Professional Skills Unit 8

CNS

(Mainly) Based on Dr. Omar Abduljabar

**HISTORY TAKING**

* Generally, the history taking in CNS is similar in format as the other systems
* However, its importance is beyond measure in nervous system
* The patient might not be the one who will answer your questions for history – the other person is called **the “informant”**
* The informant (if the not the patient themselves) can be:
  + Family member
  + Relative
  + Friend
  + Eye-witness
* **Reliability**
  + The patient might be unconscious (where an informant tells us what happened) or be conscious
  + Consciousness does not mean that they are fully alert nor does it mean they have full cognitive function
  + Patients suffering from mental illnesses or speech disabilities (Aphasias) may provide inaccurate or no relatable answers to help your diagnosis
  + You are expected to categorize the information received (from informant or patient) as good, fair or poor.
* **Observations** 
  + Parts of the clinical examination that depend on your direct observation of the patient as he/she comes in
  + There are features that are directly noticeable (limping, gait disturbances, sagging face as in bell’s palsy, mask like face in Parkinson’s disease)
* **Handedness**
  + This can be useful to assess the impact of cortical lesions
  + Right handed people are 98% left dominant (1% right dominant, 1% codominant)
  + Left handed people are 60% left dominant also (20% are right dominant, 20% codominant)

**Nervous Symptoms**

* When we test symptoms in CNS, we usually classify them as a **“positive” phenomena** or a **“negative” phenomena**
* **Negative symptoms** show a **complete loss** of function (‘its over’)
  + Loss of balance, walking difficulty
  + Anesthesia, numbness
  + Complete limb paralysis, loss of memory
* **Positive symptoms** are any signs of sensation and motor activity, even if it is abnormal – it is considered “positive” because it means the disease process is still occurring, irritating the nervous tissue, but has not reached to complete loss of function – ‘it’s not over yet’)
  + Pain
  + Seizures
  + Parasthesia
* Our doctor said this is not of great importance nowadays
* **Localizing symptom**
* The patient may complain of more than one symptom, but one out of the many symptoms will trigger your anatomy skills to “localize” the lesion to a part or specific parts of the CNS

When someone is in a coma, you can try to find out which side is lesion by looking at signs on the affected side – this is known as **LATERALIZING signs**, NOT localizing sign/symptom.

* For example, ptosis with lateral strabismus and mydriasis (dilated pupils) will immediately take your mind to CNIII or midbrain
* Loss of gag reflex will immediately take your mind to the medulla or CN9 and CN10
* It is usually the first symptom described

**HISTORY**

* Ideally, it consists of:
  + Demographics
  + Chief complaints
  + History of present illness
  + Past history
  + Family history
  + pyschosocial history
  + System review
* **History of Present Illness**
  + For certain symptoms, such as **headache**, **SOCRATES** can be used:
* Site
* Onset
* Character
* Radiation
* Associated symptoms
* Timing
* Exacerbating and relieving factors
* Severity
* Specific Symptoms to Note
  + **Headache**
* The **most common neurological symptom**
* Most common causes (MCC) are migraines and **tension-headaches**
* Acute, severe (minutes or hours)
* Intracranial hemorrhage/thrombosis
* Trauma (head injury; usually evident on patient)
* Drugs (Nitrates), infections (malaria)
* Migraine (acute attack)
* Subacute onset (Days – weeks)
* Cranial space-occupying masses
* Sinusitis, malignant hypertension
* Recurrent and/or chronic
* Migraine
* Tension headache

**Red flags of headaches:**

Sudden

Severe

Impaired mental status

Seizures

Fever

Focal neurological signs

After the age of 50

* Cluster headache
* Intracranial masses
* Imaging is recommended when it is:
* Sudden
* Any new headaches in those over 50 years old
* Accompanied by abnormal neurological signs
* Increases with change of posture or coughing, sneezing
* Posture-related headaches
* Occurs with increased intracranial pressure
* Exacerbated when coughing, sneezing, bending
* Subarachnoid hemorrhage (SAH)
* Occurs commonly with rupture of berry aneurysms
* Caused by meningeal irritation
* Commonly described as “worst headache of my life”
* Meningeal irritation
* Commonly seen in SAH and meningitis
* Headache accompanied by neck stiffness
* If with fever, think more about meningitis
* Other signs include Kernig’s and Brudzinski’s
* Migraine
* Usually affects half of face, with frontal area
* Can be accompanied by “aura” (classical)
* Aura are temporary visual changes before the actual headache (flashing lights, scotoma)
* Photophobia and phonophobia may occur
* **Weakness** 
  + **Pyramidal type**
    - Flexed upper limb
    - Extended lower limb
    - Spastic (hemiplegic) gait
  + **Extrapyramidal type**
    - “Pseudoweakness” ~ not true weakness
    - Bradykinesia, hypokinesia
    - Basal ganglia lesion (most commonly)
  + **Neuropathic type**
    - Distal parts of limbs weakened> proximal
    - E.g. Stocking-glove distribution
    - E.g. of cause: Guillain-Barre syndrome
  + **Myopathic type**
    - Proximal limb muscles weakened> distal (not always)
    - Occurs with muscular dystrophies (e.g. Duchenne)
  + **Radicular type**
    - Lesion is related to nerve roots
    - Examine dermatome, myotome and tendon reflexes
  + **Neuromuscular junction (NMJ) type**
    - Muscles easily fatigued or relieved with use
    - E.g. myasthenia gravis, lambert-eaton syndrome

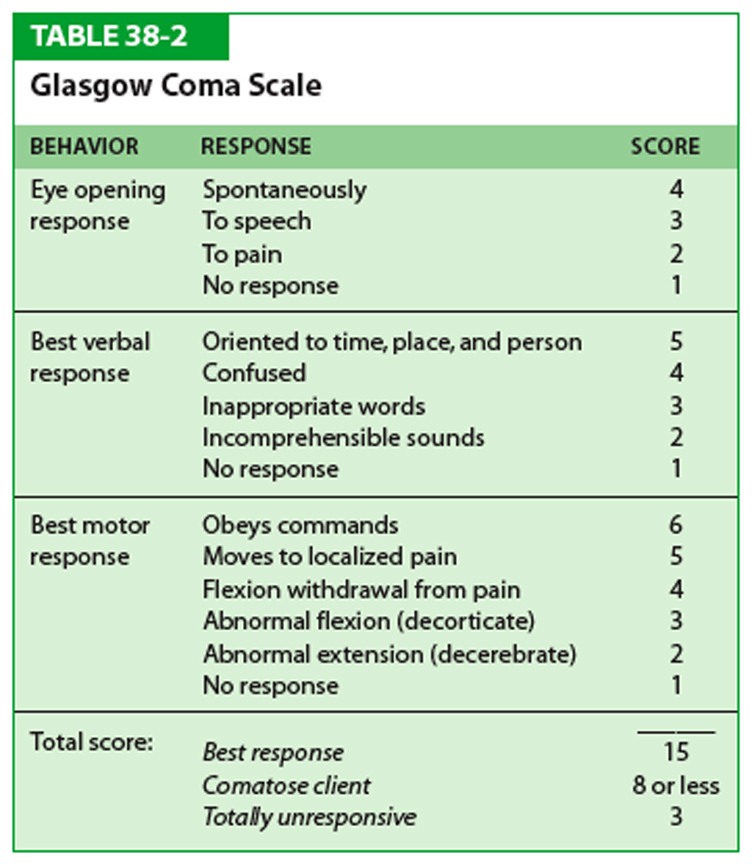
Session 2 Notes (When I began attending)

**Screening Neurological Examination**

* Start with:
  + **Consciousness**
  + **Speech**
  + **Cognition**
  + **Gait and stance**
* Move onto:
  + Cranial nerves
  + Motor and sensory systems (with reflexes)

**CONSCIOUSNESS**

* The level of consciousness of the patient needs to first be assessed before testing other functions
* The most commonly used scale is the **Glasgow Coma Scale (GCS)**
  + Has 3 components:
    - Eye opening (E) ~ 4 points max
    - Best verbal response (V) ~ 5 points max
    - Best motor response (M) ~ 6 points max
  + Each component has a minimum score of 1
    - Therefore, the **minimum total GCS score = 3**



Scoring

* **Severe (< 8) ~ coma**
* Moderate (8 – 12)
* Minor (>12)
* Best response = 15

Stimulus for pain

* **Nail-bed pressure (most preferred)**
* **Supraorbital ridge pressure**
* Trapezius pinching
* **Sternal rubbing (with knuckles)**

Example

* Opens eyes when say their name, speaks to you in *words* that make no sense, arm move away with nail-bed pressure… E3, V3, M4; GCS = 10

I think decerebrate position indicates a lesion that is closer to medulla and is considered worse

