

Neurological Exam, Brief overview

The human nervous system is an intricate and complex network of fibers that impenetrates the entire body and functions in complicated and often mysterious ways. Sophisticated imaging and laboratory tests do not always provide sufficient information about how the nerves are functioning -- or not functioning, as the case may be. The neurological examination is a series of simple questions and tests that provide crucial information about the nervous system. It is an inexpensive, noninvasive way to determine what might be wrong.

The neurological examination is divided into several components, each focusing on a different part of the nervous system:

- mental status
- cranial nerves
- motor system
- sensory system
- the deep tendon reflexes
- coordination and the cerebellum
- gait

The exam requires skill, patience, and intelligence on the part of the physician, and cooperation from the patient. Incomplete or inaccurate exams can lead to incorrect diagnoses.

Mental status

The mental status examination is a series of detailed but simple questions designed to test cognitive ability, including the patient's:

- state of consciousness (awareness and responsiveness to the environment and the senses);
- appearance and general behavior;
- mood;
- content of thought; and

intellectual resources (orientation with reference to time, place, and person; comprehension; ability to pay attention; insight; memory; judgment; abstract reasoning power; speech and language function; and intellectual capacity).

The patient may be asked to remember objects that had been listed earlier in the course of the exam; repeat sentences; solve simple mathematical problems; copy a three-dimensional drawing; and draw a clock and place the numbers and hands appropriately. When speech and language are tested, the examiner listens to the character of the speech, the fluency (smoothness of speech), and the patient's ability to understand and carry out simple or complex commands, and to read and write.

In addition to specific questions that make up the actual mental status exam, the neurologist obtains important information by observing the patient's general behavior during the examination.

Many neurological diseases, such as dementia, cause changes in intellectual status or emotional responsiveness, and specific personality features. These changes and features can be detected during the mental status portion of the neurological exam.

The mental status exam is especially important when the other parts of the neurological exam reveal no abnormalities. Sometimes, slight changes in memory or other intellectual resources may be the only indication that something is wrong.

Evaluating a person's intellectual capacity can also be helpful in determining a course of treatment and making a prognosis.

Cranial nerves

The cranial nerves are a set of 12 nerves that relay messages between the brain and the head and neck and control motor and sensory functions, including vision, smell, and movement of the tongue and vocal cords.

The cranial nerve exam involves testing the function of all 12 sets of cranial nerves. It is an essential part of the neurological exam, and helps localize central nervous system dysfunction and aids in diagnosing systemic disease. Some of the functions that are commonly tested as part of the cranial nerve exam include: eyelid strength and function; visual function; peripheral vision; pupillary light reflexes; eye muscle movements; strength of facial musculature; the gag reflex; tongue and lip movements; ability to smell and taste; hearing; and sensation in the face, head, and neck.

Motor system

The motor system includes the brain and spinal cord motor pathways, and all the motor nerves and muscles throughout the body. Abnormalities in the motor system can often be detected by assessing muscle strength and tone and by looking for a variety of characteristic signs.

The patient is usually asked to undress, so the neurologist can see the muscles and look for atrophy (shrinkage), twitching, or abnormal movements. Tests are done to evaluate strength in all the major muscle groups.

Evaluating Babinski response is an important part of testing the motor system. The neurologist strokes or scratches, heel-to-toe, the outer side of the sole of the foot and in patients over the age of 2, the toes normally curl downward in response. If the toes fan upward, a brain or spinal cord injury is indicated. A number of neurological disorders can lead to Babinski response.

Sensory system

Sensation depends on impulses that occur as a result of stimulation of receptors located in the skin, muscles, tendons, and so on, and are sent along nerve fibers to the central nervous system (brain and spinal cord). The sensory exam is used to determine areas of abnormal sensation, the quality and type of sensation impairment, and the degree and extent of tissue involvement.

A sensory exam involves evaluating different types of sensation, including pain, temperature, pressure, and position. For example, pinpricks may be used to test the patient's response to pain and compare the response in different parts or opposite sides of the body. A cold or warm object may be used to test the sensation of temperature. To test position, patients may be asked to close their eyes and determine in which direction the examiner is moving a part of their body (e.g., big toe). Patients also may be asked to identify objects with their eyes closed or identify numbers or letters traced on their body.

The sensory exam should be repeated to provide accurate results. Responses may be affected by how alert, aware, and well-rested the patient is, so this part of the neurological exam is usually performed early in the course of testing.

Deep tendon reflexes

Reflexes are actions performed involuntarily in response to impulses sent to the central nervous system. Alterations in reflexes are often the first sign of neurological dysfunction. Observing reflexes is the most objective part of the neurological exam, since the reflexes are not under voluntary control and testing does not depend on the patient's cooperation, attitude, or awareness.

Hundreds of reflexes have been identified, but the neurological exam generally involves testing only the deep tendon reflexes. Deep tendon reflexes, also known as muscle stretch reflexes, are reflexes elicited in response to stimuli to tendons. Normally, when a specific area of the muscle tendon is tapped with a soft rubber hammer, the muscle fibers contract. Abnormal responses may indicate injury to the nervous system pathways that produce the deep tendon reflex.

Coordination and the cerebellum

The cerebellum is the part of the brain that controls voluntary movement and motor coordination, including posture. Testing coordination provides clues about conditions that affect the cerebellum.

The neurologist may ask patients to move their finger from their nose to the neurologist's finger, going back and forth from nose to finger, touching the tip of each. Patients also may be asked to tap their fingers together quickly in a coordinated fashion or move their hands one on top of the other, back and forth, as smoothly as they can. Coordination in the lower limbs can be tested by asking patients to rub one heel up and down smoothly over the other shin.

Gait

Most of us take our ability to walk for granted. But as simple as it may seem, walking is a very intricate physiological process. How we walk – our gait - is influenced by a number of bodily mechanisms and nervous system reflexes. The body must be held erect; the limbs, head, and trunk must be held in the right position; the person must be oriented to the position of all body parts; parts of motor control involved with moving must be integrated; and so on. Because walking depends on so many different parts of the nervous system, it can be affected by a variety of neurological disorders.

By observing gait, the neurologist can gather important clues about what might be wrong. The patient is usually asked to walk in different ways (e.g., heel-to-toe in a straight line, turning abruptly, walking on the toes, walking on the heels, running).

References

Haerer, A.F., 1992, The Neurological Exam, J.B. Lippincott Co., Philadelphia.