CENTRAL NERVOUS SYSTEM EXAMINATION

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Presenting symptoms:

The Hx is key in the examination of many neurological cases. A patient can give the history themselves or they may come with a chaperone. Symptoms can vary. Some are discussed below:-

- **Headache:** This should be treated as any other type of pain. Establish its SOCRATES. Ask about facial and visual symptoms. There are several types of headaches including:- tension headache, subarachnoid hemorrhage, sinusitis, meningitis, cluster headache, migraine among others.
- Loss of awareness
- **Loss of consciousness:** Establish whether the patient actually lost consciousness. Patients confuse blacking out when they just fell on the ground. Eye witness account is vital.
- Alteration of perceptions
- **Dizziness**: This is used by different people to describe different things. Narrow down the exact meaning without being aggressive. Some meanings could be:
    i. Presyncope – unique feeling one gets before fainting
    ii. Vertigo – a sense of rotation
    iii. Light headedness – nonspecific symptom related to pathology.
    iv. Incoordination – due to either ataxia or weakness
- **Visual symptoms:** Establish what is being experienced, that is, visual loss, double vision(diplopia), poor or clouded vision(amblyopia) or photophobia(pain when looking at bright lights)
- Loss of smell
- Oscillopsia
- Deafness
- Tinnitus
- **Tremor:** Establish when the tremor occurs, whether at rest, only when attempting an action or both. Also there is need to establish the severity
- **Weakness and numbness**
- **Seizures:** Very difficult to assess. Establish if there was any impairment of consciousness.

In addition to the presenting symptoms, ask the patient whether they are left or right handed. This may be useful when thinking about cerebral lesions. Enquire also about other neurological symptoms other than the presenting complaint.

Make sure to take the full history including past medical history, birth history, drug, family and social history.

Communication

- **Introduction:** Greet the patient, introduce yourself, make patient feel comfortable by setting up suitable scene.
- Explain to patient what you want to do, the procedures done and reason for the procedures.
- Seek consent from the patient to continue with the examinations.
- Resume if consent is granted.
- Wash hands before commencing examinations.

EXAMINATION

The following is an outline of how examination of CNS should be approached:

i. Inspection
ii. Speech and higher mental functions
iii. Cranial nerves 1-12
iv. Motor system
v. Sensation
vi. Coordination
vii. Gait
viii. Any other tests
ix. Other relevant examinations:- skull, spine, neck, eardrums among others.

General Inspection

The exam should begin with any clues that can be gotten by just engaging and looking at the patient.

- Is the patient accompanied by caregivers, and how does the patient interact with those people?
- Does the patient use any support while walking?
- Observe the gait
- Is there any speech disturbance?
- What is their mood like?

Speech and Language

This problem may be evident from the start of the history. Ensure the patient is not deaf or that their hearing aid is working. Speech can be tested by asking a patient to read a written sentence or obey a written command and write a short sentence. Some problems may include:

i. **Dysarthria:** This is a defect of articulation with language function intact. Writing will be unaffected.
ii. **Dysphonia:** defective volume. It may be functional or from laryngeal diseases.
iii. **Dysphasia:** reading and writing and speech may be affected.

Cognitive function

This is a patient's appearance or communication skills. Formal assessment of a person's mental state is thus important. There is a brief screening tool with a maximum score of 10 points. Ask for permission to proceed with the questions.

CRANIAL NERVES

Olfactory
(Sense of smell)

Examination is not routinely tested unless the patient complains of loss of sense of smell(anosmia) and exhibits other signs of a frontal or temporal lobe cause.

Procedures:

- The patient should be seated
- Stand in front of the patient, face to face
- Have 2 or 3 vials of somatic aromatic vials

- Ask patient to close eyes and occlude one nostril at a time and determine if any loss of smell is uni or bilateral.
- The patient is asked to identify the smells.

