the trigeminal nerve which is why we are jumping to VII)
The facial nerve supplies the muscles of facial expression and the stapedius muscle in the ear. Additionally the sensory aspect supplies taste to the anterior 2/3rd of the tongue and the parasympathetic fibres to the lacrimal gland. Lower motor neuron (LMN) lesions affect all facial muscles on that side of the face, whereas unilateral upper motor neuron lesions (UMN) spare the forehead, as it is dually innervated by the right and left facial nerve.
To test the motor function, ask the patient to show their teeth, purse lips, blow out their cheeks, close their eyes tightly and open eyes as wide as they can. It is better for you to demonstrate each action first to the patient. Once you have assessed that the patient is able to do these movements, you need to assess them against resistance. To do this, with the patient’s eyes tightly shut attempt to gently pull the eyelids apart. With their eyebrows raised, attempt to pull eyebrows downwards. With their lips pursed tightly, attempt to pull lips apart. With their cheeks blown out, press against the cheek to assess strength. Remember to document any weakness.

When considering facial nerve dysfunction think:
Is the whole side of the face affected including the forehead? If so causes include: Ipsilateral LMN causes – Parotid Tumour, Bells Palsy & Trauma.
Is the whole side of the face affected excluding the forehead? If so causes include: Contralateral UMN causes – Cerebral Vascular Accident (CVA), Epilepsy (Todd’s Paresis) & Trauma.

Bilateral weakness is unusual and is only seen in less than 3% of presentations.

**Cranial Nerve VIII, Acoustic (Vestibulocochlear) nerve**
The acoustic nerve has two functions – Auditory (hearing) and Vestibular (balance).

Tests for auditory function
The first test is a simple gross test - use a watch or rub your fingers together (in a quiet environment), and judge how far away the sound can be detected. You should test each ear, one at a time and block the opposite ear. If hearing is impaired in either ear then you should perform Rinne’s and Weber’s test. These tests use a 512 Hz tuning fork which you should set vibrating by gently tapping on your knee or wrist or by squeezing the ends together and sliding your finger and thumb off the prongs.
Rinne test can be done in two ways the short and the long way. For the short way you should place the base of the vibrating tuning fork on the mastoid process, and confirm that it can be heard.

Once the patient confirms they can hear it, immediately place prongs in front of external auditory meatus, explain it is in front of the ear and ask the patient which is louder - “behind the ear or in front?” In normal conductive hearing the patient should hear it louder in front of the ear as the sound is travelling through air.

For the longer method place the vibrating tuning fork behind the ear once you have confirmed that the patient can hear the sound ask them to tell you when they can no longer hear the sound. When they can no longer hear the sound place the fork in front of ear directly over the auditory meatus and ask the patient again if they can hear the sound. If the conductive pathway is normal the patient should be able to hear the sound again.

If the patient is suffering from conductive deafness (the sounds cannot conduct from the external to the inner ear) the sound will not be heard, or will be reduced, when the tuning fork is placed in front of the ear.

In partial sensorineural deafness (due to damage to the cochlea, auditory nerve or auditory centres of the brain) the sound may be heard when the tuning fork is placed in front of the ear (but at a higher pitch than normal hearing).

In complete sensorineural deafness no sound will be heard when the tuning fork is placed in either position as the nerve pathway has been severed.

Weber’s test is performed by holding the base of the vibrating tuning fork on the top of the patient’s head or forehead. Ask the patient to tell you if the sound is louder in either ear or is the sound equal in both ears?

In normal conductive hearing the sound of the tuning fork will be heard equally in both ears or the patient will say they can’t hear it at all.
In unilateral conductive deafness the sound will be heard loudest in the affected ear this is due to the vibration passing through the bone only and not through the air.

In bilateral conductive deafness the sound will be heard loudly in both ears.

In unilateral sensorineural deafness the sound will be heard loudest in the unaffected ear as again the affected ear has had the pathway blocked.

