THE BRAIN GENERAL APPEARANCES. SPINAL CORD AND SPINAL CORD, ITS AGE-RELATED FEATURES.

Mamataliyev Asilbek Abdulla ug'li
Rizoqulov Javoxir Raufjon ug'li
Students of the 1st year group 106-b of the Faculty of Dentistry of the Tashkent State Dental Institute
Khalilov Sanjar Abdivohid ugli
Assistant teacher of the Department of Anatomy of the Tashkent State Dental Institute
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Abstract: The brain and the spinal cord are the central nervous system, and they represent the main organs of the nervous system. The spinal cord is a single structure, whereas the adult brain is described in terms of four major regions: the cerebrum, the diencephalon, the brain stem, and the cerebellum. A person's conscious experiences are based on neural activity in the brain. The regulation of homeostasis is governed by a specialized region in the brain. The coordination of reflexes depends on the integration of sensory and motor pathways in the spinal cord.

Key words: Brain, spinal cord, body, neurons system,nerve.

The spinal cord is a long, thin, tube-like structure made of nerve tissue, which extends from the medulla oblongata in the brain stem to the lumbar region of the spine. It covers the central canal of the spinal column, which stores cerebrospinal fluid. The brain and spinal cord together make up the central nervous system (CNS). In humans, the spinal cord begins at the occiput, passes through a large foramen, and enters the spinal canal at the beginning of the cervical vertebrae. The spinal cord extends downwards to the space between the first and second lumbar vertebrae and ends there. The surrounding bony spine protects the relatively short spinal cord. It is approximately 45 cm long in males and approximately 43 cm long in females. The diameter of the spinal cord varies from 13 mm in the neck and lumbar regions to 6.4 mm in the chest region.

The spinal cord is responsible for transmitting nerve signals from the motor cortex to the body and from the afferent fibers of sensory neurons to the sensory cortex. It also maintains a coordinating center for many reflexes and reflex arcs that independently control reflexes.[1] It is also home to groups of spinal interneurons that form neural loops known as central pattern generators. These loops are responsible for the control of rhythmic movements such as walking [2].

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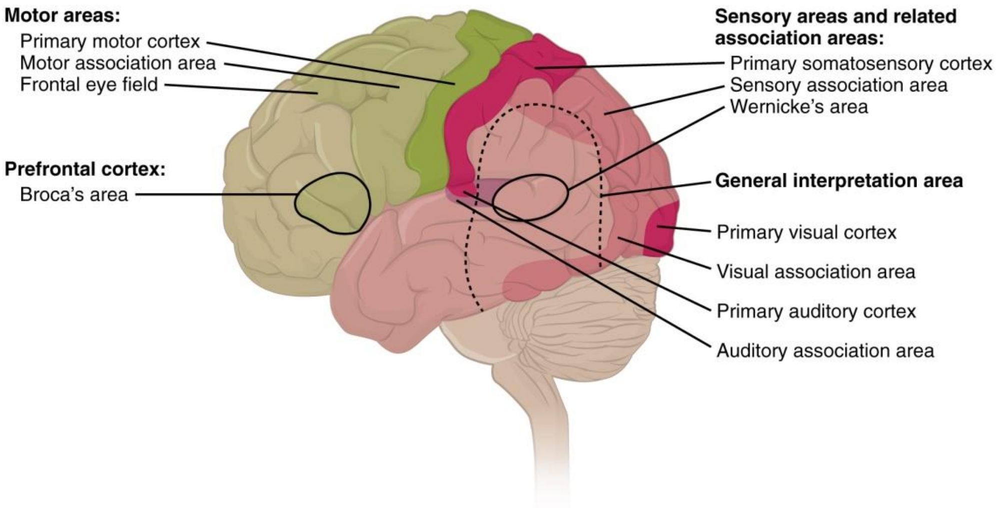