Optic nerve (sensory)

- Patient should be upright
- If the patient uses spectacles, ask them to put them on.
- Place the snellens chart on the wall
- Estimate a distance of 6m from patient to chart
- Identify the patient's visual acuity
- Check patient's record and using torch examine the eye to ascertain the need for visual acuity.
- Ask the patient if they can read the snellens chart
- Cover one of the patient's eyes with occluder to examine each eye separately.
- Ask patient to read from the largest letter to the smallest on each eye separately.
- Use the E chart if the patient can't read.
- If the patient can't see the snellens chart, reduce the distance by one meter.
- If the patient can only see the first letter, vision acuity is recorded as 5/60
- If the patient can't see at 5/60 then reduce distance to a place where they can see.
- If at one meter the patient still can't see then bring your hand at 0.9m and move it closer progressively until they can see, ask patient to count you fingers.
- If she is able to count, record vision as COUNT FINGER
- If at 0.3m they can't see, then wave your hand and ask if they can see any hand movement, record vision acuity as HM(hand movement).
- If they still can't see HM, then shine light from different direction, if they can tell where the direction of the eye comes from, you record vision acuity as LIGHT PERCEPTION.
- If the patient can't see then record acuity as NO LIGHT PERCEPTION.
- Give feedback to patient.

Peripheral: assessment done through confrontation test, this test assumes that the examiners peripheral vision is Normal.

- Sit or stand opposite the patient at eye level, distance of one meter.
- Cover left eye, ask patient to cover right eye.
- Both examiner and patient should be looking at each other's eye
- Fully extend your hand Midway between patient and self, move it centrally.
- Ask patient to tell you when the moving fingers are first seen, compare patient's response to yours.
- Test temporal, nasal, superior and inferior fields, record by shedding the quadrants which the patient is unable to see the fingers.

Occulomotor / Trochlea / abducense
(III, IV, VI)

- The three nerves control the eyelids, pupillary actions and extra-occular muscles.

- Inspection, inspect eyelids for drooping, which is a sign of paralysis of third cranial nerve.
- Compare size and shape of both pupils

- Test pupillary reaction to light
- Dim the light to the room to facilitate dilatation of pupils.
- Introduce a ray of light from pentorch into the eye from the side
- Note whether the pupils of that side constricts
- Note the consensual response of the opposite pupil constricting simultaneously with the tested pupil
- Repeat the test on the other eye

Testing for accommodation

- Ask the patient to look at a distant object and then loot at a near object like a pencil or finger held about 10cm infront
- Note pupil constricting on at near object and dilate at a distance object
- Compare pupillary reaction on both sides

Testing of extra-occular

- Full movement of the eye is achieved by the actions of the six extra-occular muscles which are controlled by the III, IV, VI cranial nerves.
- The lateral rectus supplied by the sixth cranial nerve
- The superior oblique by fourth cranial nerve
- The superior rectus, inferior rectus, medial rectus and inferior oblique by third cranial nerve.

Examination

- Hold patient's chin to prevent movement of the head and ask them to watch the movement of the finger as it moves through the six cardinal fields of gaze
- Note any impaired movement of the eye could mean paralysis of any of the muscles which in turn could mean a problem in the nerve supply of the muscle.

Trigeminal(V)

- **It's both motor and sensory.**
- **Three portions, ophthalmic, maxillary, mandibular**
- Observe face for muscle atrophy, deviation of the jaw or face to one side and fasciculation.
- Ask the patient to tightly clench the teeth, palpate the jaw muscles for tone and strength
- Ask patient to close the eyes
- Touch each side of the face at the scalp, cheek, and chin areas alternately using a cotton wisp, smooth edge of a broken tongue blade, point and rounded edge of a paper clip, making sure you do not use a predictable pattern.
- Ask patient to discriminate between the sensations.
- Use wooden applicator to test for sensations over the buccal mucosa.
- Test for corneal reflexes on both eyes by touching each cornea with a wisp of cotton
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Facial(VII)

- Has both motor and sensory functions
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Motor:

- Ask patient to smile, frown, puff the cheeks, raise the eyebrows, squeeze the eyes shut, whistle.

- Observe for tics, unusual facial confirmations and assymmetry
- Listen to patient's speech and note any difficulties with initiating labial sounds eg b, m, p
- Muscle weakness is evidenced by one side of the mouth drooping, a flattened nasolabial fall and lower eyelid sagging.