### Interpretation of Hearing tests

<table>
<thead>
<tr>
<th>TEST</th>
<th>NORMAL</th>
<th>CONDUCTIVE LOSS</th>
<th>PARTIAL SENSORINEURAL LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROSS</td>
<td>Heard at distance</td>
<td>Not heard in affected ear</td>
<td>Not heard in affected ear</td>
</tr>
<tr>
<td>(rubbing fingers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RINNE</td>
<td>Air &gt;Bone</td>
<td>Bone&gt; Air</td>
<td>Air conduction&gt;Bone</td>
</tr>
<tr>
<td>WEBER</td>
<td>Equal</td>
<td>Deaf ear&gt;Normal ear</td>
<td>Good ear&gt;Deaf ear</td>
</tr>
</tbody>
</table>

In addition to CN VIII dysfunction, hearing may be affected by number of conditions: Blockage of ear canal, Perforated eardrum, Disarticulation of ossicles, Inner ear infections, MS or Tumour.

### Tests for vestibular function

There are a number of tests to assess the vestibular function. Firstly assess gait by asking the patient to walk heel to toe. Observe to see if the patient veers to the affected side and is unsteady.

You need to observe for nystagmus (involuntary rhythmic eye movements) which may be caused by peripheral or central vestibular, or cerebellum problems.

A nystagmus takes one of the 3 forms and may be rotary or linear:
- **Jerk nystagmus**: slow drifting movement followed by fast corrective movement.
- **Pendular nystagmus**: drifting & corrective movements occur slowly.
- **Mixed nystagmus**: there is a pendular movement in the primary position of gaze (straight ahead) but a jerk nystagmus on lateral gaze.

When examining the patient a note is made of which position of gaze the nystagmus occurs in. The primary position is when the patient is looking straight ahead. The secondary position is looking straight up or down & straight right or left. The tertiary position is the four oblique positions; up & right, down & right, up & left and down & left. Cardinal positions include the right & left (secondary) positions and all tertiary positions.

To examine for nystagmus you use the same double H pattern (as described previously – Cranial nerves III, IV and VI). Ask the patient to comment on any visual symptoms e.g. “vision has gone blurry towards the left side,” “I can see two fingers when looking up and right.”
Enquire about the patient’s ‘null’ point: This is the gaze position of least eye movement and tends to be where vision is best. Abnormal head posture is usually observed, as tilting or turning the head into this direction, where the movements are least, can optimise vision.

If a nystagmus is present there are some points to note. What is the eye position and gaze direction when nystagmus occurs? Note the direction of the fast movement and the plane is it horizontal, vertical, rotatory. Is the abducting eye affected more than the adducting? Does it occur in other directions of gaze? A typical description could be; “a linear nystagmus, fast phase to the left, in both eyes on left lateral gaze.”

In addition to CN VIII dysfunction, balance may be affected by number of conditions: Inner ear infections, Labyrinthitis, MS, Diabetes, Cardiovascular conditions, Alcohol Misuse, Migraine, Anxiety or Tumour.

**Cranial Nerve IX, Glossopharyngeal nerve**

There is a sensory component that affects the posterior 1/3rd of tongue, the pharynx and middle ear. There is also a motor component affecting the stylopharyngeus muscle. An autonomic response affects the parotid salivary gland and the carotid baroreceptors.

To test for glossopharyngeal function, the gag reflex is bilaterally assessed in a specialised clinical environment. The glossopharyngeal has the afferent effect and senses that there is something present, the Vagus nerve (Cranial nerve X) creates the motor response. Using a cotton tipped swab briefly touch the pharyngeal wall behind the pillars of the fauces and ask if patient can feel it, while also observing for a gag response. If there is no feeling or gag it may mean an ipsilateral 9th nerve dysfunction.

Another assessment is to ask the patients to say “Ahh” while observing their uvula for any deviation. If there is a deviation one way, it indicates weakness on the opposite side as shown above.

**Cranial Nerve X, Vagus nerve**

This is also a mixed nerve with both sensory and motor aspects. The tympanic membrane, external auditory canal are external ear sensory components, whereas, the muscles of the palate, pharynx and larynx are motor components. Additionally the parasympathetic supply to and from thorax and abdomen is an autonomic response.