**Speech**

* We mostly focus on dysarthria and dysphasias/aphasias (but dysphonias, hoarsness, monotonous tone can occur)
* Dysphasias indicate a higher function disorder and is related to abnormal language skills:
  + Expressive (Broca’s) dysphasia – understands but not fluent (sense)
  + Receptive (Wernicke’s) dysphasia – does not understand, but fluent (fluent non-sense)
  + Conductive dysphasia (arcuate fasciculus lesion) – understands and is fluent but the can’t find the words (and gets frustrated)
* Dysphasias are clinically tested
* Dysarthrias are investigated using a detailed history
  + Could be related to the cerebellum, brainstem
  + Could be developmental
* **Confusion vs. receptive dysphasia**

**Where do you live?**

Confused: Hospital!?!?@?$

Receptive dysphasia: Dog ☺

* + **Confused patients** are usually **aggressive**
  + **Receptive dysphasic** patients are usually **cooperative**
  + Confused people answer questions with a wrong answer
  + Receptive dysphasia patients answer a different question than the one asked

**Cognitive Function**

* Before doing a detailed cognitive examination, we perform “rough” tests and see whether it is worthy to proceed to the cognitive exam
* **“Recall”**
  + Rough test
  + The patient is asked to memorize 3 random words you tell him (Apple – clouds – house)
  + You MUST make SURE that he repeats them in front of you when you first tell him the 3 words
  + You MUST tell them that you will ask them about the 3 words later and that he needs to remember them
  + After distracting them with questions, ask them to recall the 3 words
  + Normally, the 3 words should be recalled (normal recall)
  + If he can remember 2/3 words, make him draw a clock with the current timing (if he can, then considered “normal”)
  + If he can remember only ONE word = “IMPAIRED RECALL”
* **Mini-Mental State Examination (MMSE)**
  + One quick cognitive examination
  + Performed when:
    - Receiving “IMPAIRED RECALL”
    - Family complains that the person forgets and has symptoms of dementia
  + You need to assess:
    - Orientation
    - Memory
    - Calculation
    - Abstract thinking
  + **Orientation**
* To **time**
* Start with more specific timing (10:10 A.M.)
* If cannot, move to more general (23rd of January, Sunday, 2016)

With confusion/disorientation, typically the person is first disoriented with **time, then place, then person**.

* At the very least, ask them to look outside a window and ask what time of day is it (day, night)
* To **place** (Where are you right now?)
* Again, from specific to more general if they can’t tell
* To **person** (what is your name, do you recognize “X”?)
* **Memory**
  + **Immediate memory** (Registration)
    - Make them repeat a sentence after you
  + **Intermediate memory**
    - What did you eat last night for dinner?
  + **Remote memory**
    - When were you born? When was your son born?
  + Notes:
    - Remote memory is the LAST memory that is affected
    - Remote memory is usually spared unless the disease is ADVANCED
* **Calculation**
  + Subtract 7 from 100 (within time limit) **“serial 7s test”**
  + This can indicate any signs of dyscalculia
  + The test can be simplified if patient uneducated or not well educated
    - Subtract 5 from 100/ say “World” backwards
* **Abstract** (Reasoning and judgment)
  + Ask them to **explain the meaning of a famous proverb** (e.g. when the going gets tough, the tough gets going)
  + Dementia patients go around the question and criticize the question instead of analyzing the proverb

< 11 years old tend to not have full abstract thinking, so they say both are round instead of giving meaning to objects (e.g. orange is a fruit you can eat, baseball is

for sports).

* + Ask them to **differentiate between two objects** (orange and baseball) or compare

**GAIT & STANCE**

* Gait & stance is better left for the VERY **END of the examination**
* Assessing the gait (and stance) is very important because it sometimes is the only noticeable sign of an underlying neurological disease
* The **mid-calf should be clearly visible (shoes off)**, and there must be space for you to see the arms move + space between limbs while alternating
* Make sure you command the patient to get up, move, turn and come back
* **Assess their stance**
  + Tell the patient to **stand up**
  + Any signs of vertigo might be obvious when getting up
  + Check for **Romberg’s sign**

Note:

Flexors of upper limb are stronger than extensors (so weaknesses will cause flexion of upper limb).

Extensors of lower limbs [hip, thigh] are stronger than flexors (so weaknesses will cause extension).

In the foot, plantarflexors are stronger, so the foot assumes a plantarflex position in weakness.

* + - Stand NEXT to the patient
    - Your arm should be near his back to support (in case he falls)
    - Ask the patient to raise his arms and close his eyes
    - If patient sways or falls while eyes closed = +ve Romberg
    - Note that Romberg’s sign means ataxia when eyes are closed, so if there is ataxia when eyes are opened and closed, it is NOT a positive Romberg sign.
  + Romberg’s sign is seen in sensory ataxia (dorsal column involvement such as in tabes dorsalis [tertiary syphilis] or diabetic neuropathy)
  + Romberg’s sign from history
    - Most commonly in diabetic neuropathy
    - Family complains that the person often falls when using the toilet at night in the dark (can’t see 🡪 falls)

Falls when washing face or taking a shower, or on the way to the bathroom (darkness)

* Then observe their:
  + **Walking gait**
  + **Tandem gait** (walk on a straight line, one foot after the other)
  + Gait while walking **on their tip-toes**
  + Gait while walking **on their heels**
* **Physiological ataxia** 
  + Seen in infants when first learning to walk
  + Considered “wide-based” gait (?)
  + According to sources, it is due to an incompletely developed cerebellar vermis
* **Hemiplegic (“Spastic”) gait** 
  + Occurs following stroke
  + It is the **MOST COMMON** gait abnormality seen
  + Results from **pyramidal** weakness of one side
  + The patient has a flexed affected upper limb and a circumduction of a fully extended affected lower limb while walking
* **Scissoring gait** 
  + Bilateral spastic weakness and resulting spastic gaits
  + Seen in cerebral palsy (& in paraplegia)
* **Waddling gait**
  + Proximal muscle group is weakened
  + Usually seen with any muscle disorders, especially those affecting proximal muscles of limbs first (such as dystrophies… e.g. duchenne muscular dystrophy)
  + Patient walks on their tiptoes and their arms are stretched backwards
* **Stomping gait** 
  + Also known as “sensory ataxia gait”
  + Results from large fiber peripheral neuropathies and most commonly when dorsal column pathway is involved
  + Patient lacks sensation of hitting the ground and so the body cannot tell with how much force it should land the feet on the ground while walking
* **High-Steppage gait**
  + Seen with any cause of foot-drop (plantarflexed foot that cannot dorsiflex) – deep fibular nerve injury, disc prolapse, surgical causes
  + The lower limbs are lifted high above the ground and forwards (the foot is very visibly plantarflexed during this high swing)
* **Shuffling gait**

For PD, the gait is commonly called “Parkinsonian gait” because it starts off with shuffling gait and then becomes the festinating gait.

* + The feet are not lifted off the ground while walking
  + Seen with tibial nerve damage (can’t plantarflex)
* **Festinating gait**
  + Seen in Parkinson’s disease
  + Similar to shuffling gait, but the steps are much smaller, the back is arched, the **arms do not swing** (stay flat on side of body)
  + It is said that this is done to prevent from falling over, which they often do (they are too slow to prevent themselves from falling)
* **Antalgic gait**
  + Gait that develops when person is trying to avoid pain while walking
  + Stance phase is shorter than swinging phase
  + Patient’s face shows that he is in pain
* **Apraxic gait**
  + When obstacles are put in the way, the patient stops walking (appears as if legs are glued to the ground)
  + They basically “forgot” how to walk and stop often
  + May indicate bilateral dysfunction of frontal lobes (executing the willingness to walk)
* **Ataxic gait** 
  + Inability to perform tandem gait without deviating or falling
  + Seen in **motor ataxia** (cerebellar dysfunction or disease)
    - Wide-based (truncal ataxia) as in alcoholics
    - Appendicular ataxia (limbs affected)
  + *Astasia abasia* (Non-organic gait disorder)
    - Hysterical attacks result in a functional gait disorder
    - Patient has very abnormal gait that cannot be anatomically related (all tests show he is normal)
* **Gluteal gait** 
  + Gluteus medius muscle weakness
  + Results in dropping of opposite hip upon walking

OTHER SPECIFIC OBSERVATIONS

* Signs of **Cerebellar dysfunction** (Note: all signs are **ipsilateral** to lesion)
  + **Head titubation** (shaking/nodding movement of head)
  + **Nystagmus** 
    - Primary (occurs at its current position)
    - Second degree (occurs when looking left or right)
    - Third degree (when looking left, right and at position)
  + **Dysarthria**

Dr. will ask you to examine a patient’s cerebellar function. You must start from UP to DOWN (or vice versa). So, look at head (titubations), eyes (nystagmus), speech (scanning/staccato), arms (intention tremors, rebound phenomena, dysmetria, dysdiadochokinesis), legs (heel-shin test), and his gait and stance (ataxic gait with ipsilateral leaning + cannot perform tandem walking + negative Romberg sign)