Sensory

- **Test ability to identify sweet and salty test on each side of the tongue**
- To evaluate test, sensual function of nerve vii and ix, have available four solutions of different tests, applicators and a card showing taste areas
- Ask patient to keep the tongue protruded and to indicate the taste perceived using a card
- Apply one solution at a time to The lateral side of the tongue in the appropriate taste buds region
- Alternate the solutions using a different applicator for each
- Offer a sip of water after each stimulus
- The patient should identify each taste bilaterally,, if not mark the areas on a card with a sketch of a tongue

Cranial nerve III (acoustic nerve)

- Occlude one ear, rub your thumb and fingers together close to the patient's ear. Or whisper.
- Examine each

Glossopharyngeal nerve(IX) | Vagus nerve(X)

- Ask the patient to open mouth wide
- Moisten tongue blade with warm water (will not trigger a gag reflex as easily as a dry one)
- Touch the posterior pharynx of the tongue blade
- The patient's gags- closure of faucets and swallowing
- Test both sides of the pharynxs, expect a bilateral response
- Lack of gag may suggest paralysis of nerve Ix and x

Spinal accessory nerve

Motor:

- It innervates the larynx, pharynx, sternocleidomastoid
- Test the trapezius muscles strength, ask the patient to shrug the shoulders as you apply resistance to them with your hands.
- Test sternocleidomastoid muscle, ask the patient to turn the head to each side against resistance.

Hypoglossal nerve(XII)

Motor:

- It supply tongue and hyoid
- Inspect the patient's tongue while at rest on the floor of the mouth and while protruded from mouth
- Note any fasciculation, assymmetry, atrophy or deviation from the midline
- Ask patient to move the tongue in and out of the mouth from side to side curled upwards as if to touch the nose and curled downwards as if to lick the chin
- Note any difficulties or lack of movement

- Test tongue muscles stry by asking patient to push the tongue against the cheek as you apply resistance with an index finger and assess the strength
- Tell the patient to repeat these letters, L, T, D, N.
- Evaluate the quality of the lingual speech. A deficit in pronunciation means weakness in the tongue a disorder in the XI nerve.

Motor System

Begins when you first set eyes on the patient and it continues through history taking. See if the patient uses any walking aids or abnormal gait, any abnormalities when shaking hands with the patient and other abnormalities like muscle wasting and irregular contractions of muscles.

When doing a formal examination and inspection, the patient should be seated or lying comfortably with as much of their body exposed as possible: -

Tone- the aim is to test resting tone in the limbs

i. **Arms:**
   - Take the patient's hand in yours and hold their elbow with your other hand.
   - Pronate and supinate the patient's forearm
   - Roll the patient's wrist through 360 degrees
   - Flex and extend the patient's elbow.

ii. **Legs:**
   - With the patient lying flat, legs straight, hold onto the patient's knee and roll it from side to side.
   - In the same position, put your hand behind the patient's knee and raise it quickly. Watch the heel, it should lift from the bed or exam table slightly.
   - Holding the foot and the lower leg, flex and dorsiflex the ankle

Power – this tests muscle power. It is graded from 0-5.

i. **Shoulder:**
   - Abduction: Ask the patient to abduct their arms with elbows bent. Ask them to hold still as you attempt to push their arms down
   - Adduction: The patient should hold their arms tightly to their sides with elbows bent. Attempt to push their arms out

ii. **Elbow:**
   - The patient holds their elbows bent and supinated in front of them. Hold the patient at the elbow and wrist and attempt to extend their arm.
   - In the same position, ask the patient to push you away as you resist extension at the elbow by pushing on their distal forearm.

iii. **Wrist:**

- Flexion: With arms supinated, the patient should flex their wrist and hold as you try to extend it by pulling from your own wrists.
- Extension: The opposite of flexion. The patient holds their hand out straight and resists your attempts to bend it.

iv. Fingers

- Flexion: Ask the patient to squeeze your fingers or (better) ask the patient to grip your fingers palm to palm and resist your attempts to pull their hand open.
- Extension: Ask the patient to hold their fingers out straight. You support their wrist with one hand and try to push their fingers down with the side of your hand over their first interphalangeal joints.
- Abduction: Ask the patient to splay their fingers out and resist your attempts to push them together.
- Adduction: Holding the patient's middle, ring, and little finger with one hand and their index finger with the other, ask the patient to pull their fingers together or place a piece of paper between their outstretched fingers and ask them to resist your attempts to pull it away.

