NEUROLOGIC EXAMINATION

Part of "1 - NEUROPSYCHIATRIC EXAMINATION"

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The neurologic examination complements the clinical history and mental status examinations that preceded it (3). In the neurologic examination the examiner confirms and disconfirms impressions that arise during the interview. No examination is ever "comprehensive." Measures are emphasized from the neurologic examination that amplify and corroborate the clinician's developing impression of neuropsychiatric disease, individualized in each case. The examination has powerful operator characteristics related to the experience of the clinician, which are difficult to measure. The basic outlines of the major components of the neurologic examination follow.

Cranial Nerves

Cranial Nerve I

Smell should be tested separately in each nostril using a distinctive stimulus such as cloves. The substance should be nonirritating. "Scratch-and-sniff" cards are available for systematic, validated olfactory screening using standardized stimuli. Disturbance of the sense of smell may occur in a wide variety of neurologic disorders. Shearing of the olfactory filaments as they traverse the cribriform plate occurs frequently with closed head injury and can take place without loss of consciousness. Smoking probably is the most common cause of impaired smell in Western societies. Complete anosmia should be distinguished from partial loss of olfactory capacity (hyposmia). Some patients are unaware of their olfactory loss and may not appear concerned even when a clear olfactory deficit is documented, whereas other individuals complain bitterly of their loss of olfactory perception.

Cranial Nerve II

Examination of the optic nerve entails examination of the optic fundus (retina), visual fields, visual acuity, and pupil. Funduscopic examination allows consideration of the retinal vascularity and the optic disk. Visual acuity can be assessed with a pocket screener or wall chart. It is important to indicate whether acuity is assessed with patients wearing corrective lenses or glasses. In the absence of corrective lenses, a pinhole can be used to correct for refractive errors. Visual fields can be tested with small red-and-white objects on the tip of a pointer. Cotton swabs on long sticks will serve the purpose at the bedside if standard test objects are not at hand. Each eye is examined independently. Pupillary reactivity to direct and consensual light is recorded, as is the near reflex (accommodation and convergence).

Cranial Nerves III, IV, and VI

Extraocular motility is examined by observing the patient's upward, downward, lateral, and angular gaze. The examiner looks closely for nystagmus, diplopia, or limitation of gaze in

any direction.

Cranial Nerve V

Facial sensation over each of the three branches of the trigeminal nerve is tested with light touch and pinprick, and each side compared to the other. The corneal reflex (afferent limb via cranial nerve V, efferent limb via cranial nerve VII) should be tested with a wisp of cotton. Its absence can be the sole evidence of trigeminal nerve dysfunction; its presence is evidence against facial anesthesia.

Cranial Nerve VII

Evidence of facial asymmetry is noted both at rest and during facial expression. In peripheral facial nerve lesions, the entire hemiface is involved, whereas in a central lesion the forehead is spared. Central lesions involving the right face may be associated with aphasia.

Cranial Nerve VIII

Sensorineural hearing loss should be distinguished from conductive hearing loss, if possible. High-frequency hearing loss (presbycusis) is common in the elderly. Hearing may be assessed at the bedside with whispering, tuning forks, or ideally an audioscope. The examiner also performs the Weber test in which a 512-Hz tuning fork is placed on the vertex and the patient is asked whether the sound is heard equally well in both ears. In conductive hearing loss, the sound will be louder on the defective side. In sensorineural hearing loss, the sound will be greater on the less impaired side. Finally, bone conduction is compared with air conduction by placing the base of the vibrating tuning first on the mastoid process behind the ear and asking the patient to compare the strength of that sound with the sound of the tuning fork in the air. In conductive hearing loss, bone conduction is greater than air conduction.

The vestibular component of cranial nerve VIII can be tested with the Nylen-Báarány maneuver, which stimulates the vestibular apparatus. The patient initially is seated and then moved rapidly into a supine posture with head tilted 45 degrees backward below the level of the table and 45 degrees to the left. The patient resumes the seated posture and the maneuver is repeated, moving the head backward and 45 degrees to the right. The examiner notes whether nystagmus or symptoms of vertigo are produced by this maneuver and compares the intensity and duration of nystagmus with turning of the head toward the left and the right sides.

Cranial Nerves IX and X

The afferent limb of the gag reflex is via cranial nerve IX and the efferent limb via cranial nerve X. Patients with upper motor neuron palsy may have an overly brisk reflex

with excessive coughing, whereas patients with lower motor neuron palsy may have a diminished or absent gag reflex leading to increased risk of aspiration. Swallowing is a complex act that can be impaired even if the gag reflex is intact. Timed swallowing of liquid

is a sensitive bedside test for dysphagia. A rate less than 10 mL/s is strongly associated with objective demonstration of dysphagia on cine esophagram.

Cranial Nerve XI

Function of the accessory nerve is tested by palpation of the sternocleidomastoid muscle as the patient turns his or her head to the left and right alternately while being opposed by the hand of the examiner. Weakness of the *left* sternocleidomastoid impairs head turning to the *right,* and vice versa. This point occasionally is useful in identifying weakness due to (hysterical) conversion. Shrugging or elevation of the shoulders is accomplished through activation of the trapezius muscle. The examiner requests the patient to elevate his or her shoulders while the examiner palpates the involved muscle.

Cranial Nerve XII

The patient is asked to protrude the tongue and move it from side to side. In unilateral paralysis of cranial nerve XII, the tongue will be observed to deviate toward the side of the weakness.

Motor Examination

Muscle mass is observed for any asymmetry of bulk and for any focal atrophy due to peripheral lesions or disuse.

