

Neurologic Examination

The neurological examination has five major parts of which are approximately of equal importance and which you should allot equal time.

Every patient should have a neurological examination. A patient with a obvious diagnosis, like a broken leg, should have a abbreviated neurological exam. **Bold lettering designates parts of the examination which are appropriate for a patient without neurologic complaints or neurologic disease.**

Mental Status Examination

Because you need information as a point of reference to determine if there has been any changes you need to determine the patients educational level, where he went to school, how far he went through school, what the best job he ever had, and if that is not his current job why did he leave? The question you are trying to answer is, Are the results of this examination indicate a decrease from a previously obtained level of function?. You can determine the probable previous level of function at the bed side by determining three things: Does the patients vocabulary indicate a better intellectual achievement than you are now finding? Does his work history indicate he must have been functioning at a better level? Did his scholastic accomplishments (grade level obtained, schools attended, or grades in particular subjects) indicate that he must have been functioning at a higher level in the past?

1. **Orientation to person, place, date, and situation.** Can the patient state his name? Can the patient name the place where the examination is occurring? Can he give the complete date? Can he state why he is at the doctor's office?
2. **Memory - Presidents; Recent important news in the papers and on TV.** Who is the current President? Who was the President prior to this President? Continue the Presidents backwards to the limit of the patient's ability. What was the most important news story of this week? Check details of this story with patient.
3. **Recent Memory** Give the patients four objects to remember in 5 minutes. For example: a green ball, a red tie, 813, and an island. Then after 5 minutes have patient repeat objects. Record in the examination as one of four objects at 5 minutes or 2 of 4 objects at 5 minutes.
4. **Digit Span Forward** Tell the patient that you wish for him to repeat back to you the numbers you give him in the same order. Then give him a string of 5 to 6 numbers. Avoid grouping numbers together or a sing song speech. Give the patient a steady smooth and slow rate of the numbers. If the patient is able to get 5 numbers easily, then try 6 numbers, then 7. Continue until the patient is not able to repeat them accurately. Then have the patient repeat them back to you in the reverse order that you give them to the patient. It is frequently easier if you give the example of "If I say 1-2-3 you say 3-2-1". Record on the patients chart 7 numbers forward and 4 numbers

backwards.

5. **Arithmetic** Serial subtraction 100 - 7 or 30 - 3, etc. Ask the patient to subtract 7 from 100. If he can do this correctly record the results. If the patient is unable to do serial subtraction of 7 from 100, try simpler subtraction of 3 from 30. Record the results as serial 7's from 100 to 36 with 3 errors.
6. **Ability to abstract: Similarity and Differences** In this portion of the mental status examination we are trying to determine if the patients thought processes are abstract or concrete. Ask the question "What is like an apple and an orange?" The answer "fruit" is an abstract response the answer "round" is a concrete response. Other questions would include "What is alike about an axe and a saw?" and "How are a seed and an egg alike?" Interpretation of proverbs "What does it mean when I say people who live in glass houses should not throw stones?" Another example would be "What does it mean when I say "You should not count your chickens before they hatch?" Record whether the patient's answers are abstract or concrete.
7. **Speech and Language** Listen to the patient as he answers questions. Does he articulate words clearly or does he have nasal or slurred speech? Does he use his words correctly or instead seem to make errors by using the wrong word at the wrong time? Does he recognize that he is making errors? If he seems to use the wrong words ask him the names of the objects or parts of objects. A good test is to ask him parts of your shirt or blouse by pointing to the pocket, sleeve, collar, buttons and asking him to name each.
8. **Visual Spatial Skills** Have the patient draw a clock at 11:15. Have the patient draw a cube. Patients with right hemisphere problems will often have difficulty with visual spatial tasks. If a patient is unable to draw the clock or the cube try easier tasks such as drawing a square, bisecting a line, or other simple figures.