* + - Scanning & staccato speech (ce-re-bell-um)
  + **Intention tremor**
    - Best observed during **finger-nose test**
    - Tremors begin to occur *near the target* (his nose)
    - Note you must show them by doing it yourself
    - *Let him reach out* his finger to your finger (let’s call it finger-finger test) and *keep changing the position* of your finger
  + **Dysmetria** 
    - Can be demonstrated in finger-finger test or meeting of both their index fingers while eyes are closed
    - Prepointing occurs (will reach out his finger but will not reach yours)
    - Past pointing occurs (his finger goes beyond your finger)
  + **Rebound Phenomena**
    - Tell them to flex their forearm at the elbow while you resist this movement
    - Make sure you **COVER their face with your other hand**
    - Suddenly stop the resistance
    - Normally, the arm will stop flexing too hard when resistance is no longer present
    - Abnormally, their arm will continue to flex strongly and may hit their face (Rebound phenomena)
  + **Dysdiadochokinesis (Rapid Alternating Movement Test)**
    - Inability to perform alternating movements
    - Let them lay out on of their palms and the other hand performs pronation and supination quickly on the palm, slapping the palm while doing this and the slapping hand should be raised off between each hit
    - They will not be able to do it properly, instead it will be slow or hit the edge of the palm or do two pronation then one supination
    - Another way: shake both hands at the same time
  + **Heel-Shin Test (failure)**
    - You must passively do it on them before asking them to do it on their own
    - Raise opposite leg high up and rub against the flat leg’s shin from the knee downwards to the foot (and repeat)

According to the booklet:

1- Nystagmus

2 – Scanning speech

3 – **Hypotonia**

4- Intention tremor

5 – Rebound phenomena

6 – Dysdiadochokinesis

7- **Pendular knee jerk**

8 - Impaired heel-shin test

9 – impaired tandem walking

10 – ataxic gait (can be wide-based + deviating to affected side)

* + - Between each rep, leg should be raised high up & circle around
  + **Motor Ataxia (ataxic gait and impaired tandem walking)**
    - Ataxic gait (e.g. deviation of walking towards affected side)
    - Romberg sign negative (ataxic when eyes open AND closed)
  + Note: He said **only test cerebellum if muscle grade > 4**

Extra: **Pronator drift** (laying arms out stretched with patient eyes closed & hands supinated, results in eventual pronation of forearm of the affected side, with drifting of the whole limb to the affected side). This occurs in pyramidal tract lesion and cerebellar lesion. It is accentuated with tapping of the hand.

* **Signs of meningeal irritation**

Dr. will ask you to examine for meningeal irritation. You will start by examining for neck stiffness by passively flexing the neck forward AND sideways (but be careful) – noting rigidity or tenderness and brudzinski sign. **Note that if patient has tenderness/stiffness turning left and right (and up & down) then consider CERVICAL SPINE abnormalities (spondylosis). IMPORTANT.** Meningeal symptoms also occur with intrathecal chemotherapy (methotrexate for ALL)

* + Seen in **meningitis** (expect to see fever) and **SAH** (no fever)
  + **Neck stiffness** (nuchal rigidity)
    - The MOST IMPORTANT, because other signs rarely seen
    - It is PASSIVELY done
    - **YOU** flex their neck while patient is supine, resulting in stretch of meninges that are already irritated
    - Patient will feel pain and resist your flexion (“Boardlike”)
    - Is not exclusive to meningeal irritation
  + **Brudzinski Sign**
    - Seen concurrently when checking for neck stiffness
    - When flexing neck, the hip and knees also flex and pain is noted
  + **Kernig Sign**
    - While supine and their hip and knees are flexed, you passively extend their leg so that the lower limb fully extends in air
    - This stretches the meninges and is painful, causing the patient to resist this extension of the leg
  + **Other signs**
    - Headache
    - Photophobia
    - Abnormal behavior

**CRANIAL NERVES**

* **CN I (OLFACTORY NERVE)**
  + Not routinely examined unless patient has or complains of:

The most common cause of anosmia is upper respiratory tract infection. Other causes include trauma that destroys anterior cranial base (e.g. cribriform plate fracture), meningiomas or masses that impinge on the olfactory bulb. Other causes include PD, AD, chronic sinusitis.

* + - Chronic headache
    - Behavioral changes
    - Anosmia (inability to smell)
  + Olfactory meningioma usually seen with one-sided anosmia
  + Use non-irritating odors that are obvious (fruits, coffee, etc.)
    - The object that will be sniffed should ideally be disguised so the patient doesn’t see it and answer based on vision
    - Or ask them to close their eyes
  + Test one nostril at a time
* **CNII (OPTIC NERVE)**
  + Tested for by:
    - Visual acuity

Note:

Even before testing CN2, **perform an inspection of the eyes**:

- Look for **ptosis, nystagmus, strabismus, redness**

- When you are looking at the pupil (mostly done during the reflexes) comment on the pupils – they should be rounded, symmetrical (equal) and reactive to light and accommodation. The normal pupil size is **2 – 5 mm** (they do ask about it).

* + - Visual field
    - Visual reflexes
    - Ophthalmoscopy
    - +/- color vision
  + **Visual acuity**

**Pin-hole card/test** is used in order to remove refractory error during assessment and cuts off lateral light rays, and if it STILL doesn’t help, then the patient most likely has cataracts (or even glaucoma which causes tunnel vision)

Interpretation of Snellen chart if 20/20 (or 6/6): the patient can see at 6 meters (or 20 feet) what an average person can see at 6 meters (20 feet). 10/20 means that he can see at 10 meters what people can normally see at 20 meters (Bad!)

* + - Done for each eye separately
    - Initially use a **Snellen Chart** (in clinic setting)
    - In hospital setting, we instead ask them to cover one eye and count the number of fingers being held up by the doctor from a distance (initially far, if not successful, move closely)

If you can’t have space for 6 meters, then make him view the snellen chart thru a MIRROR 3 meters away (doubles it to 6 meters).

* + - If he cannot count fingers when fingers held up right in front of him AND absent light reflex/light perception 🡪 “blind”
    - To confirm blindness, eyes are checked for “optokinetic nystagmus” in which we see if a sudden, loud noise (closing a tape measure) causes nystagmus (if not = BLIND)
  + **Visual Field**
    - Done for each eye separately
    - Visual field is best determined using perimetry

**Tell the patient to look at your eyes/nose and fix on that position.**

* + - Test using **CONFRONTATIONAL METHOD**
* In this, YOU and the patient are in this together
* YOU are the “NORMAL” or “HEALTHY” person
* YOU stand at the SAME level as patient and **ONE meter** away, cover the untested eye (best with paper)

The blind spot is the point where there is no photoreceptors because all optic fibers converge here at the optic disc.

* Your finger movements should ideally be **MIDWAY** between you and him
* Tell the patient to tell you when they see your finger, while you move your finger from FAR AWAY towards the CENTER of the eye, SLOWLY

Normal field of vision is “SNIT” with 50, 60, 70, 90.

**S**uperior – 50

**N**asal – 60

**I**nferior – 70

**T**emporal – 90

* Do it for each corner of the field (so 4 times)
* Then find the **BLIND SPOT**, using the cap of a rounded RED pen
* Ask the patient to look ONLY at your eye across the red pen
* Move red pen SLOWLY from central visual field to periphery

Bilateral ocular signs only occur at or beyond optic chiasm (optic tract, occipital cortex). Monocular signs occur in optic nerves (before optic chiasm).

Heteronomous (bitemporal) hemianopia means lateral sides of both fields are affected, that can only happen if optic chiasm affected. Homonymous hemianopia means same side of both fields are affected. Left homonymous occurs in right optic tract/occipital cortex damage and vice versa. E.g. left homonymous can occur in acute stroke affecting right occipital lobe (they need to turn their heads to look on the affected sides).

Craniopharyngioma can lead to heteronemous hem.

