

Human physiology (II) laboratory

Lab3: The Neurological Exam part 1

The nervous system is made up of the brain and spinal cord as the central organs (central nervous system), and the ganglia and nerves organs in the periphery (peripheral nervous system).

The neurological exam is a clinical assessment tool used to determine what specific parts of the CNS are affected by damage or disease. It can be performed in a short time to establish neurological function.

Causes of Neurological Deficits

Damage to the nervous system can be limited to individual structures or can be distributed across broad areas of the brain and spinal cord. Localized, limited injury to the nervous system is most often the result of **circulatory problems. Neurons are very sensitive to oxygen deprivation and will start to deteriorate within 1 or 2 minutes, and permanent damage (cell death) could result within a few hours. The loss of blood flow to part of the brain is known as a stroke, or a cerebrovascular accident (CVA).**

There are two main types of strokes, depending on how the blood supply is compromised: ischemic and hemorrhagic.

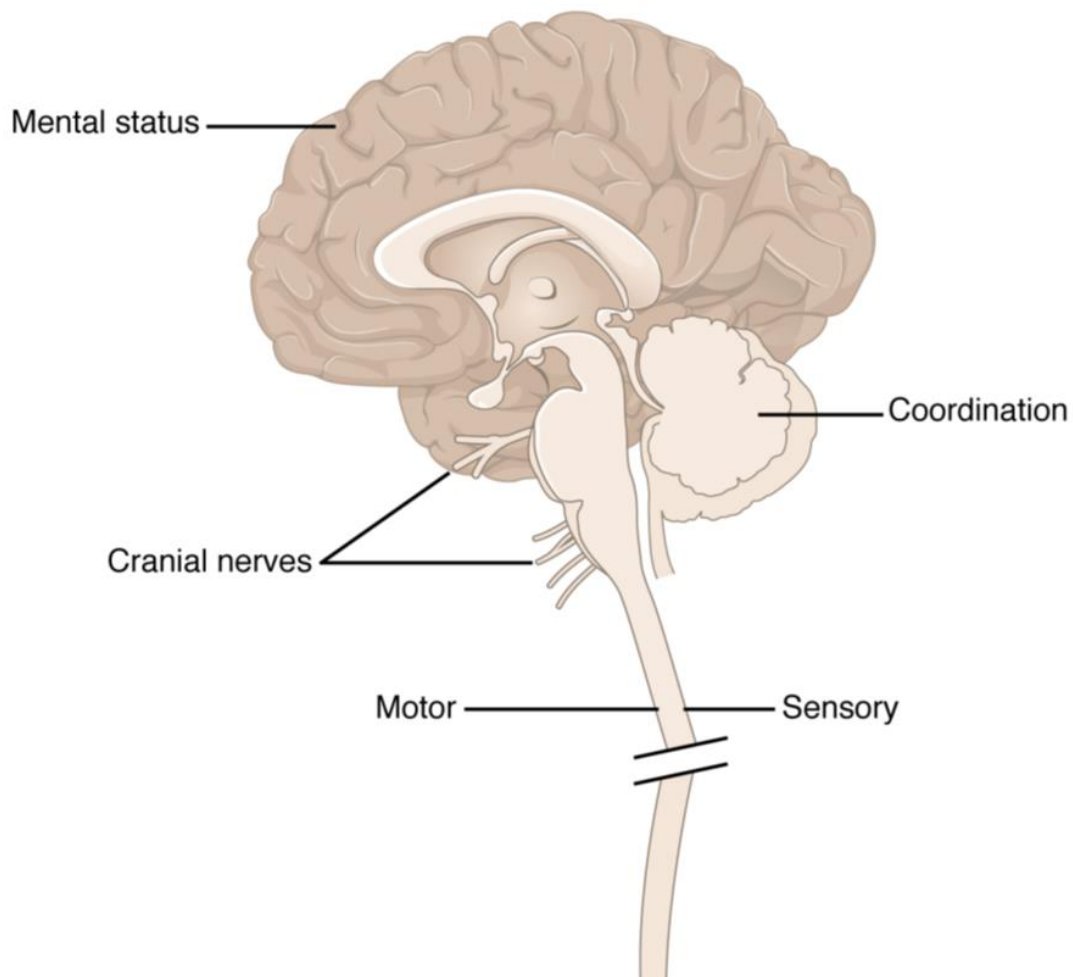
An ischemic stroke is the loss of blood flow to an area because vessels are blocked or narrowed. **This is often caused by an embolus, which may be a blood clot or a drop in blood volume in the brain known as hypovolemia.**