Cranial Nerves

1. **Olfactory Nerve**—the sense of smell: Test each nostril separately. Ask the patient to identify something that has a distinctive odor. Do not pick something that irritates the nose (e.g. alcohol) because that stimulates the fifth cranial nerve. Good choices are garlic chips or garlic powder, cinnamon, peppermint, or favoring like vanilla extract. Coffee grounds are also an aromatic stimulus. Most common causes of the inability to recognize an odor are a cold, the residual of old head trauma, or the after effects from smoking for many years. Unilateral loss of smell is much more important than bilateral loss of the ability to recognize odors. The loss of smell is also a false positive finding (a patient with a heavy smoking history). Therefore, this part of the examination is very often skipped.
2. **Optic Nerve: Test visual quality, visual fields, pupillary responses and the fundus.** Test visual quality with a hand held visual quality chart. Use the numbers or the E's for an illiterate patient. For a neurological examination always test a patient

with his glasses on. (Best corrected vision) Results are reported as distance equivalent (e.g. 20/ 200 or 20/40) Visual fields can be tested at the bedside with moving fingers. Begin testing the visual fields with both eyes open and giving patients stimulus in each quadrant of each field. If you seem to find an abnormality, each eye needs to be tested individually, again with a stimulus in each quadrant of the visual field.

3. **Pupillary Responses:** Pupillary examination begins with the size of the pupils, Secondly, we look also at the shape of the pupil (round, oval, tear drop shaped). Determine how each pupil responds to direct stimulus with the flash light and determine how each pupil responds consensually with the light in the other eye. The pupils also constrict as the eyes converge to look at a near object. (accommodation) This is best tested by giving a patient an object approximately 2 feet away and then bringing the object close to the patient while he focuses on the object.
4. **Fundus:** You should always pay particular attention to the optic disk and its margins. Optic disk margins are sharp. Other observations should include the ratio of artery to vein size. The number of vessels leaving the disk. Can venous pulsations be detected? Is there any evidence of hemorrhage into the retina. The fundoscopic examination is a **very** important part of the neurologic examination. This is the only place in the neurologic examination where the doctor is actually seeing the nervous system. Every patient with a headache no matter how minor, needs a close fundoscopic examination.
5. **Ocular, Trochlear, and Abducens :** Extraocular movements should be tested on both the horizontal and vertical meridian as well as in all four corners of the patient's visual field. Test the ability of the patient to look completely up, completely down, completely to the left, and then completely to the right. Then have the patient follow your finger as you draw an imaginary square to test the limits of the eyes movements in all areas. The ocular motor nerve primarily abducts, and elevates and depresses the eye. The trochlear nerve innervates the superior oblique muscle which primarily depresses and intorts the eye. The abducens nerve innervates the lateral rectus muscles which abducts the eye. Spontaneous or gaze induced regular to and for movements of the eye are occasionally observed. This is a term called Nystagmus. Nystagmus can be from side to side, up and down, or even rotatory. Nystagmus can be a component of brain stem or cerebellar lesions.
6. **Trigeminal Nerve:** The Trigeminal nerve provides sensation to the face but also has a motor component of opening the patient's mouth. Sensation of the face can be tested to touch, pin, and double stimulation. The cornea reflex is carried by division V₁. This is an extremely important reflex as it tests the ability of the first division of the trigeminal nerve to sense stimulus to the cornea as well as the seventh cranial nerve to quickly close the eye. As with pupillary reflexes you should note both the direct and consensual response to corneal stimulation.
7. **Facial Nerve:** The seventh nerve controls movement of the face. There are five divisions of the seventh cranial nerve in terms of motor function. These include wrinkling of the forehead, raising the eyebrows, closing the eyes tightly, smiling,

pursing the lips as if whistling, and grimacing causing contraction of the platysma. The patient should be able to close his eyes so tightly as to hide his eye lashes. You should not be able to pull a patient's pursed lips apart. It is very important to note symmetry in facial movements and to note movements in the upper and lower face. Central nervous system systems that affect facial movements will only be demonstrated by lower facial weakness. Lesions involving the seventh nerve nucleus or seventh nerve after it leaves the brain stem will cause weakness in all five divisions of the seventh nerve. The ability to detect taste is on the anterior 2/3 of the tongue can be tested but this is rarely done in a routine examination.