* Ask them to tell you WHEN they see the color change and when the pen disappears and when it reappears (NOTE: YOU and the PATIENT have the SAME blind spot, so when you see it and he doesn’t say anything, there’s something wrong)
  + - Check for:
* Altitudinal field defects
* Homonymous hemianopia (turns head to look)
* Heteronomous (bitemporal) hemianopia
  + - **Optic neuritis**
      * Single eye manifests with blurry vision that improves with 1 – 2 weeks
    - For lesions, the key is that pre-chiasmic (optic chiasm) results in mono-ocular manifestation, but chiasmic and post-chiasmic (including occipital lobe) damage results in bilateral ocular manifestations
* **Visual Reflexes**
  + **Light Reflex**

**Argyll-Robertson** (“Prostitute”) **pupil** is one that accommodates but doesn’t react to light (neurosyphilis).

**Adie pupil** (Holmes-Adie) is one that has no response in light reflex or sluggish to respond.

**Marcus-Gunn pupil** is tested using **swinging light test**, in which the affected eye paradoxically dilates – this is called **relative afferent pupillary defect (RAPD).**

* + - **Dim the lights** of the room
    - Ask the patient to **look at an object far away** (to dilate pupils)
    - The light source should come slowly **from the SIDE**
    - Look at the DIRECT reflex (constriction) and then do it again ON THE SAME EYE and check for the CONSENSUAL (indirect) reflex in the other eye (both eyes should undergo pupillary constriction)
    - **Afferent limb = CN II** (optic); **efferent limb = CN III** [PS fibers from Edinger Westphal nucleus to ciliary ganglion]
    - Multiple sclerosis 🡪 optic neuritis is common, there is pain with blurred vision and SLOW light reflex (due to demyelination) – (Marcus Gunn Pupils in MS/optic neuritis)
  + **Accommodation and Convergence** 
    - Let patient look at a distance as you slowly approach object
    - Ask the patient to look at the object you hold
    - Slowly move close to the patient in between both his eyes
    - There should be:
      * Eyes **converging medially** (adducting using both medial rectus muscles innervated by CN III)
      * Eyes **constriction** (by PS fibers of CN III)
      * **Increased convexity** of lens by ciliary muscle (by CN III, and NOT visible)
    - **Afferent limb = CN II (optic)**
    - Involves occipital lobes (unlike light reflexes)
    - **Efferent limb = CN III (motor)**
    - So, why is it important to do this reflex? WE ALSO CHECK FOR THE **INTEGRITY OF THE OCCIPITAL CORTEX**!
* **Ophthalmoscopy (Fundoscopy)**
  + **Dim the lights**, ask the patient to **look at a far object**
  + You must **wear your glasses if you have one**, otherwise you must correct the scope, the **patient should remove** any contact lenses or glasses (and you adjust scope for his vision)
  + Check each eye alone
  + YOU MUST:
    - Check patient’s **RIGHT** EYE
    - You will hold the scope in your **RIGHT** HAND

& Vice versa

* + - You will look through the scope with your **RIGHT** EYE
  + Turn it on, test the light on your hand, move in from a **lateral position**
  + You must start off 1 foot away and then slowly move closer to the point that you are touching their cheeks

The **optic disc** contains a depression called the **cup**, which his usually **30% the size of the whole optic disc**. So the normal cup:disc ratio is 0.3 (it is increased in **glaucoma**, where there is **“cupping”** with a deep and large cup). In **papilledema** there is **bulging** of the optic disc and **reflects high ICP.**

* + Check for **red reflex**
    - The pupil will appear red (you are now looking at the retina)
    - This **may be absent in cataracts, scar, retinoblastoma**
  + When you have adjusted the scope and the retina is clear, you must follow the vessels to converging center where the **optic disc** is present
    - Basically you move towards the “nasal retina” where the optic disc is seen (the macula is lateral to the optic disc)
  + To check for macula, ask the patient to look at the scope
  + What is the use of this?
    - Check for **red reflex & optic disc**
    - Check for **anterior chamber abnormalities**
    - Check for **venous pulsations** and **vessels**
    - Check for **macula** (ask patient to look at scope)
  + **Retinal vasculature**

Retinal detachment can be seen. So can the pigmented spots in retinitis pigmentosa.

* + - Diabetes – cotton wool exudates & neovascularization
    - HTN – AV nicking & flame shaped hemorrhages
    - Retinal artery occlusion – cherry red spot
  + What are two important conditions that can be studied?
    - **PAPILLEDEMA**
    - **OPTIC ATROPHY**
  + What is the difference clinically between papillitis (optic neuritis) and papilledema?
    - In papilledema, the patient can “see everything” [normal vision] and the doctor can “see everything” [on ophthalmoscopy, the signs of papilledema are seen]
    - In papillitis, the patient “can’t see anything” [visual impairment] and the doctor “can’t see anything” [no signs on ophthalmoscopy because the pathology is beyond the scope, or “**retrobulbar**”]
* **COLOR VISION**
  + By **ishihara chart**

**CN III, CN IV, CN VI**

* **Both eyes tested** together for these ocular motor innervations
* **Inspection**:
  + Ptosis
  + Nystagmus
  + Strabismus (squint)
  + Skewed deviation
  + Pupil size
  + Convergence and divergence (upon inspection)
* **Movement and Diplopia (double vision) testing** 
  + Your one finger is placed at the level of both eyes, and you move it upwards, downwards (medially + laterally), laterally and medially
  + Upwards = Inferior oblique and superior rectus (CN III)
  + Medially = adduction; medial rectus (CNIII)
  + Laterally = abduction; lateral rectus (CN VI)
  + Downwards and medially [adduction] = superior oblique (CNIV)
  + At each point ask if they see ONE or TWO fingers (if they see two, you know where the double vision is and therefore what affected nerve is responsible)
  + Use 2 fingers to find out exactly which eye has the affected nerve causing double vision
    - General rule = outer image is the false image
    - I didn’t understand shit here so I gave up…
  + **Conjugate eye movements** = eyes are moving together, opposing each other’s action
    - When looking to the left, your left eye is abducting (using CNVI) and your right eye is adducting (using CNIII)
    - This communication between the two nerves is done using the **median longitudinal fasciculus (MLF)**
  + **Intranuclear ophthalmoplegia (INO)**
    - Occurs in **multiple sclerosis**
    - MLF demyelination (or damage) results in failure of conjugate eye movements, BUT **convergence is intact** (both eyes use CNIII to abduct)
    - So when looking to the right, right eye abducts, but left eye doesn’t adduct; when looking to the left, left eye abducts, but right eye doesn’t adduct
    - Note that the “working” or “moving” eye will show nystagmus
    - Distinguished from pure CNIII damage by lack of ptosis and pupillary light reflexes are intact

FEF lesion in frontal lobe = Looking TOWARDS pathology and AWAY from hemiparesis.

Seizures in ipsilateral frontal lobe FEF (overstimulation) results in eyes looking AWAY from pathology and TOWARDS side with convulsions.

Medial pontine lesions can affect ipsilateral PPRF and uncrossed corticospinal tracts (so contralateral) resulting in eyes looking AWAY from pathology and TOWARDS side with hemiparesis.

* + Frontal lobe lesion results in defect in frontal eye field (FEF)
    - Ipsilateral FEF stimulates contralateral PPRF for contralateral (voluntary) saccades and thus conjugate movement
    - Stroke in right frontal lobe (right FEF) results in inability of eyes to both look towards the left, and so the patient’s eyes will TOWARDS the lesion (right side) but the associated hemiparesis is on contralateral side (left) and thus it can also be said that the patient is “looking away from hemiparesis”
  + **CN III, IV and VI can all be affected together** if there is compression to them in the **CAVERNOUS SINUS (e.g. cavernous sinus thrombosis)**
  + **CN VI is the most likely nerve to get damaged** because it has the longest course

**CN V**

* **Inspection & palpation** 
  + Look for **signs of atrophy** in **muscles of mastication**
  + Palpate for the muscles of mastication, they are:
    - **Temporalis muscles** (on the sides of the forehead when clenching your teeth)
    - **Masseter muscles** (bulk of muscle in sides of cheeks as you clench your teeth)
    - **Pterygoid muscles** (only tested by opening jaw against resistance)
  + For palpation you need to first feel the specific muscle *before* the patient is asked to clench his teeth
    - Then, ask the patient to clench his teeth to feel the bulk of muscles
    - Feel the temporalis and masseter muscles
  + For **pterygoid muscles,** the patient is asked to open their jaw
    - The first time they open the jaw you *do not* apply resistance
    - The jaw can be seen if it is deviated or not
    - **If the jaw deviates, in LMNL it is towards the side of lesion (ipsilateral deviation)**
    - Then close their jaw and ask them to **open it again against resistance** with your hand
* **Testing for sensation** 
  + The tools used include cotton and pin (he only demonstrated light touch) + tuning fork
  + **Light touch:**
    - First ask the patient to **close their eyes**
    - Perform literally a **single flick on the skin** (do **not** wipe)
    - This must firstly be done in the **“CENTRAL area”** of the face (mid forehead for example)
    - If the patient **CAN feel** it in the central area, then you **CONTINUE** the exam
    - If the patient **CANNOT feel** it in the central area, then **DISCONTINUE** the exam (patient cannot feel light touch)
    - After +ve sensation in central area, perform light touch over **BOTH sides** of forehead, BOTH sides of cheeks and both sides on the jaw area
  + **Pain** (same principle for light touch)
  + **Vibration**
    - Done with **128 Hz or 256 Hz** (common for both vibration senses and hearing)
    - Place it on the **center of forehead** (like in Weber’s) and ask the patient to tell you when he stops feeling it
    - Normally, it **should be felt for at least 15 seconds**
* Reflexes
  + **Corneal reflex** (usually done)
    - A tip of tissue (that’s what he used) is used to ideally touch the cornea, but you can do it on the sclera if patient is irritated
    - The normal result is blinking of **both eyes**
    - **Afferent = CN V1 (ophthalmic division); efferent = CNVII (thru orbicularis oculi)**
    - Abnormal if there is no blinking (brain death, pons damage)
  + **Jaw reflex** 
    - **Afferent & efferent = motor fibers running in CNV3**
    - Placing your index finger above patient’s open mouthed chin, you tap on your finger with the hammer at a **45 degree angle**
    - The idea is to see if tapping elicits a muscle spindle reflex on muscle of mastication
    - NORMALLY, this reflex is NOT present (jaw **should NOT close**)
    - ABNORMALLY, reflex present and jaw closes shut
    - Consider a corticobulbar lesion to CNV motor nucleus
  + **Glabellar reflex**
    - Normally tapping in the center of the forehead multiple times will cause a person to blink for the first few times, but eventually the **blinking STOPS** (“habituation”)
    - **Afferent = CNV1, efferent = CNVII** (orbicularis oculi)
    - Getting used to it needs normal integrated function of the **basal ganglia**
    - If the blinking continues indefinitely, then it is called the **Myerson sign** – which can indicate **Parkinson’s Disease** (PD)