A related type of CVA is known as a **transient ischemic attack (TIA)**, which is like a stroke although it does not last as long.

A hemorrhagic stroke is bleeding into the brain because of a damaged blood vessel. Accumulated blood fills a region of the cranial vault and presses against the tissue in the brain. Physical pressure on the brain can cause the loss of function.

The exam is a series of subtests separated into five major sections.

- 1- **The mental status exam** which assesses the higher cognitive functions such as memory, orientation, and language
- 2- **The cranial nerve exam**, which tests the function of the 12 cranial nerves.
- 3- **The spinal sensory exam**
- 4- **The spinal motor exam**
- 5- **The coordination exam** tests the ability to perform complex and coordinated movements.
Example: The gait exam specifically assesses the motor function of walking.



The five major sections of the neurological exam are related to the major regions of the CNS. The mental status exam assesses functions related to the cerebrum. The cranial nerve exam is for the nerves that connect to the diencephalon and brain stem (as well as the olfactory connections to the forebrain). The coordination exam and the related gait exam primarily assess the functions of the cerebellum. The motor and sensory exams are associated with the spinal cord and its connections through the spinal nerves.

The mental status exam:

Assessment of **cerebral functions is directed at cognitive abilities**. The abilities assessed through the **mental status exam can be separated into four groups**:

1-Orientation and memory, Orientation is the patient's awareness of their immediate circumstances. It is awareness of time, not in terms of the clock, but of the date and what is occurring around the patient. The initial tests of orientation are based on the questions, "Do you know what the date is?" or "Do you know where you are?" or "What is your name?" Further understanding of a patient's awareness of orientation can come from questions that address

remote memory, such as “Who is the President of the United States?” or asking what happened on a specific date.

There are also specific tasks to address memory. One is the three-word recall test. The patient is given three words to recall, such as book, clock, and shovel. After a short interval, during which other parts of the interview continue, the patient is asked to recall the three words.

Memory is largely a function of the temporal lobe

2-Language and speech: the neurological exam has two specific subtests that address language. One measures the ability of the patient to understand language by asking them to follow a set of instructions to perform an action, such as “touch your right finger to your left elbow and then to your right knee

Wernicke’s integrative area is located Adjacent to the auditory association cortex, at the end of the lateral sulcus just anterior to the visual cortex and Broca’s area located at the lateral aspect of the frontal lobe is highly associated with losses of speech and language (aphasia).

3-Sensorium: parts of the brain involved in the reception and interpretation of sensory stimuli are referred to as the sensorium. The cerebral cortex has several regions that are necessary for sensory perception. Two subtests assess specific functions of these cortical areas.

The first is **praxis**, a practical exercise in which the patient performs a task completely on the basis of verbal description without any demonstration from the examiner. For example, the patient can be told to take their left hand and place it palm down on their left thigh, then flip it over so the palm is facing up, and then repeat this four times.

The second is **gnosis**, which involves two tasks. The first task, known as **stereognosis**, involves the naming of objects strictly based on the somatosensory information that comes from manipulating them. The patient keeps their eyes closed and is given a common object, such as a coin, that they must identify. **The second task, graphesthesia**, is to recognize numbers or

letters written on the palm of the hand with a dull pointer, such as a pen cap.

