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Neuro assessment by PATTY NOAH, RN, MSN, CNRN PATTY NOAH is the director of the neuro intensive care unit at Allegheny General Hospital in Pittsburgh.

Whether it's a brief check of neurological status or a comprehensive neuro exam, your assessment may uncover nervous system dysfunction before it's too late.

The neuro assessment is a key component in the care of the neurological patient. It can help you detect the presence of neurological disease or injury and monitor its progression, determine the type of care you'll provide, and gauge the patient's response to your interventions.

The initial assessment should be a comprehensive exam covering several critical areas: level of consciousness and mentation, cranial nerves, movement, sensation, cerebellar function, and reflexes. This initial exam will establish baseline data with which to compare subsequent assessment findings.

Once a thorough exam is done on admission or at the beginning of each shift, subsequent assessments should be problem-focused, zeroing in on the parts of the nervous system affected by the patient's condition. The patient's diagnosis and the acuity of her condition will determine how extensive your problem-focused assessments will be and how frequently you'll need to conduct them.

The single most important assessment

Evaluation of level of consciousness (LOC) and mentation are the most important parts of the neuro exam. A change in either is usually the first clue to a deteriorating condition.

The following terms are commonly used to describe a decreased LOC, so it helps to be familiar with them:

Full consciousness. The patient is alert, attentive, and follows commands. If asleep, she responds promptly to external stimulation and, once awake, remains attentive.[1]
Lethargy. The patient is drowsy but awakens—although not fully—to stimulation. She will answer questions and follow commands, but will do so slowly and inattentively.[1]
Obtundation. The patient is difficult to arouse and needs constant stimulation in order to follow a simple command. She may respond verbally with one or two words, but will drift back to sleep between stimulation.

Stupor. The patient arouses to vigorous and continuous stimulation; typically, a painful stimulus is required.[1] She may moan briefly but does not follow commands. Her only response may be an attempt to withdraw from or remove the painful stimulus.
Coma. The patient does not respond to continuous or painful stimulation. She does not move—except, possibly, reflexively—and does not make any verbal sounds.

Since these and other terms used to categorize LOC are frequently used imprecisely, you'd be wise to avoid using them in your documentation.[1,2] Instead, describe how the patient responds to a given stimulus. For example, write: "Mrs. Jones moans briefly when sternum is gently rubbed, but does not follow commands." Bear in mind that recognizing and describing a change in LOC is more important than appropriately naming it.[3]
When assessing LOC, there are several tools you can choose from. With stroke patients, for instance, you may want to use the National Institutes of Health (NIH) Stroke Scale. (You can obtain a copy atwww.strokecenter.org/trials/scales/nihss.pdf.) Typically, though, it is the Glasgow Coma Scale (GCS) that comes to mind when one is assessing LOC. It's especially useful for evaluating patients during the acute stages of head injury.
A GCS score is based on three patient responses: eye opening, motor response, and verbal response. The patient receives a score for her best response in each of these areas, and the three scores are added together. The total score will range from 3 to 15; the higher the number, the better. A score of 8 or lower usually indicates coma.[1,2]
If the patient is alert or awake enough to answer questions, you'll also assess mentation. Determine if she is oriented to person, place, and time by asking questions like: What is your name? Where are you right now? Why are you here? What year is it? Who is the president?

A comprehensive evaluation of mentation will include tests of higher intellectual function, as well. To test abstract reasoning, for example, you might ask the patient to interpret a well-known proverb.

Pupils are another important component of the neuro exam. Assessing them is especially important in a patient with impaired LOC. Like a change in LOC, a change in pupil size, shape, or reactivity can indicate increasing intracranial pressure (ICP) from a mass or fluid. You'll check pupils as part of the cranial nerve assessment, which is covered in the table at right.

Assessing for signs of motor dysfunction

A bedside neuro assessment almost always includes an evaluation of motor function. Since you'll be assessing the ability to move on command, the patient must be awake, willing to cooperate, and able to understand what you are asking her.