**CN VII**

* **Principle for UMNL and LMNL**
  + Look at the **lower half of face to assess which side** (right or left facial nerve) is affected
  + Look at the **upper half of face to assess whether it is lower motor or upper motor**
* **Inspection**
  + **Look at the nasolabial folds for flattening**

If on the right lower face you see signs of facial nerve palsy, then it is right sided, and if you see that the upper part of the right face is unaffected then it is UMN of right facial nerve… (This is caused by damage of corticobulbar fibers of the opposite side, but this is confusing in this context, so just keep this in the back of your mind)

* + - In facial nerve palsy, the nasolabial fold is flattened
    - Sometimes, if there is bilateral facial nerve palsy, try to look at which one shows more flattening to assess which side is affected to a greater degree
  + Look for **drooping of the corner of the mouth**
  + Once you’ve established which side is affected by looking at the lower half of face, look at the upper half of face on the affected side
    - Note if the there is **inability to close or blink the eye of the affected side**
    - Note if the **wrinkles of the forehead is less prominent** on one side or not

CN7 supplies the frontalis, orbicularis oculi, buccinator, orbicularis oris, levator angularis, stapedius and platysmus muscles. It has supplies PS fibers for salivation and tears (but this cannot really be tested) + taste fibers to anterior 2/3rd of tongue + patch of skin on auricle of ear.

* + **Inspect the EARS**
    - Check for any **vesicles** that indicate **herpes zoster (VZV) infection** and **Ramsay-Hunt Syndrome**
* **Palpation**
  + Ask the patient to **wrinkle their forehead** (+ against resistance)
  + Ask the patient to **close their eyes very tightly**, to the point that the **eyelashes can no longer be seen** (+/- against resistance)
  + Ask the patient to **fill up their mouth with air** (press lightly to see if the air comes out easily) – (buccinator)
  + Ask the patient to **purse their lips (orbicular oris)**
  + Ask the patient to **smile or show their teeth (levator angularis)**
  + You may also rub your thumb with your finger near his ears to see if there is irritation that might indicate **hyperacusis** (CN7 supplies stapedius muscle in ears)

According to other doctors, the tongue must be wiped between each taste so that you don’t stimulate CN9 taste fibers in back of tongue.

* Taste
  + CN7 receive taste fibers from **anterior 2/3rd of tongue**
  + Not routinely tested (must be indicated)
  + Identify sugar, salt, sour and bitter (**bitter is kept to the end**) with eyes closed. Let him indicate with **finger cues** you told him for what he tastes (E.g. 1 finger up = sugar, 2 fingers up = salt, etc.)

**CN IX, X**

* Glossopharyngeal and vagus nerves are tested together
* The examination involves the following:
  + **Swallowing**
  + **Examining the uvula (Aah method)**
  + **Examining the soft palate**
  + **Coughing**
  + **Sensation**
  + **Gag reflex** (**always kept for LAST**)
* Note that the patient might have speech abnormalities (dysphonia, hoarseness of voice in the case of vagus nerve injuries)
* **Swallowing**
  + Ask the patient to swallow water
  + Vagus nerve damage can result in impaired swallowing
* Examining the **uvula**

Glossopharyngeal supplies only ONE muscle (stylopharnygeus), and also sends PS fibers to parotid glands.

Vagus nerve supplies all muscles of palate except tensor palati (by CN V3 motor fibers), all muscles of pharynx except stylopharyngeus (glossopharyngeus), all muscles of larynx, esophagus and downwards till the midgut.

* + Ask the patient to **say “aah”** and open their mouth
  + The uvula should normally be centered & not deviated
  + LMNL of vagus nerve will result in deviation of uvula to unaffected side (contralateral side) with drooping of ipsilateral side of palate.
* Examining the **soft palate & coughing**
  + With their mouth open, see if the palate is drooping in one side (asymmetrical), which indicates LMNL of affected side
  + Coughing and soft palate actions are done by vagus nerve
* **Sensation**

You may be asked about the foramen these nerves exit:

CN1 – cribriform plate

CN 2 – optic canal

CN 3, 4, 6, CNV1 – superior orbital fissure

CNV2 – foramen rotundum (goes into IOF, exits thru infraorbital foramen)

CNV3 foramen ovale

CN7 & 8 – internal auditory meatus (CN7 exits using stylomastoid foramen)

CN 9, 10, 11 – jugular foramen

CN 12 – hypoglossal canal.

* + He broke the tongue depressor into two halves with sharped ends
  + The patient is asked to open his mouth while you use the sharp end to lightly poke in the back of the mouth on both side
  + The patient is asked to blink their eyes or use their hand to indicate when they do feel something
  + Afferent only = glossopharyngeal nerve
* **Gag reflex** 
  + A tongue depressor is placed deep in the back of the mouth/tongue to assess for gagging – perform it once on BOTH sides
  + Afferent = glossopharyngeal; efferent = vagus
  + If sensation is intact and gag reflex is absent, therefore the afferent limb (glossopharyngeal nerve) is unaffected and hence the efferent limb (vagus nerve) is affected

**CN XI**

* The accessory nerve has two divisions:
  + Spinal accessory nerve
  + Cranial accessory nerve (Which joins the vagus nerve)
* The spinal accessory nerve supplies the sternocleidomastoid and trapezius muscle
* **Sternocleidomastoid** (rotates head to **opposite side**)
  + **Inspect and palpate for atrophy** of the muscle
  + The muscle is then **tested with resistance**
    - The patient is asked to forcefully look to the opposite direction of the SCM being tested (look right to test for left SCM)
    - One of your hands should be providing the resistance, while the **other is on the side of the neck** containing the SCM being tested
* **Trapezius muscle** 
  + Inspect and palpate the muscle + **raise shoulder against resistance**

**CN XII**

* The hypoglossal nerve supplies most of the muscles that act on the tongue (EXCEPT palatoglossus, which is supplied by vagus nerve)

**Rule of 17:**

**CN 10 + 7 = 17**

**CN 12 + 5 = 17**

CN 10 and CN 7 have movement to contralateral side with LMNL (e.g. mouth and uvula deviate opposite to side of lesion).

CN12 and CN5 have movement to ipsilateral side with LMNL (tongue & jaw deviates towards side of lesion) due to unopposed genioglossus & pterygoid muscles of other side respectively.

* Assess the tongue by:
  + Inspecting it in **its resting position** when mouth is open
    - This is the best way to check for **fasciculation and atrophy**
  + Asking the patient to **push his tongue against the side of the mouth**
    - You can **apply resistance** from the outside on the tongue to test its power
    - Do it for **both sides**
  + Asking the patient to **stick out their tongue**
    - This is the best position to **see any deviations**
    - **LMNL of CNXII** shows deviations TOWARDS the affected side (**ipsilateral deviation**) and this is accompanied by atrophy and fasiculations on observation

**MOTOR SYSTEM**

* Involves:
  + **Inspection**
  + **Muscle tone**
  + **Muscle power**
  + **Reflexes (deep tendon and superficial reflexes)**
* Inspection
  + Always follow a direction
    - Start with the upper limb (medially to distally)
    - Then with lower limb (medially to distally)

Lower motor neuron lesions show fasiculations & atrophy grossly and fibrillations on EMG.

* + Always compare both sides
  + Note the following:
    - Differences in the **bulk of muscle** of both limbs (**symmetry**)
    - Inspect for **atrophy, hypertrophy, fasciculation**, hair loss
    - **Abnormal movements** (**tremors**, chorea, athetosis, dystonia or hypokinesia)
* **Muscle tone**
  + Tone is defined as the **resistance** a muscle has when subjected to **passive movement** around a **fixed joint**
  + The tone of a muscle is examined by **stretching** the muscle, so do the opposite action of that muscle (extend at elbow to assess biceps tone)
  + Tone can be exaggerated (hypertonia) or depressed (hypotonia)
  + **Hypotonia indicates flaccidity**

The doctor will ask you to “examine the tone of this patient’s muscles.” You will start passively moving joints of upper limb and go down to lower limb, noting any abnormalities in tone (this requires a lot of practice on friends and family to figure out what “normal” tone is). You should check for clasp knife and cogwheel when you feel there is hypertonia.