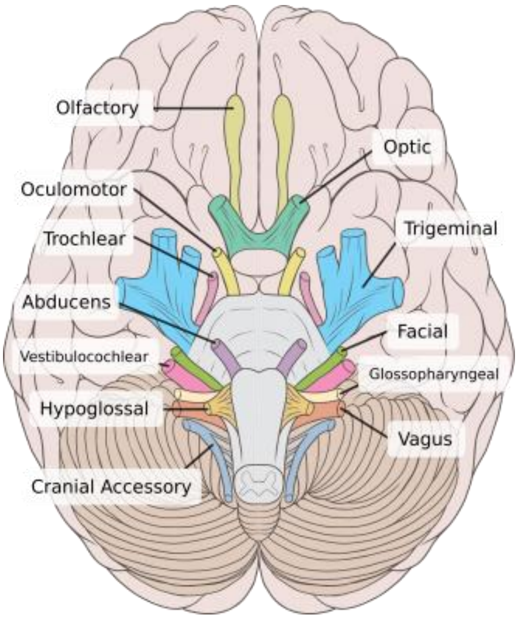
The spinal cord is the main pathway connecting the brain and the peripheral nervous system.[3][4] Much shorter than the vertebral column that protects it, the human spinal cord originates at the brain stem, passes through a large foramen, and continues through the conus medullaris near the second lumbar vertebra before terminating in a fibrous extension known as the filum terminale.

It is approximately 45 cm long in men and 43 cm long in women, oval in shape and widened at the neck and waist. The cervical spine, extending from C5 to T1, is the area that receives sensory impulses from the arms and body and sends motor impulses. The lumbar spine is an area between L1 and S3 that receives sensory impulses from the arm and sends motor impulses to the legs.

The spinal cord is a continuation of the caudal portion of the medulla oblongata, extending from the base of the skull to the first lumbar vertebra of the body. It does not extend the full length of the spine in adults. It consists of 31 segments with one pair of sensory roots and one pair of motor roots. The nerve roots then merge into bilaterally symmetrical pairs of spinal nerves. The peripheral nervous system consists of these roots, nerves and ganglia (nodes).

Dorsal roots are afferent bundles that receive sensory impulses from internal organs related to the skin, muscles, and brain. Roots terminate in dorsal root ganglia, which are composed of corresponding neuronal cell bodies. The anterior roots consist of efferent fibers and arise from the cell bodies of motor neurons found in the anterior gray branches of the spinal cord.

The spinal cord (and brain) is protected by three layers of tissue or membranes, called meninges, which surround the canal. The dura forms the outermost layer and a hard protective covering. The space between the dura mater and the surrounding vertebral bones is called the epidural space. The epidural space is filled with fatty tissue and contains the vascular system. The reticulate veil, the middle protective layer, is so named because of its open, spider-web-like appearance. The space between the retina and the underlying soft tissue is called the subarachnoid space. The subarachnoid space contains cerebrospinal fluid, which can be examined through a lumbar puncture procedure. The delicate soft tissue is the innermost protective layer and is closely connected to the surface of the spinal cord. The spinal cord is stabilized by the dentate ligaments that attach to the dura mater, and these ligaments emerge from the dura mater between their lateral, posterior, and anterior roots. The dural sac ends in the area of the second iliac spine.



In cross-section, the peripheral part of the spinal cord contains neuronal white matter tracts consisting of sensory and motor axons. Inside this peripheral area is the gray matter and consists of nerve cell bodies arranged along three gray columns that give it a butterfly shape. This central area surrounds the central canal, which is a continuation of the fourth ventricle and contains cerebrospinal fluid. The spinal cord is elliptical in cross-section, dorsolaterally compressed. Two prominent grooves or egates run along its length. the posterior median egate (lat. sulcus medianus posterior) is the posterior egate and the anterior middle egate (lat. sulcus medianus anterior) is the egate on the front side.

Spinal cord segments

The human spinal cord is divided into segments where pairs of spinal nerves (mixed; sensory and motor) form. Six to eight motor nerve rootlets emerge from the right and left ventrolateral egates and are arranged in a very orderly fashion. Nerve roots unite to form nerve roots. Similarly, sensory nerve roots from the right and left dorsolateral egates form the sensory nerve roots. The anterior (ventral) (motor) and posterior (dorsal) (sensory) roots join to form one spinal nerve (mixed; sensory and motor) on each side of the spinal cord. Spinal nerves, except C1 and C2, originate within the intervertebral foramen. These rootlets form the demarcation that separates the central and peripheral nervous systems. The gray column, (like the three gray column areas) in the center of the spinal cord, is butterfly-shaped and consists of interneurons, motor neurons, neuroglial cell bodies, and unmyelinated axons. The anterior and posterior gray matter are projections of the superior gray matter and are known as spinal cords. The gray columns and gray commissure together form the "gray H".