With the patient in bed, assess motor strength bilaterally: Have the patient flex and extend her arm against your hand, squeeze your fingers, lift her leg while you press down on her thigh, hold her leg straight and lift it against gravity, and flex and extend her foot against your hand. Grade each extremity using a motor scale like the one below.[4]
+5 - full ROM, full strength

+4 - full ROM, less than normal strength

+3 - can raise extremity but not against resistance

+2 - can move extremity but not lift it

+1 - slight movement

0 - no movement

As part of the motor assessment, also check for arm pronation or drift. Have the patient hold her arms out in front of her with her palms facing the ceiling. If you observe pronation—a turning inward—of the palm or the arm or the arm drifts downward, it means the limb is weak.

Assess motor response in an unconscious patient by applying a noxious stimulus and observing the patient's response to it. Another approach is central stimulation, such as sternal pressure. Central stimulation produces an overall body response and is more reliable than peripheral stimulation for this purpose. The reason: In an unconscious patient, peripheral stimulation, such as nail bed pressure, can elicit a reflex response, which is not a true indicator of motor activity.

If you use central stimulation, however, do so judiciously because deep sternal pressure can easily bruise the soft tissue above the sternum.[4] In our neuro intensive care unit (NICU), we avoid sternal pressure. Instead, we squeeze the trapezius muscle because it's less traumatic. Supraorbital pressure is another option for central stimulation. Don't, however, use it on patients with facial fractures or vagal nerve sensitivity.

Evaluating sensation and cerebellar function

The sensory exam evaluates the patient's ability, or lack thereof, to perceive and identify specific sensations with her eyes closed. Include it in your neuro assessment if there's a specific need, as in spinal cord injury. The patient must be able to cooperate with the exam. She'll need to tell you whether she feels the sensation and whether both sides of her body feel it equally.

Begin with the feet and move up the body to the face, comparing one side with the other. Assess sensation to light touch using your fingertips or cotton.

Test superficial pain sensation with a clean, unused safety pin. Be sure not to break the skin, and discard the pin appropriately after you've finished using it on the patient. If you prefer to use something less invasive, snap a wooden, cotton-tipped swab in two and use one of the broken ends; again, take care not to scratch or puncture the skin. Also, test sensation using a dull object. The patient should be able to distinguish sharp from dull.

If you need to test temperature sensation, you can use a specimen tube of ice or cold water or the chilled handle of a reflex hammer. To test vibratory sensation, use a tuning fork.

Test proprioception, or position sense, by moving the patient's toes and fingers up or down. Grasp the digit by its sides and have the patient tell you which way it's pointing.[3] Remember, guessing will yield correct answers 50% of the time.[2]
Move on to the cerebellar assessment, if indicated. It may not be necessary in a problem-focused exam, and it can't be done if the patient can't or won't follow commands.

If the patient is in bed, you may not be expected to assess her balance and gait. In that case, limiting testing to coordination is acceptable. Hold up your finger and have the patient quickly and repeatedly move her finger back and forth from your finger to her nose. Then have her alternately touch her nose with her right and left index fingers. Finally, have her repeat these tasks with her eyes closed. The movements should be precise and smooth.[3]
To assess the lower extremities, have the patient bend her leg and slide that heel along the opposite shin, from the knee to the ankle. This movement, too, should be accurate, smooth, and without tremors.[2]
If the patient is able to stand and she's not restricted to bed, you can assess her balance using the Romberg test. Have her stand with her feet together, arms at her sides, and eyes open; she should be able to stand upright with no swaying. If she can do that, have her close her eyes and stand the same way. If she falls or breaks her stance after closing her eyes, the Romberg test is positive, indicating proprioceptive or vestibular dysfunction.[2,5]

Deep tendon, superficial, and brain stem reflexes

Reflex assessment encompasses deep tendon, superficial, and brain stem reflexes. Deep tendon reflexes include the triceps, biceps, brachioradialis, patellar, and the Achilles tendon. The box at left shows how to assess them. Although deep tendon reflexes aren't routinely assessed, they should be tested in any patient with a spinal cord injury.