* + **Hypertonia can be one of two types:**
    - **Spasticity**
    - **Rigidity**
  + **Spasticity**
    - Hypertonia that results several weeks after an injury to CNS, specifically the pyramidal tracts/**corticospinal tracts** (ipsilaterally in the SC, contralaterally above the MO)
    - The affected lower limb is hyperextended and the affected upper limb is usually flexed
    - There is exaggerated deep tendon reflexes on the affected side (depending on the site of the UMN lesion)
    - Associated with **clasp knife spasticity**
      * Resistance is only **at the beginning**, then the muscle gives way like a clasp-knife
      * The increased tone is either in agonist **or** antagonist
    - There is also clonus and Babinski’s sign (see reflexes)
  + **Rigidity** 
    - Hypertonia resulting from **EXTRA-PYRAMIDAL** tract lesions
      * This includes the basal ganglia (BG)
    - Associated with **lead-pipe rigidity**
      * Resistance of muscle **THROUGHOUT** its stretch
      * Seen in **Parkinson’s disease**
      * Indicates hypertonia in **both** agonist & antagonist
    - Associated with **cog-wheeling** 
      * It is essentially lead-pipe rigidity with **superimposed tremors** (it feels like changing gears in a car)
      * Best done at the **wrist joint,** where the elbow is kept fixed and the doctor moves the wrist in a circular motion
  + Assessing the muscle tone
    - Start with upper limb and proximally (and check both sides)
    - Perform shoulder movements, then at elbow, then at the wrist, also supinate and pronate the forearm
    - Move to the lower limbs, and perform passive movements at hip, knee and ankle
* **Muscle power**
  + Again, go in order, from upper limbs to lower limbs

Remember the movements can be:

Passive

Active

Against resistance

* + Always compare both sides
  + Muscle power is checking the **action of the muscle** (contraction)
    - E.g. For biceps, flex at elbow; for triceps; extend at elbow
  + Ideally, you should go down all the way to the hand (grasping) and fingers (e.g. palmar interossei to adduct fingers strongly) including the thumb
  + The same thing goes for the lower limb (hip, knee, ankle, toes)
  + Grading:
    - **5 = normal power**

UMNL results in exaggerated deep tendon reflexes and absent superficial reflexes (cremasteric and abdominal reflexes), but this only occurs weeks after the injury to the CNS – after SPINAL SHOCK.

* + - 4 = movement possible against resistance
      * Subdivided into 4+, 4 and 4-
      * 4+ = submaximal movement against resistance
      * 4 = moderate movement against resistance
      * 4 - = slight movement against resistance
    - 3 = moves AGAINST gravity but NOT against resistance
    - 2 = can only move WITH gravity (sideways & down)
    - 1 = flicker movements only seen
    - 0 = no movement
* Reflexes
  + **Deep tendon reflexes**
    - Again, start from upper limb proximally & compare both sides
    - For upper limb, check:
      * Biceps reflex

Extra reflexes the doctor talked about:

- Cross-adductor reflex

- Pectoralis reflex

- Inverted reflex

* + - * Triceps reflex

**Grading of reflexes**:

0 = No reflex

+ = Hyporeflexia (diminished)

**++ = NORMAL reflex**

+++ = Hypereflexia (exaggerated)

++++ = Hypereflexia **with CLONUS**

**+**/- if only present after reinforcement

* + - * Brachioradialis reflex
    - For lower limb, check:

The muscle you are testing by doing reflexes must be visible, because the most **dependent sign is the muscle moving**, **not the action itself**. The patient & his muscles must be relaxed – **So start off by asking them to relax.**

* + - * Patellar (knee jerk) reflex
      * Ankle reflex
    - **Hold from the end** of hammer so it becomes pendulous, but make sure to hold it **as if you are about to hit someone with it** (you need to use power so you can elicit the reflex)
    - In the hospital setting, the patient **need not be seated up**
    - The limb being tested **must be relaxed**

IMPORTANT:

**When can you say the reflex is ABSENT?**

If you notice **no response**, you must ask the patient to provide **REINFORCEMENT** by **clenching their teeth** or **hold both hands together** (**Jendrassik maneuver**). If with reinforcement there is still no response, then you can say the reflex is ABSENT. This is **especially true in the lower limb** (ankle).

**IF THE REFLEX IS NOT PRESENT NORMALLY, BUT PRESENT WITH REINFORCEMENT, YOU SAY PLUS OR MINUS (+/- grade)**

* + - If reflexes are not very obvious, **distract the patient**
    - For upper limb reflexes:
      * **Hoffman’s sign** is seen in UMNL, where flicking of the index finger results in flexion of the thumb
      * Once seen, it doesn’t matter what grades you give to any of the upper limb reflex, straight away consider it grade 3 or 4
    - For lower limb reflexes:
      * The **lower limb must be exposed up to mid-thigh**
      * For example, for knee jerk, we see extension of leg, but we should also look at quadriceps for contraction
      * **Ankle jerk** make sure to check for **plantarflexion** AND **vibration of the gastrocnemius** (sometimes, the plantarflexion is not so obvious, but the contraction of grastrocnemius must be seen) ~ **ankle must be slightly dorsiflexed**

From above to umbilicus is T8, T9, T10. From below to umbilicus is T12, T11, T10. Umbilicus is at level T10.

* + Superficial reflexes & other reflexes
    - **Abdominal reflex** 
      * Starting from **each corner**, stroke the abdomen until to **reach the umbilicus** (so you do it 4 times)

S1, S2 🡪 ankle reflex

L3, L4 🡪 knee jerk reflex

C5, C6 🡪 biceps tendon reflex

C7, C8 🡪 triceps reflex

C6 🡪 brachioradialis

Plantar reflex results from PAIN STIMULUS (in dermatome S1 in sole of foot), and plantarflexion (normally) from roots L5, S1. Babinski’s sign = dorsiflexion (up-going). Don’t say Babinski negative if it is down-going, say normal plantar reflex (plantarflexion).

* + - * Ipsilateral abdominal muscle should contract (umbilicus moves towards the stroke)
      * Not so obvious in obese individuals
    - **Cremasteric reflex (L1, L2)**
      * Stroking the medial side of thigh results in cremasteric contraction and thus **ipsilateral rise of testicle**
    - **Plantar Reflex (Testing for Babinski sign)** 
      * The UMN for this primitive plantar reflex (which results in dorsiflexion) normally suppressed
      * **Normally**, in adults there should be a **plantarflexion** (**“down-going”** plantar response) instead
      * The **sharp edge** of your reflex hammer should be used, because the **stimulus is pain**

Note that abdominal reflexes are lost below the level of an UMN lesion and at the level of LMNL (because reflex arc is affected).

* + - * Using the sharp end, you carefully press on the **lateral border of the foot** from the heel and trace it upwards, and upon reaching near the little toe, turn it medially and trace until you end near the big toe
      * The response is assessed based on the **FIRST ACTION of the BIG TOE** (*not* the other toes)

Extra Tricks:

Localizing a lesion of paraplegia/monoplegia (not hemiplegia) is best done in reference to the umbilicus (Above or below T10). If superficial reflexes absent below umbilicus + lower limbs have hyper-reflexia = UMN lesion below/at T10 on the affected side. If absent superficial reflex above and below umbilicus + hyper-reflexia = ipsilateral UMN lesion way above T10 (< T8).

**Can you get absent knee jerk with ankle hyper-reflexia? Yes** with **cauda equina** damage to L3, L4 (opposite also true)

If you’re still at the lateral border of foot and you see plantarflexion or dorsiflexion of big toe, **stop**… you got what you were looking for.

* + - * **Whenever you see any response, STOP the exam**
      * **Babinski sign = dorsiflexion** of the big toe during this action (pathological)
      * **Never say Babinski negative** (it is a sign, not a test)
      * Babinski sign is seen in infants, because the CST have not yet been fully myelinated (so uninhibited plantar reflex)
    - **Clonus** 
      * Seen in **UMNL** (pyramidal tract involvement)
      * This is elicited when **examiner** repeatedly dorsiflexes and plantarflexes foot & suddenly stops at dorsiflexion
      * A clonus shows **continued dorsiflexion and plantarflexion** even when examiner stops

**SENSORY SYSTEM**

Light (fine) touch, vibration, pressure and conscious proprioception is carried by dorsal-column-medial-lemniscus pathway. At the SC, these fibers are uncrossed (damage at the SC causes ipsilateral loss below lesion).

Pain and temperature are carried by the lateral spinothalamic pathway, which raise 1 – 2 levels and cross at that SC (damage at SC causes contralateral loss starting a few segments below level of lesion).

