LINGUISTIC SPECIFICITY OF THE LEFT TEMPORAL CORTEX

Abstract. This article presents the actual information about brain functioning in the specific area of the temporal cortex. The left temporal lobe of the brain is determined by important functions for humans. Such as recognition and processing of written text. There are also many injuries and problems that could lead to detailed difficulties in the work of the language, as well as written and oral speech.

Keywords: Brain, temporal lobe, hemisphere, cortex, frontal lobe.

The brain (encephalon) is the highest department of the central nervous system, which controls all processes occurring in the body and provides all higher and lower nervous activity. It develops in connection with the development of three main analyzers (olfactory, visual and equilibrium-auditory). The development of the olfactory receptor is accompanied by the formation of the terminal and intermediate parts of the brain; the visual receptor - the middle part of the brain; the state-acoustic receptor - the diamond-shaped part of the brain. The progressive development of the brain is due to the formation of a large number of insertion neurons, which are structurally designed in the form of nuclei. The specific features of the human brain structure that distinguish it from the brain of highly developed. As animals are the maximum predominance of the young parts of the central nervous system over the old ones: the brain over the spinal cord, the cloak over the trunk, the new cortex over the old, the surface layers of the cerebral cortex over the deep ones. [1]

Our brain consists of two hemispheres (left and right). Each hemisphere is
divided into occipital, parietal, temporal, frontal lobes, which perform certain functions. [3]

The lateral (sylvian) furrow bound the temporal lobe, and the caudal border is drawn according to the same principles as that of the parietal lobe. The temporal lobe consists of: the upper temporal sulcus (sulcus temporalis superior), the lower temporal sulcus (sulcus temporalis inferior). There are three horizontal gyri on the outer surface: the upper temporal gyrus (gyrus temporalis superior), the middle temporal gyrus (gyrus temporalis medius), and the lower temporal gyrus (gyrus temporalis inferior). On the basis of the lobe (basally), the lateral gyrus and the inner (medially) gyrus of the hippocampus are distinguished. [1]

The temporal lobe is also known as the temporal brain. It forms part of the brain and is the second largest lobe of it after the frontal lobe. The temporal lobe is considered a diverse part of the human brain both in its functions and anatomical.

Thus, it includes important memory structures, the Wernicke speech center, as well as the primary auditory cortex. The temporal lobe forms the lower and lateral parts of the brain. His deduction occurs opposite the clock frontal lobe (Lobus frontalis) and parietal lobe (Lobus parietalis). On the posterior side, it is separated by the occipital lobe (frontal occipital lobe). [5]

The areas of the cerebral cortex that are approached by ascending pathways from the organs of vision, hearing, smell, taste, pain, temperature and tactile receptors of the skin, from internal organs, are called "cortical analyzer departments". Accordingly, there are visual, auditory, olfactory, gustatory, skin, motor (muscle) analyzers [1]

Asymmetric centers (available only in one hemisphere) in most people (right-handers) are located in the left hemisphere (in left–handers - often in the right). These include the centers of reading, writing, speech and action (praxia). All these centers are associative. They are not directly connected to any projection systems. These centers are much less "independent" than the centers of such relatively elementary functions as the functions of motion and sensitivity. The act of speech, reading, writing, and praxia, of course, involves various areas of the cortex. It is possible that these functions require integral activity of the entire cerebral cortex.
However, there is no doubt that different lobes of the brain have far from the same significance for this activity. Practically, "centers" should be called those areas of the cortex, the defeat of which especially easily leads to a violation of a particular function. This is the motor center of speech (Broca’s), localized in the left hemisphere. The defeat of this center is affected by motor aphasia – the patient understands everything that is being said to him, but he cannot speak himself. [1]

The temporal lobe performs some important functions. This includes primarily hearing. Thus, the primary auditory center is located inside a deep lateral fissure. In turns, it reaches the final section of the auditory track. This is responsible for transmitting signals from sensory cells in the cochlea.

The main auditory center is also called the cross turn and reaches the size of a postage stamp only. The tertiary and secondary auditory centers located in the middle and upper turns of the temporal lobe fall out significantly more. They occupy almost the entire cortical area of the temporal lobe. The most famous center is the Wernicke Sensory Speech Center. It is located mainly in the left hemisphere.

Another important task of the temporal lobe is the sense of smell. The "uncus" is a small bulge directed inward. Among the olfactory cortex, you can find the amygdala (amygdala), which functionally belongs to the limbic system. Among other things, the amygdala is responsible for the feeling of fear.

The temporal lobe is also extremely important for human memory. This is especially true for the parahippocampal gyrus, in which the entorhinal cortex is located. This, so to speak, forms an intersection between things that have just been experienced and memory. Thus, the entorhinal cortex and the formation of the hippocampus provide the input of new memory contents and the acquisition of existing memories. Despite extensive knowledge about the temporal lobe, it is still not known exactly what functions are performed in its anterior regions. [4]

At the same time, the occipital lobe receives, processes and stores information about the diversity of the visible world (shape, color of objects, individual facial features, facial expressions, gestures, etc.). The temporal lobe receives and stores information about all non-speech sounds (from wind noise to birdsong, from technical sounds to musical compositions), and also perceives speech intonation,
pitch and timbre of voice. The parietal lobe is responsible for all the diverse spatially organized human experience acquired from early childhood (kinesthetic skills of dressing, washing, walking, using a spoon, needle, etc. P.), it allows you to touch the structure of the body, its parts, to recognize objects by touch with your eyes closed. The frontal lobe "monitors" the performance of non-verbal actions.