The plantar reflex is the only superficial reflex that's commonly assessed and should be tested in comatose patients and in those with suspected injury to the lumbar 4 – 5 or sacral 1– 2 areas of the spinal cord. Stimulate the sole of the foot with a tongue blade or the handle of a reflex hammer. Begin at the heel and move up the foot, in a continuous motion, along the outer aspect of the sole and then across the ball to the base of the big toe.

The normal response is plantar flexion (curling under) of the toes. Extension of the big toe—Babinski's sign—is abnormal, except in children younger than 2 years.[1,2,5]
Assess brain stem reflexes in stuporous or comatose patients to determine if the brain stem is intact. (You'll check for the protective reflexes—coughing, gagging, and the corneal response—as part of the cranial nerve assessment.) To test the oculocephalic, or doll's eye, reflex, turn the patient's head briskly from side to side; the eyes should move to the left while the head is turned to the right, and vice versa. If this reflex is absent, there will be no eye movement.

To test the oculovestibular reflex, also known as the ice caloric or cold caloric reflex, a physician will instill at least 20 ml of ice water into the patient's ear. In patients with an intact brain stem, the eyes will move laterally toward the affected ear. In patients with severe brain stem injury, the gaze will remain at midline.

What vital signs reveal about neuro status

Because the brain stem and vagus nerve (CN X) play an important role in vasomotor tone, conditions affecting these areas can cause vital signs to change. A change in vital signs, however, is not a reliable indicator of neurological deterioration, as they tend to change too late to prevent irreversible brain damage.

ICP produces a specific set of changes known as Cushing's triad. Present in herniation syndromes, Cushing's triad consists of: increasing systolic blood pressure with a widening pulse pressure, bradycardia, and bradypnea.[6]
Cushing's triad is a late sign of increased ICP. Once this pattern of vital signs occurs, brain stem herniation is already in progress and it may be too late to reverse it. To detect increasing ICP before it reaches this point, be alert for earlier signs: a subtle change in LOC or pupils, for example.

Accurate and consistent documentation helps ensure that subtle changes in neuro status are caught early on. Whether the unit you're working on uses computerized charting, flow sheets, or hand-written notes, it's essential that you compare your findings to those of previous exams. Through comparison, you'll be able to spot changes and trends and, when necessary, intervene quickly and appropriately.

Verbal communication is important, too. In many NICUs, including ours, a bedside neuro exam is done as part of the change-of-shift report, so that the off-going and oncoming nurses can assess the patient together. The off-going nurse can then verify that the patient's status is unchanged, perhaps saving the patient an unnecessary CT scan.

The neurological exam can be complex, but it's essential to the diagnosis and treatment of a wide variety of neurological conditions. With practice and repetition, you will hone this essential, life-saving skill, and your patients are bound to benefit.

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Quick facts

- No matter how brief or extensive your neuro assessments are, comparing your findings to those of previous exams is essential.
- When assessing motor response, use sternal pressure judiciously. Deep sternal pressure can cause bruising.
- In many NICUs, a bedside neuro exam is done as part of the change-of-shift report so that both sets of nurses can assess the patient together.

Assessing the cranial nerves

There are 12 pairs of cranial nerves—some sensory, some motor, and some both. The table below lists the functions of each nerve and explains how to test them.

Whether you assess all 12 will depend upon the patient's diagnosis. If a patient has an acoustic neuroma, for example, you'll focus on the acoustic nerve (CN VIII) and the nearby facial nerve (CN VII). Because many of the nerves can't be tested without the patient's cooperation, you won't be able to do a complete assessment on a comatose patient.

Extraocular movements (EOMs) are controlled by cranial nerves III, IV, and VI, which you'll test together. Other functions that are dependent on more than one cranial nerve are: pupillary response (CN II and III); the corneal reflex (CN V and VII); and the gag reflex (CN IX and X).