8. **Auditory and Vestibular:** Hearing is best tested at the bed side by the ability of the patient to repeat numbers which are whispered into his ear. You can mask the sounds to the other ears by gently placing your finger in the opposite ear and moving it gently. The vestibular nerve is not usually tested at the bedside except to note that nystagmus is present. Occasionally nystagmus indicates vestibular nerve and end organ disease.
9. **Glossopharyngeal and Vagus:** These nerves are usually tested together. The patient is asked to open his mouth widely and you should observe the movement of the soft palate as the patient phonates "AH". You also observe the movement of the palate to stimulation of the posterior pharynx on each side (the gag reflex). You should also listen to the patient's voice as a nasal voice may indicate palatal weakness and hoarse voice may indicate vocal cord paralysis as part of a vagus nerve lesion.
10. **Spinal Accessory Nerve:** The spinal accessory nerve provides motor power to the sternocleidomastoid and to the upper fibers of trapezius muscle. The trapezius muscle is also innervated by the upper cervical motor nerves of C 3 - C 4. The sternocleidomastoid is only innervated by the spinal accessory nerve. To test the spinal accessory nerve, have the patient turn his head to the side against resistance while palpating the opposite sternocleidomastoid muscle and observing bulk and tone. The right sternocleidomastoid muscle turns the head to the left.
11. **Hypoglossal Nerve:** This nerve supplies the motor input to the tongue. You should look at the tongue at rest in the floor of the mouth to look for atrophy or small flickering movements of the tongue muscles which do not move the tongue (fasciculations). The power of the tongue is observed as the patient moves his tongue or is felt as the patient pushing against your hand through his cheek.

Motor Examination:

During the motor examination you will want to test muscle power, muscle tone, and muscle coordination. Also, during this time you observe muscle bulk and look for abnormal movements. Asymmetry or dystrophic changes in the bulk of muscles are best detected by observing the patient in a well lit exam room after he has taken off all or most of his clothes. This is also the best way to see abnormal movements of the muscles such as dystonias or fasciculations. A patient who is complaining of weakness must be

undressed for a motor examination. Tone is test by passively moving the arms and legs while the patient is completely relaxed. Some patients find it all but impossible to relax. Therefore it is all but impossible to test the tone in these patients. Each muscle's power can be observed independently but this would take much to long. The following muscle groups should be tested in every patient: 1) Shoulder Abduction (deltoid) 2) Elbow Flexion (biceps) 3) Elbow Extension (triceps) 4) Wrist Extension 5) Wrist Flexion 6) Hand Intrinsic Muscle Strength. In the lower extremities the muscle groups include: 1) Hip Flexion (iliopsoas) 2) Knee Extension (quadriceps) 3) Knee Flexion (hamstring groups) 4) Ankle Dorsiflexion (anterior tibialis) 5) Ankle or Foot Plantar Flexion (gastrocnemius, soleus) 6) Foot Eversion (peroneal muscles) 7) Foot Inversion (posterior tibialis). Lower Extremities muscle strength is often tested best by having patients do routine functions such as standing from a sitting position without the use of his arms. Stepping up on a step and walking on his heels and toes.

Sensory Examination:

Sensory examination by its nature is subjective, therefore at times difficult to interrupt. This test should include light touch, pin prick, position sense, vibration, two point discrimination, stereognosis, and double simultaneous stimulation. Light touch is tested by using a cotton tip swab or tissue to gently touch the patient in the lower extremities and determine if the patient can discriminate when he is touched. During this portion of the examination double simultaneous stimulation is often tested. While touching the patient on the left, right or both sides ask the patient what he senses. Inability to recognize being touch on the right side during double simultaneous stimulation is often a symptom of neglect syndromes with right parietal lesions. Pin prick is best tested with the patient's eyes closed while you touch him lightly with a pin. Never use a dull pin! Do not use IV angiocaths as they will draw blood. Use the pin and the tip of your finger to ask the patient to discriminate sharp versus dull. Position senses usually tested in the fingers and the toes only, but can be tested else where. Position senses are tested by grasping the patient's finger or toe firmly while the patient has his eyes closed. At that point make small quick movements up or down several millimeters and ask the patient to respond, "up" or "down". Make the movements random, not : up, down, up, down, up, down, etc. Two point discrimination is best tested on the fingertips or on the lips only. Using a special tool or a bent paper clip with the tips moved approximately 3 or 4 millimeters apart. With the patient's eyes closed the patient should be able to