Pronator drift

This is a useful test of subtle weakness. The patient is asked to hold their arms outstretched in front, palms upward and eyes closed. If one side is weak, the arm will pronate and slowly drift downward.

Power of Lower Limbs

The patient should be seated on an exam table or bed with legs outstretched in front of them. The limbs should be exposed as much as possible so that contractions of the muscles can be seen.

i. Hip

- Flexion: With the lower limbs lying on the bed or couch, the patient raises each leg, keeping the knee straight. Oppose the movement by pushing down on the thigh just above the knee.
- Extension: Ask the patient to keep their leg pressed against the bed as you attempt to lift it, either with a hand beneath the calf or the ankle
- Abduction: Ask the patient to move their leg out to the side as you oppose the movement with a hand on the lateral thigh
- Adduction: With the legs central, put your hand on the medial thigh and attempt to pull the leg out to the side against resistance

ii. Knee

- Flexion: Take hold of the patient's knee with one hand and their ankle with the other and flex the leg to about 60 degrees. Ask the patient to bend their leg further and oppose the movement at their ankle.

- Extension: With the patient's leg in the flexion position, have the patient extend their leg as you oppose it. Alternatively, attempt to bend the patient's leg from a straightened starting position.

iii. Ankle

- Plantar flexion: With the patient's leg out straight and ankle relaxed, put your hand on the ball of the foot and ask the patient to push you away.
- Dorsiflexion: From the starting position for plantar flexion, hold the patient's foot just above the toes and ask them to pull their foot backward. Patients often attempt to move their entire leg here.

Tendon Reflexes

The sudden stretch of a muscle is detected by a muscle spindle, which initiates reflexes causing the muscle to contract. The tendons are tapped with a reflex hammer. The hammer should be held at the far end of the handle and swung in a loose movement from the wrist. The patient should be relaxed.

Examination

i. Biceps(C5, C6)

With the patient seated, lay their arms across their abdomen. Place your thumb across the biceps tendon and strike it with the reflex hammer as above. Watch the biceps for contraction.

ii. Supinator (C5, C6)

The muscle tested is actually the brachioradialis. With the patient's arms lying loosely across their abdomen, put your fingers on the radial tuberosity and tap with the hammer. The arm will flex at the elbow. If brisk, the fingers may also flex.

iii. Triceps (C7)

Taking hold of the patient's wrist, flex their arm to 790*. Tap the triceps tendon about 5 cm superior to the olecranon process of the ulna. Watch the triceps.

iv. Fingers (C8)

This is only present if tone is pathological. With your palm up and the patient's arm pronated, lay their fingers on yours. Strike the back of your fingers. The patient's fingers will flex.

v. Knee (L3, L4)

With the patient's leg extended, use one hand behind their knee to lift their leg. Tap the patella tendon and watch the quadriceps. If brisk, proceed to testing for clonus here.

vi. Knee clonus

With the patient's leg extended, place your thumb and index finger over the superior edge of the patella. Create a sudden downward (toward the feet) movement and hold. Watch the quadriceps. Any beat of clonus here is abnormal.

vii. Ankle (S1, S2)

With the hip flexed and externally rotated and the knee flexed, hold the foot and tap the Achilles tendon. Watch the calf muscles for contraction and ankle flexion.
Alternatively, with the leg extended and relaxed, place your hand on the ball of the foot and strike your hand with the hammer.

Sensory Examination

i. **Light touch**

With the patient's eyes closed, touch their skin with a piece of cotton wool and ask them to respond if the feel the touch. After testing each limb and body area, double check with patient whether it felt the same all over.

ii. Vibration sense

A 128Hz tuning fork is used. Ask the patient to close their eyes, tap the tuning fork and place the base on a bone. Ask the patient whether they can feel the vibration.

iii. Pin-prick

Use a safety pin and repeat the test for light touch. Occasionally use the blunt side of the pin to test uniformity and honesty of the patient.

GAIT

Ask the patient to walk a few steps, turn and walk back to you.

- Observe posture
- Observe any abnormalities
- Patient's behavior
- Patient's motor coordination

You can also ask the patient to walk on tiptoes and also on their heels.

Conclusion

The above tests are some of the main tests performed in a neurological exam. After completion of the exam, tell the patient how they performed and also thank them for their cooperation. You can then walk out of the examination room and let the patient get dressed.

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