The left hemisphere of a right-handed person is purely verbal, or rather, speech-thinking. The left occipital lobe accepts, processes and stores in its memory abstract, code sign systems (alphabets, mathematical, road signs, etc.), allowing, for example, to read and control the written word (text). The left frontal lobe plans speech activity, organizes the syntax of an utterance that unfolds in time, predicts the result of an action on a situation, generates various levels of speech and abstract thinking, using the capabilities of all other lobes of the brain that receive, process and store abundant information about the outside world in their memory. [3]

It is known that various higher mental functions (or, more precisely, functional systems) have common links, i.e. they are carried out with the participation of common components. For example, writing, like the pronunciation of words, includes in its composition the reception of acoustic elements of the word.

Therefore, the primary violation of sound analysis and synthesis, which occurs when the cortex of the temporal region of the left hemisphere is affected, will inevitably lead to a violation not only of writing, but also of remembering words, holding a long series of speech sounds, etc., without affecting, however, functions such as counting or spatial perception. On the contrary, damage to the cortex of the parietal-occipital region of the left hemisphere will necessarily cause a violation of spatial operations, counting, but will not be accompanied by a violation of the perception of the sound composition of words and related violations of writing, pronunciation of words, etc. Thus, the presence of a primary defect associated with the "intrinsic function" of a given brain region inevitably leads to a violation of a number of functional systems, i.e., to the appearance of a whole complex of symptoms, or a syndrome composed of externally heterogeneous, but in fact internally related symptoms. [2]

Since the temporal lobe performs many important functions, traumatic lesions
can lead to serious consequences of disruption of this brain structure.

The first known case of the disease was registered in an American worker, Henry Gustav Molison (1926-2008). [6]

Molison suffered from epilepsy, which could not be successfully cured. For this reason, surgical removal of the medial sections of both temporal lobes occurred in the 50s. After significant intervention, anterograde amnesia occurred. Thus, the patient could no longer insert the newly learned things into his long-term memory.

Among the most common disorders of the temporal lobe is temporal lobe epilepsy. Epileptic seizures occur in this case in the amygdala, hippocampus, as well as in the adjacent convolutions. With a 27 percent share, temporal lobe epilepsy is the most common localization-related epilepsy. Typical features of epileptic seizures are the appearance of visceral auras, as well as unpleasant sensations in the stomach area. After that, there are smacking-chewing movements with the mouth, movements throughout the body and loss of consciousness. Medication treatment of temporal lobe epilepsy is considered difficult. [4,5]

If there is a lesion of the associative temporal cortex, this often leads to sound and visual disturbances. This is noticeable due to problems with the identification of persons or objects. Sometimes you also can't recognize melodies, rhythms, or sounds.

In the most severe cases of damage to the left temporal region, patients cannot clearly distinguish and repeat even single speech sounds (reproducing "u" as "o" or "o" as "u" or "a" and repeating "t" as "k", "c" as "w", "w" or "z"). Only relying on the visual perception of the oral image allows them to correctly repeat the necessary sounds. [2]

In less pronounced cases, violations in the differentiation of speech sounds occur as soon as two close sounds are presented to patients that differ only in one sign (the so-called "oppositional" or "correlating" phonemes). These patients, who easily repeat pairs of roughly different sounds (for example, "r" and "m", "d" and "c"), were unable to correctly reproduce such pairs of sounds as "d–t" and "t–d", "b–p" and "p–b" or "s–s" and "s–z", repeating them to "d–d" or "t–t", etc. Sometimes patients indicate that there is some difference between this and the sounds, which,
however, they cannot qualify. The defeat of the secondary parts of the auditory cortex of the left hemisphere leads, therefore, to a violation of the phonemic "code", on the basis of which the process of analysis and synthesis of speech sounds proceeds. [2]

The syndrome of violation of higher cortical functions in lesions of the auditory parts of the temporal cortex of the left hemisphere is based on a violation of those forms of work of the cortical parts of the auditory analyzer, which analyze and synthesize speech sounds under the determining influence of the phonemic structure of the language. As a result, there is a disintegration of the phonemic structure of speech, and with it a violation of its semantic side in the form of alienation of the meaning of words and violation of their subject relationship. Violation of the phonemic structure of speech leads to a distinct violation of verbal memory, manifested both when repeating words or naming objects, and when the patient's independent speech is expanded; an attempt to revive traces of the right words with a hint does not help in these cases. [2]

Despite the fact that our hemispheres and lobes of the brain perform different functions, but they work in a single mechanism. It is necessary to understand that injuries and damage to the left lobe of the brain lead to various losses in auditory and speech function, as well as affect short-term and long-term memory.

References:
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