The SC level at the lesion shows anesthesia.

* **General sensation** 
  + Assess the sensation of:

**Dermatomes** (Fast):

C2 – vertex to occiput

C3 – neck

C4 – shoulder

C5 – lateral arm

C6 – thumb

C7 – middle finger

C8 – little finger

T1 – medial forearm

T2 – Axilla

**T4 – level of nipple**

**T7 – epigastrium**

**T10 – umbilicus**

L1 – groin/inguinal region

L2 – upper thigh

L3 – lower thigh

L4 – medial leg (up to big toe)

L5 – lateral leg & dorsum of foot

S1 – sole of foot + lateral border of foot including little toe

S2 – back of lower limb

S3 – buttocks

S4 – peri-anal area

S5 - anus

* + - **Light touch**
    - **Pain**
    - **Temperature**
    - **Vibration**
    - **Proprioception** (positional sense)
  + These are done for upper and then lower limbs of both sides
    - Ideally, you should start from the neck, then to the shoulder, arm, forearm, hand, fingers, then back to the chest, down the abdomen and to the thighs, legs, feet and toes
  + The patient should **normally feel the stimulus on both sides and equally**
  + The **dermatomes should be known**, because for any altered sensation you must say which spinal nerve root is affected, or even which spinal cord segment
  + **Eyes should be closed**, test all 5 things for the limb you are on
  + Light touch can be done using cotton
  + Pain can be tested using anything with a sharped end
  + **Vibration** is tested using a **tuning fork**
    - **128 Hz or 256 Hz**
    - You must hit the prongs (paired end) on **your knee** or body and **not** on any hard surfaces (like a wall)
    - The stem (single end) is placed on **bony prominences** on the limb being tested

**Show the patient what vibration feels like by placing the tuning fork on the sternum or forehead FIRST, before checking distally to proximally. This is also to see if they can even feel vibration or not… If they can’t just stop the exam.**

* + - **Start distally and move proximally** (The reason for this is that afferent fibers are long and if they are damaged they are most likely going to start distally and progress proximally; if the patient can feel vibrations in his phalanges and radial styloid process, then you don’t need to continue up the arm)
    - Basically, if a nerve is injured at any point of its course, it is the sensation distal to the injury that gets affected

**How can you tell if the vibration sense of a patient is shorter than normal?**

Ask them to tell you when **they stop feeling** the vibration and immediately **put it on your joint** and see if you can still feel it or not (if you can, then that means his vibration sense is of shorter duration).

* + - If there is impaired sensation, then continue the exam to see until where the sensation is felt (outlining the borders)
    - Worst case scenario is testing over the trunk (e.g. sternum, clavicle)
  + **Conscious proprioception**
    - Sense of joint position when joints **passively moved** by examiner

**Do NOT press on the toe or finger (common locations for proprioception examination include big toe and middle finger) over the nail – instead hold on the sides and move it up and down. DO NOT PRESS ON THE NAIL.**

* + - **Start distally and move proximally**, no need to examine proximally when patient can feel distally
    - Move the finger/toe with the patient’s **eyes open**, so that the patient knows the possible movements you are going to do
    - Ask the patient to **close their eyes**, and do the movements but in different small degrees and in an unordered fashion
    - Ask the patient whether the finger/toe is moving up or down
    - They should normally be able to tell you without mistake
* **Cortical sensation**
  + General sensation tests whether they can feel, cortical sensation tests whether they know and can say that they are feeling and where exactly
    - This is the function of the parietal lobe (primary somatosensory cortex)
    - For these to be tested, general sensation must be intact (there is no point asking them if they know the object they’re feeling if they cannot feel!)
  + **Examination includes:**
    - **Tactile localization**
    - **Two-point discrimination**
    - **Stereognosis**
    - **Graphesthesia**
    - **Extinction**
  + **Tactile localization** 
    - With the patient’s **eyes closed**, touch them in several different parts of their limbs and body
    - Ask them to tell you exactly **where they felt each touch (localization)**
    - Poor localization means they can feel a touch, but they can’t say where
  + **Two-point discrimination**
    - The **ability to feel two points as two separate points**
    - Two toothpicks are used for this, and **eyes must be closed**
    - The receptive field of skin mechanoreceptors vary in size
      * E.g. In the **hand**, they are very small and numerous, so two separate points even when very close together can still be felt as two separate points
      * E.g. In the arm, there are large receptive fields and less numerous than the hands; two separate points when brought close enough together will be felt as one point only
    - In fingertips, two point discrimination starts between 2 – 8 mm, while in the arms, thighs and back, the two points are felt as separate points when the distance between the two points is at least 40 – 75 mm.
  + **Stereognosis**
    - This is the ability to **tell what an object is by feeling it** and with **eyes closed**
    - Put a ball, pencil, etc. in their hand and ask them what it is
    - Absence of stereognosis is called astereognosis
  + **Graphesthesia** 
    - It is the **ability to identify numbers** (or letters) **when traced** on the skin and **eyes closed**
    - Write numbers 1 – 10 in their hands and see if they can tell you what number it is (obviously, don’t go in order! 1, 5, 2, 3, not 1, 2, 3, 4, 5)
  + **Extinction**
    - **Two** (types of) **stimuli** (pain, light touch) **on two different body parts** (left arm, right leg) **can both be felt** at the same time with the **eyes closed**
    - Ask the patient where and what he is feeling
    - Abnormally, only one stimulus is felt while the other is ignored

The most common cause of neuropathy worldwide is diabetes (diabetic neuropathy)

**Extra Notes**

* In the beginning of history taking you must write or say who the informant is
  + If the patient seems unreliable (for whatever reason) ask if there is someone else you can talk to about the patient (Family, guardian, etc.)
* **Examine the tone of this patient + define what “tone” is**.
  + Tone is the **resistance of a muscle** during **passive movement** **around a fixed joint**
  + Start from the wrist by flexing and extending it, keeping the elbow fixed – then circumduct the wrist (to check for cogwheeling) – do the same for the other side (to compare)

It takes longer for fine muscle movements of the hand (and arm) to heal and become spastic than for the lower limb; so in patients being tested you may note a hypotonic upper limb and spastic lower limb, possibly with very visible Babinski sign (“7ayu 3ala el Salah” sign xD!)

* + Then test the elbow by flexing and extending it, do the same for the other side
  + If there is hypertonia, continue to test for signs of either rigidity (throughout range of movement –lead pipe +/- cogwheeling) or spasticity (only the beginning – clasp knife)
  + If there is hypotonia, describe it as flaccidity and note which side the flaccidity is on (a few days to weeks following a neurological injury, the affected side will show hypotonia – this is the “spinal shock” phase)
  + For the lower limb, expose the patient up to the mid-thigh

Patellar clonus is just like ankle clonus but done on the patella, where you move it up and down and then stop at down to see if there is any repetitive jerking of the patella

* + Inspect first to see if any of the limbs are externally rotated (can be fracture of neck of femur or more commonly hemiparesis)
  + Begin from the foot by dorsiflexing and plantarflexing it (do the same for the other foot)
  + Then for the knee, flex the knee and hip and extend the lower limb **trying to keep the hip fixed** (do the same for the other side)
  + **To test for the hip, place one hand on the thigh and the other on the leg and roll the lower limb** (do the same for the other side)
  + If you notice hypertonia you must check for:
    - Spasticity (where you would check for Babinski, ankle clonus, clasp-knife rigidity)
    - Rigidity (check for cog-wheeling and lead-pipe rigidity)
* A patient has diplopia, examine the cranial nerve(s) that may be responsible (in awake and unconscious patient)
  + These are the CN3, 4, 6
  + Always perform inspection first (note any abnormalities in the eye)
  + You may perform the light reflex to check for integrity of PS of CN3
  + Check both eyes together in conscious patient + check for accommodation
  + Ask them to tell you when they see double vision
* Examine the reflexes of the lower limb
* Examine the speech of the patient (with normal hearing)
  + Ask the patient to raise their arm – obeying commands (with your hands behind your back as to not give him a clue)
    - Possible outcomes include no response (receptive aphasia?) or response
  + If they do raise their arm, ask them to tell you what brought him here – ability to answer
    - You shouldn’t ask them to tell you their name, because this kind of question has an answer that is at the tip of their tongue (it is an automatic response ~ BG)

Normally, it is considered that 100 words/minute is normal (broca’s aphasic patients can rarely speak over 10 words in a minute… that’s why it’s also called non-fluent aphasia)

* + - If he answers you, note whether the speech is normal or abnormal (dysarthria, fluency, non-fluency and whether it makes sense or not)
    - If he does not, it is most likely expressive aphasia or a milder form (aphemia)
  + Ask them to make out familiar objects (pen, pencil) and if they cannot, ask them to tell you what it is used for
    - Some people may have anomia, where they are unable to name things because of damage to naming center (angular gyrus)
  + Ask them to write their name down on a paper
* Assess the level of consciousness of this patient (unconscious patient)
  + Call their name out loud (then repeat REALLY loudly)
  + Call their name out loud with superficial stimulation (shaking their shoulder)
  + If there is no eye opening or response, then use pain as a stimulus (fingernail bed pressure with a pen, or rub on sternum, or supra-orbital pressure) – note if there is withdrawal from the pain (as a whole) or moves the stimulated limb away
  + Use the Glasgow coma scale to come up with a score
* Grade the muscle power of an unconscious patient
  + This can be done while assessing the tone and plantar reflex, where the painful stimuli may cause the patient to withdraw their feet (if raised away against gravity = grade 3 or more)
  + Note, in conscious patients, you would ask them to move their muscles against resistance and actively, and so on…
* Examine a patient with a paralyzed part of his face (CN7)
* Perform examinations to assess signs of meningeal irritation
* Examine for CN5, CN 3, 4, 6 + CN7 (important) + tone?