The white matter lies outside the gray matter and consists almost entirely of motor and sensory myelinated axons. White matter "columns" carry information down or up the spinal cord. The spinal cord actually ends in an area called the conus medullaris, but the soft tissue continues as an extension called the filum terminale, eventually leading to the coccyx. Cauda equina ("horse's tail") is a bundle of nerves that descends from the conus medullaris down the spine to the tail. Cauda equina is formed because the spinal cord stops growing at about four years of age, while the spine continues to grow into adulthood. This causes the coccygeal spinal nerves to appear in the upper lumbar region.

In the central nervous system (CNS), nerve cell bodies are arranged in functional clusters called nuclei. Axons in the MNS are grouped into tracts.

Language and Speech

Language is, arguably, a very human aspect of neurological function. There are certainly strides being made in understanding communication in other species, but much of what makes the human experience seemingly unique is its basis in language. Any understanding of our species is necessarily reflective, as suggested by the question “What am I?” And the fundamental answer to this question is suggested by the famous quote by René Descartes: “Cogito Ergo Sum” (translated from Latin as “I think, therefore I am”). Formulating an understanding of yourself is largely describing who you are to yourself. It is a confusing topic to delve into, but language is certainly at the core of what it means to be self-aware.

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.” Another subtest assesses the fluency and coherency of language by having the patient generate descriptions of objects or scenes depicted in drawings, and by reciting sentences or explaining a written passage. Language, however, is important in so many ways in the neurological exam. The patient needs to know what to do, whether it is as simple as explaining how the knee-jerk reflex is going to be performed, or asking a question such as “What is your name?” Often, language deficits can be determined without specific subtests; if a person cannot reply to a question properly, there may be a problem with the reception of language.

An important example of multimodal integrative areas is associated with language function (Figure 14.3.5). Adjacent to the auditory association cortex, at the end of the lateral sulcus just anterior to the visual cortex, is Wernicke’s area. In the lateral aspect of the frontal lobe, just anterior to the region of the motor cortex associated with the head and neck, is Broca’s area. Both regions were originally described on the basis of losses of speech and language, which is called aphasia. The aphasia associated with Broca’s area is known as an expressive aphasia, which means that speech production is compromised.

This type of aphasia is often described as non-fluency because the ability to say some words leads to broken or halting speech. Grammar can also appear to be lost. The aphasia associated with Wernicke’s area is known as a receptive aphasia, which is not a loss of speech production, but a loss of understanding of content. Patients, after recovering from acute forms of this aphasia, report not being able to understand what is said to them or what they are saying to themselves, but they often cannot keep from talking.

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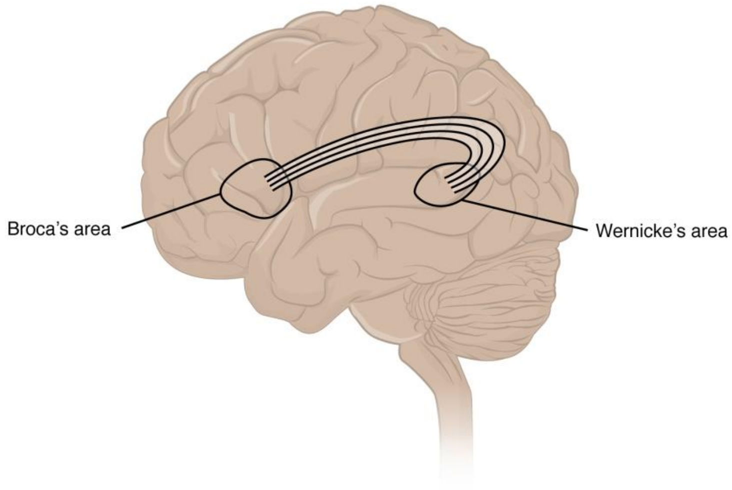

Broca's and Wernicke's Areas: *Two important integration areas of the cerebral cortex associated with language function are Broca's and Wernicke's areas. The two areas are connected through the deep white matter running from the posterior temporal lobe to the frontal lobe.*

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