Nerve	Classification	Major functions	Assessment
I Olfactory	Sensory	Smell	Have patient identify a familiar scent with eyes closed (usually deferred).
II Optic	Sensory	Vision (acuity and field of vision); pupil reactivity to light and accommodation (afferent impulse)	Have patient read from a card or newspaper, one eye at a time. Test visual fields by having patient cover one eye, focus on your nose, and identify the number of fingers you're holding up in each of four visual quadrants.
III Oculomotor	Motor	Eyelid elevation; most EOMs; pupil size and reactivity (efferent impulse)	Check pupillary responses by shining a bright light on one pupil; both pupils should constrict. Do the same for the other eye. To check accommodation, move your finger toward the patient's nose; the pupils should constrict and converge. Check EOMs by having patient look up, down, laterally, and diagonally.
IV Trochlear	Motor	EOM (turns eye downward and laterally)	Have patient look down and in.

V Trigeminal	Both	Chewing; facial and mouth sensation; corneal reflex (sensory)	Ask patient to hold the mouth open while you try to close it and to move the jaw laterally against your hand. With patient's eyes closed, touch her face with cotton and have her identify the area touched. In comatose patients, brush the cornea with a wisp of cotton; the patient should blink.
VI Abducens	Motor	EOM (turns eye laterally)	Have patient move the eyes from side to side.
VII Facial	Both	Facial expression; taste; corneal reflex (motor); eyelid and lip closure	Ask patient to smile, raise eyebrows, and keep eyes and lips closed while you try to open them. Have patient identify salt or sugar placed on the tongue (usually deferred).
VIII Acoustic	Sensory	Hearing; equilibrium	To test hearing, use tuning fork or rub your fingers, place a ticking watch, or whisper near each ear. Equilibrium testing is usually deferred.
IX Glossopharyngeal	Both	Gagging and swallowing (sensory); taste	Touch back of throat with sterile tongue depressor or cotton-tipped applicator. Have patient swallow.
X Vagus	Both	Gagging and swallowing (motor); speech (phonation)	Assess gag and swallowing with CN IX. Assess vocal quality.
XI Spinal accessory	Motor	Shoulder movement; head rotation	Have patient shrug shoulders and turn head from side to side (not routinely tested).
XII Hypoglossal	Motor	Tongue movement; speech (articulation)	Have patient stick out tongue and move it internally from cheek to cheek. Assess articulation.

Sources: 1. Hickey, J. V. (2003). *The clinical practice or neurological and neurosurgical nursing*. Philadelphia: Lippincott Williams & Wilkins. **2.**Marshall, R. S., & Mayer, S. A. (2001). *On call neurology* (2nd ed.). New York: W. B. Saunders. **3.** Messner, R., & Wolfe, S. (1997). *RN's pocket assessment guide*. Montvale, NJ: Medical Economics. **4.** Vos, H. (2002). The neurologic assessment. In E. Barker (Ed.), *Neuroscience nursing: Spectrum of care* (2nd ed.). St. Louis: Mosby.

Assessing deep tendon reflexes

Deep tendon reflexes are tested with a reflex hammer. Test each of the following, grading them from 0 to 5+, with 0 being no reflex, 2+ being normal, and 5+ being hyperreflexia with clonus (repeated rhythmic contractions):

Biceps. The patient's arm should be flexed slightly with the palm facing up. Hold the arm with your thumb in the antecubital space over the biceps tendon. Strike your thumb with the hammer; the arm should flex slightly.

Triceps. The patient's arm should be flexed 90 degrees. Support the arm and strike it just above the elbow, between the epicondyles; the arm should extend at the elbow.

Brachioradialis. The patient's arm should be flexed slightly and resting on the lap with the palm facing down. Strike the outer forearm about two inches above the wrist; the palm should turn upward as the forearm rotates laterally.

Patellar. With the patient's legs dangling (if possible), place your hand on one thigh and strike the leg just below the kneecap; the leg should extend at the knee.

Achilles tendon**.** With the patient's foot in slight dorsiflexion, lightly strike the back of the ankle, just above the heel; the foot should plantar flex.