IMPORTANT NOTES:

* If you test for reflexes and there is no response, and while you apply reinforcement there is a response, then your grade should be **+/-** 
  + Abdulla Tabtabae said that you say **“+/- ONE”**
* **Superficial reflex root values**
  + Cremasteric reflex root value is L1, L2
  + Abdominal reflex elicited from above to the umbilicus – T8, T9, 10
  + Abdominal reflex elicited from below to the umbilicus – T10, T11, T12
* Abdulla Tabtabae said about the motor examination:
  + **Inspection**
  + **Tone** (SLIGHT resistance of muscle to passive movement)
  + **Power**
  + **Coordination** (Dr. HSNIII)
  + **Reflexes**

**Ophthalmology** session notes:

* **Inspection**
  + Redness, nystagmus, tenderness, comment on roundness, symmetry of pupils
* **Visual acuity** 
  + Snell Chart:
    - Letter chart version (for educated individuals)
    - E or C chart for children & uneducated
    - Stand at SIX meters (or TWENTY feet)
    - If you can’t get 6 meters away, make him stand 3 meters away from a **MIRROR** of the snellen chart (mirror doubles the distance)
    - Interpretation:
      * 6/6 he can see at 6 meters what average person sees at 6 meters
      * 6/20 he can see at 6 meters what average person can see at 20 meters (get it? Bigger the dominator, the worse his vision)
* **Field of vision**
  + Just the same as stated for CN2, but here she emphasized NOT to make the patient use his hand to cover the other eye – instead USE A PAPER to cover his eye
  + SNIT: 50, 60, 70, 90
* **Visual reflexes**
  + While doing this, place should be dark and patient should look far
  + Do direct pupil examination & light reflex, swinging light test, accommodation reflex
    - For **swinging light test** each swing should be done between 2 seconds (“one one thousand, two one thousand”)
    - Check for direct & consensual
* **Color vision**
* **Extra-ocular muscles movement**
  + Elevation & depression (she says CALL IT THIS, not up & down)
  + Abduction and adduction
* **Ophthalmoscopy** 
  + Use a **“DIRECT” ophthalmoscope** (CALL IT THIS)
  + The ophthalmoscope is turned on, the **measure should be 0 at first**, the light should be **YELLOW**
  + You keep your glasses on if you have them, but remove the patient’s if he has them (the goal is that YOU can see clearly)
    - Hypermetrope (farsightedness) turn measure to GREEN (depends on degree)

If you are asked to comment on the fundus, know that you should mention the color, shape, margins, and cup.

Normally it should be creamy yellow to pinkish in color, round or oval, with distinct margins. The cup should be less than half the diameter of the optic disc (actually, < 0.3).

* + - Myope (nearsightedness) turn measure to RED
  + Dim the light of the room and make patient stare ahead at something
  + Patient’s right eye you examine with your right hand and right eye
    - Slowly approach from the side
    - If you are holding the ophthalmoscope wrong you will “kiss” the patient because your lips will come close to his – BUT if you are holding the right way, your hand will be in the way between his lips and yours
  + Look for light reflex for both eyes (one hand’s length from the patient at least) & slowly approach from the side
  + **They may ask you to DRAW the FUNDUS/RETINA** or show you a picture and ask you to comment
    - The **OPTIC DISC is MEDIALLY located (NASALLY)** while the MACULA & FOVEA are LATERALLY
    - On paper check which side the optic disc is on (this is nasal), therefore you now know which eye you are looking at
* **Ears**
  + **Inspection** 
    - Color, nodules, lesions, infections, pus, mucus, etc.
  + **Palpation**
    - Brief, to check for tenderness
    - Move the ear pinna up and down and press on tragus & mastoid (check for tenderness)
  + **Using the Otoscope**
    - Use an otoscope to visualize the tympanic membrane
    - The **ear canal is not straight**, so you must **straighten it by**:
      * **Pulling the ears UP** (& back) in **ADULTS**
      * **Pulling the ears DOWN** in **CHILDREN**
    - Turn on the otoscope and put in the correct speculum on top of it – ALWAYS START WITH NORMAL, THEN GO TO ABNORMAL
    - Commonly used insertion position is by **holding the handle facing upwards or on the side**
    - Use your **LEFT hand to examine the LEFT ears** & vice versa (like ophthalmoscopy)
    - The tympanic membrane is normally **PEARLY WHITE** in color and shows **CONE OF LIGHT**
    - You may see redness, dulling of color, fluid behind the membrane which indicate effusion (Otitis media), perforation, discharge from perforation, cholesteatoma, tympanosclerosis (looks like yellow plaque on outer surface of membrane)
  + **Whisper test**
    - Start by **rubbing on the tragus of the opposite ear** and ask them (or you) **cover their other ear** – this is done to isolate the hearing in the ear being tested
    - **Whisper a number/word** into his ear and ask him to repeat it
      * If heard- his hearing is better than 30 dB
    - Say a number/word into his ear in NORMAL conversation volume
      * If heard - his hearing is better than 60 dB
    - Worst case scenario is shouting a number/word
      * If heard - > 90 dB hearing threshold (severe hearing loss)
  + **Rinnie Test**
    - Choose a **512 Hz**
    - Hit it **across a bony prominence** (***not*** the table)
    - Place it on the patient’s **mastoid process** and ask him to tell you when he stops hearing the vibration sound
    - When he does, place the tuning fork’s two pointed end near his ear and let him tell you if he can hear something
    - If he does, then **air conduction** is better than **bone conduction** and he has **POSITIVE Rinnie, which is NORMAL**
    - If bone conduction is better than air conduction (i.e. he cannot hear when it was placed over the ear) then he has **NEGATIVE Rinnie and has CONDUCTIVE hearing loss**
    - In **sensorineural hearing loss**, both air and bone conduction are very brief and cannot be heard for long
  + **Weber Test**
    - If you know which ear is affected, this can be useful to you for this test
    - Again, a 512 Hz is used and is placed either on the **VERTEX** (top of head) or **middle of forehead**
    - Ask him to tell you where he can hear the sound (if they say both ears or say they’re not sure or express any signs in which they cannot decide – this is NORMAL)
    - If the sound localizes to one ear, this is called **LATERALIZATION**
    - If it lateralizes to the one side (e.g. the left) then:
      * Conduction hearing loss on the left ear (this is because vibrations easily pass thru bone without distraction to the ear and is even more obvious when ear is blocked – try blocking your ear with your finger and doing this test, you will see the blocked ear hears better – the other ear will be distracted by background air noise)
      * Sensorineural deafness on right ear (the left ear hears better than the one that cannot hear at all)
* **Nose**
  + **Inspection**
    - Deformities that are obvious, trauma, POLYPS
    - Lesions, scars, obvious deviations to left or right
  + **Nasal speculum** use
    - Hold the **nasal speculum** by the handle from above (handle and your hand is up, the two headed end is down)
    - **TILT THE PATIENT’S HEAD BACK**
    - Insert it into **ONE NOSTRIL** (Don’t insert it into both nostrils at the same time!) and examine that one and do the same for the other nostril
    - Insert it in with the two headed ends **CLOSED at first**, THEN open it when it is inside the nose
    - Use the otoscope or any **light source to see** (it’s dark in there!)
    - Note the structures in the vestibule of the nose:
      * **Septum** (Comment on whether it is **deviated or not**, he said that most people have slight deviation)
      * **Turbinates/Concha** (we have 3, the smallest one is the superior turbinate, the most visible/seen one in this examination is the INFERIOR turbinate)
    - Document your findings and you may be asked to point out or mention the location of the **paranasal sinuses** (They drain into the meatuses of the nose)
* **Throat examination** (usually does not come in exam)
  + Use a torch and spatula to aid in your inspection and palpation
  + **Inspection**
    - **Lips**
    - **Inner cheeks**
    - **Gums**
    - **Teeth**
    - **Palate (soft and hard)**
  + **Palpate** (wearing gloves)
    - Same areas as above (really!)