4-Judgment and abstract reasoning.: The prefrontal cortex is responsible for the functions responsible for planning and making decisions. In the mental status exam, the subtest that assesses judgment and reasoning is directed at three aspects of frontal lobe function. Example the examiner asks questions about problem solving, such as “If you see a house on fire, what would you do?”

The Cranial Nerve Exam

The twelve cranial nerves can be categorized by functions, and subtests of the cranial nerve exam can clarify these functional groupings.

Table 23.1 The Cranial Nerves			
Number	Name	Type	Function(s)
I	Olfactory	Sensory	• Sensory information from the nose.
II	Optic	Sensory	• Sensory information from the eyes.

III	Oculomotor	Motor	<ul style="list-style-type: none"> • Motor information to most rectus and inferior oblique muscles to cause eye movement.
IV	Trochlear	Motor	<ul style="list-style-type: none"> • Motor information to superior oblique muscle for eye movement.
V	Trigeminal	Both	<ul style="list-style-type: none"> • Sensory information from and motor information to the face. • Motor information for chewing.
VI	Abducens	Motor	<ul style="list-style-type: none"> • Motor information to lateral rectus muscle to cause eye movement.
VII	Facial	Both	<ul style="list-style-type: none"> • Sensory information from anterior part of the tongue. • Motor information to the face. • Innervates lacrimal, salivary and other glands.
VIII	Vestibulocochlear	Sensory	<ul style="list-style-type: none"> • Sensory information from the ear for hearing and equilibrium.
IX	Glossopharyngeal	Both	<ul style="list-style-type: none"> • Sensory information from posterior part of the tongue. • Motor information to tongue and throat.
X	Vagus	Both	<ul style="list-style-type: none"> • Sensory information from abdomen, thorax, neck and root of tongue. • Motor information to heart, digestive organs, spleen and kidneys.
XI	Accessory	Motor	<ul style="list-style-type: none"> • Motor information for swallowing.
XII	Hypoglossal	Motor	<ul style="list-style-type: none"> • Motor information to the tongue.

Special senses

Three of the nerves are strictly responsible for special senses: The olfactory, optic, and vestibulocochlear nerves (cranial nerves I, II, and VIII) are dedicated to four of the special senses: smell, vision, equilibrium, and hearing, respectively.

1-Testing smell is straightforward (The olfactory nerve I), as common smells are presented to one nostril at a time. The patient should be able to recognize the smell of coffee or mint. Loss of the sense of smell is called **anosmia** and can be lost following blunt trauma to the head or through aging. Anosmia means that food will not seem to have the same taste.

2- Testing vision (optic nerve II) relies on the tests that are common in an optometry office. **The Snellen chart** demonstrates visual acuity

3- Testing The equilibrium and hearing (vestibulocochlear nerve VIII) carries both equilibrium and auditory sensations from the inner ear to the medulla. Hearing is tested by either the Rinne test or the weber test using a tuning fork.

4- The trigeminal system of the head and neck is the equivalent of the ascending spinal cord systems. The trigeminal nerve(V) responsible for the somatosensation of the face and for Motor information for chewing. The jaw-jerk reflex, a stretch reflex of the masseter muscle is used to evaluate the trigeminal nerve.

Gaze Control

The three nerves that control the extraocular muscles are the oculomotor (III), trochlear (IV), and abducens nerves (VI)

The abducens nerve is responsible for abducting the eye (Medial Movement), which it controls through contraction of **the lateral rectus muscle**.

The trochlear nerve controls the **superior oblique muscle** to rotate the eye along its axis in the orbit medially (**Intorsion**).

The oculomotor nerve controls all the other extraocular muscles, as well as a muscle of the upper eyelid to Elevate or depress the eye.

Movements of the two eyes need to be coordinated to locate and track visual stimuli accurately, coordinated movement of both eyes requires integrated processing through the brain stem.