Muscle Tone

Muscle tone is tested by passively moving the patient's limb. The examiner compares tone in both extremities and notes the presence or absence of increased tone. Increased tone may be characterized as having a "jackknife" quality typical of upper motor neuron disease: paratonic (a ratchetlike intermittent tone seen in frontal lobe disease), cog wheeling (parkinsonian), or negativistic (the rigid resistance of catatonia). Absence or flaccidity of muscle tone is indicative of lower motor neuron disease, and decreased tone is associated with cerebellar lesions. Tone varies considerably among normal individuals.

Muscle Strength

Muscle strength is graded from 0 to 5, where 0 is no movement, 1 is trace movement, 2 is movement with gravity in a horizontal plane, 3 is movement against gravity, 4 is movement against gravity and against applied force, and 5 is normal strength. The examiner compares left versus right, proximal versus distal, and upper versus lower extremity strength.

Reflexes

Reflexes are graded from 0 to 4, with 2 being average. Briskness of reflexes varies in healthy normal individuals, and areflexia that is not asymmetric and not associated with weakness or other motor or sensory problems is not necessarily pathologic. In individuals who are anxious, consuming benzodiazepines, or withdrawing from alcohol, reflexes may be diffusely increased. Asymmetry between reflexes and discrepancy between reflexes in

upper and lower extremities can have localizing significance.

Pathologic reflexes: In a normal adult, stimulation of the plantar surface of the foot produces either no response or plantar flexion (a downgoing toe). In individuals with upper motor neuron pathology (i.e., a pyramidal tract lesion), the great toe may dorsiflex (i.e., extend) and the toes fan out. An upgoing toe with or without fanning of the other toes is referred to as a *Babinski sign.* The Babinski sign in an adult usually implies structural disease of the central nervous system or a toxic metabolic encephalopathy.

There are a number of *"primitive" reflexes* that may be seen in infants during the first year of life. Reappearance of these reflexes (i.e., grasp, suck, snout, root) suggests frontal lobe disorders. The occurrence of primitive reflexes in elderly persons is of relatively low diagnostic specificity.

Coordination

Coordination (cerebellar) testing consists of finger-nose-finger, heel-knee-shin, and rapid alternating movements. Weakness can interfere with coordination testing. Spasticity can cause clumsiness but not the dysmetria typical of cerebellar lesions.

Station

Is the patient able to stand comfortably with his or her feet together? Is there evidence of swaying when the patient is asked to close his or her eyes (positive Romberg sign)? Can the patient stand on one foot?

Gait

The examiner should observe several components in a patient's gait. How wide is the stride? How broad based is the gait? Are movements made in a shuffling tentative fashion? Is there a footdrop with a "steppage" gait? Is turning done smoothly or "en bloc"? Is there asymmetry of arm swing? The time taken to walk a fixed distance can be used as a quantitative measure of a patient's gait.

Abnormal Movements

Is there a paucity or an excess of movements (hypokinesia vs. hyperkinesia)? Are there spontaneous dyskinesias (such as those of Huntington disease or tardive dyskinesia)? Is there a

tremor visible at rest (parkinsonian tremor), postural tremor (familial or essential tremor), or tremor that appears only with intention (cerebellar tremor)?

Myoclonic jerks may involve a single limb or the entire body. Fasciculations (movements of small muscle groups) can be seen in amyotrophic lateral sclerosis (ALS) and in nerve-root lesions.

Sensation

The examiner tests primary sensory perception by examining the patient's awareness of pinprick, light touch, position, and vibration. Parietal sensory testing consists of examining a patient's capacity to recognize numbers or letters written on the palm or on the sole of the foot while the patient is not looking (graphesthesia); the ability to recognize an object from manipulating or palpating it (stereognosis); and the ability to detect sensory stimuli applied at the same time in different anatomic regions (double-simultaneous stimulation). It is meaningless to test for parietal deficits in a region of significant primary sensory loss.

Soft Signs

The neurologic and psychiatric literature has been inconsistent as to whether the traditional neurologic examination is of assistance in the evaluation of learning difficulties. Several pediatric neurologists have attempted to refine the neurologic examination by asking patients to repetitively perform certain tasks, such as jumping on one foot, and noting the nature of difficulties seen over specific periods of time.

In contrast to "subtle" signs of neurologic abnormalities, such as reflex asymmetries or equivocal Babinski signs, "soft" neurologic signs are unlikely to imply lateralized pathology and more often reflect developmental immaturity of the central nervous system.

Soft neurologic signs include the following:

Fine motor incoordination: Awkwardness at tasks such as handwriting, finger-nose-finger, and finger pursuit in the absence of frank cerebellar dysmetria

Dysrhythmia: Lack of smooth transitions between different motor tasks

Mirror movements: Contralateral overflow of motor activity in homologous muscle groups

Synkinesis: Ipsilateral overflow of extraneous associated movements when the patient is asked to perform an activity involving a specific set of muscle groups

Both mirror movements and synkinesis can be elicited by asking the patient to perform activities that involve discrete muscle groups: (a) tap one foot; (b) alternately tap heel and toe; (c) pat one's thigh; (d) flip-flop one hand on one's thigh; (e) tap one's thumb and index finger repeatedly; and (f) successively touch one's index, middle, ring, and little fingers to one's thumb.

Mirror movements and synkinesis may be seen as a failure to inhibit or suppress movements in larger or distant muscle groups while attempting to perform a discrete task.

The reliability of rating of soft signs can be enhanced by having a standard routine for eliciting the signs, such as having the patient performing movements *a* through *f* ten times in succession on the right and then on the left. Timing the sets of ten with a stopwatch can give further useful information about lateralized differences in speed of performance.

Soft signs do not correlate sharply with neuroanatomic systems, as do the preceding components of the neurologic examination. They are useful occasionally as indices of more

global cerebral dysfunction of various etiologies and should be used to confirm impressions of such global impairment.