To test the vagus nerve, ask the patient to say “Ahh”, observing for any deviation, as mentioned previously with the glossopharyngeal. If there is no movement on saying “Ahh” or no gag there is a bilateral palatal muscle paresis.

**Cranial Nerve XII, Hypoglossal nerve**

We have skipped XI for now as IX, X and XII can be tested together. The hypoglossal innervates the extrinsic and intrinsic muscles of the tongue (except for the palatoglossus), which is innervated by the vagus nerve. The hypoglossal nerve is tested by asking the patient to open their mouth and examine the tongue resting inside the
mouth. Observe for fasciculation and / or wasting (atrophy) as this is one of the indications of a LMN lesion. If it is unilateral it is a nerve problem, if it is bilateral it is usually a bulbar palsy.

Ask the patient to stick out their tongue and you should observe for any deviation to one side, which indicates a weakness on that side, as tongue muscles “push”. Ask the patient to waggle their tongue, which you should demonstrate to them first. You should see normal smooth bulk, however, poor movement control, usually bilateral indicates an UMN lesion (“pseudobulbar” palsy).

To test the power of the tongue, ask the patient to push their tongue against the inside of their cheek and you should press against the patient’s skin, where the tongue is pushing the cheek outwards. This should then be repeated for the other side.

**Cranial Nerve XI, Accessory nerve (Spinal Accessory nerve)**

This is a motor nerve. Each side of the brain supplies the ipsilateral sternocleidomastoid muscle and the contralateral trapezius muscle, therefore, a lesion on one side can give rise to signs on both sides.

**Right accessory nerve governs the ipsilateral (same) sternocleidomastoid and the contralateral (opposite) trapezius**

To test for the sternocleidomastoid ask the patient to turn their head to one side. Stabilise the patient with shoulder counter pressure and then put your hand against patient’s chin and cheek and ask patient to resist you *rotating* their head back to the midline. Watch the opposite sternocleidomastoid contract while testing its power.

To assess the trapezius muscles ask the patient to shrug their shoulders and push down against the movement. This should be done one side at a time.

Ask the patient to lift their shoulder & you oppose them
Weakness of sternocleidomastoid and trapezius on the same side indicates a lower motor neuron nerve lesion on the affected side. Weakness of sternocleidomastoid and trapezius on the other side indicates an upper motor neuron lesion on the side of the affected sternocleidomastoid.

In addition to CN XI dysfunction, causes of weakness may include: Myasthenia Gravis, MS, Motor Neurone Disease, Tumour or Trauma including stroke.

**Glasgow Coma Scale (GCS)**

The GCS is a global neurological assessment, where the conscious state of a patient is recorded, based on eye, verbal and motor responses.

How to assess a patient using this scale can be found in the “later years’ study guides” on Vital entitled “coma”. A score of 15/15 indicates a patient who is orientated, opens their eyes spontaneously and can obey commands. Accurate assessment of cranial nerve function may be impaired by a decreased conscious level. Conscious level must be considered before assessing cranial nerves.

**Glossary**

- **Atrophy** – Muscle wasting
- **Bulbar palsy** – This is the result of diseases affecting the lower cranial nerves (VII-XII). A speech deficit occurs due to paralysis or weakness of the muscles of articulation which are supplied by these cranial nerves.
- **Conjugate** – Moving together
- **Contralateral** – Occurring on the opposite side of the body
- **Diplopia** – Double Vision
- **Disconjugate** – Not moving together
- **Fasciculation** – spontaneous, involuntary, contraction of a number of muscle fibres, often causing a flickering under skin.
- **Ipsilateral** – Occurring on the same side of the body
- **Nystagmus** – Rapid, repetitive, involuntary eye movement

**Further reading:**

For details of the anatomy look at Aclands Video Atlas, Volume 4

Eye movements;
[https://www.liverpool.ac.uk/elearning/orthoptics-project/](https://www.liverpool.ac.uk/elearning/orthoptics-project/)
Paul Rea (2014)