identify if you are touching him with one or two points. Vibration is best tested with a tuning fork. The best tuning fork is a steel footed tuning fork with a frequency of 128 hertz. The tuning fork is applied to bony prominences (ankle, wrist, rim of pelvis). At times the tuning fork should be vibrating at other times it should not. The patient is to tell you whether or not the fork is vibrating. Stereognosis is the ability to tell you what you have in your hand by feeling the object without looking at the object. Stereognosis implies that you have good two point senses. Frequently coins are used and the patients are asked to differentiate between a dime and a penny with his eyes closed.

Reflexes:

Reflexes are the most important objective part of the examination of the extremities, therefore, one of the most valuable parts of the examinations. The tendon reflexes and muscle stretch reflexes are the same entity. Reflexes are tested with the patient fully at rest. They are tested by tapping on the tendon of the indicated muscle briskly with the hammer or in some cases you tap you thumb which has been placed on the tendon. During the reflex you are looking for muscle response. Here again having the patient undressed is important. Quick responses (brisk reflexes) are usually larger and much more easily seen. If the response is brisk it may move the joint, and that makes it easier for you to see the reflex. Ordinary we test the biceps, triceps, brachioradialis, knee and ankle jerk reflexes. Reflexes should be symmetric in both the upper and lower extremities.

Some reflexes are only found in patients with the disease of the nervous system.

These are called pathological reflexes. The most important is the Babinski, other pathologic reflexes include the suck and snap reflex, Hoffmann, and Tromner Sign.

The Babinski sign is tested by stroking the sole of the foot along the lateral border

from the heel to the base of the toes and then across the base of the toes. You must use a noxious stimuli but never should you draw blood. The response (a present Babinski sign) is the first movement of the great toe in a upward motion. Technically, there is no negative or positive sign, instead the Babinski is usually present or absent. The normal response is for the toe to flex in response to stimulation along a plantar surface. A Babinski sign is always abnormal in an adult patient. The Hoffman and Tromner reflexes are other ways to illustrate brisk reflexes in the upper extremities.

Cerebellum Examination:

In the cerebellum examination we test midline cerebellar function as well as cerebellar hemispheric function. Midline cerebellum function is tested by having the patient walk on a straight line as if walking a tight rope in the circus. Obviously in doing this you are also testing the patients strength, proprioception, and the cerebellar functions. Cerebellar hemispheric function is tested by rapidly having the patient touch his nose and then your moving index finger. You are watching for the speed and accuracy at which the patient can perform this task. Coordination is a complex motor activity involving the cerebellum and basal ganglia and corticospinal system. Rapid alternating movements (e.g. having the patients rapidly pronate and supinate his hand) tests all three systems. In the lower extremities heel to shin testing also tests cerebellar hemisphere function.

Lastly, the neurological examination is completed when the patient is observed walking normally. Particular portions of gait include length of stride, width of base, the ability to make rapid turns, degree in symmetry of alternating arm swings. Throughout the neurologic exam you are looking primarily for symmetry. Symmetry in facial movement, motor strength and coordination, sensation, ability to sense stimuli and reflexes.

A 84 year old female with chronic renal disease on dialysis 3 times a week may only have 4/5 strength through out. It is the symmetry of this strength in the upper and lower extremities that would help you differentiate possible stroke symptoms. It is the symmetry of her reflexes that would help you differentiate a peripheral neuropathy versus a radiculopathy in her lower extremities. It is the symmetry which she does finger to nose and heel to shin testing which will help you determine if she has had a cerebellar hemispheric infarction.

Being able to do a complete and thorough neurologic examination takes practice. An examination screening all the components of the nervous system can be completed in less than 10 minutes and frequently can help a physician localize a nervous system lesion anatomically while examining the patient at the bedside.