

Disorders of speech and other symbolic functions

Speech disorders

Speech is an organizationally rather complex tool of human communication. For correct speech, whether spoken or written, it is necessary to have in order:

- **afferentation** (auditory analyzer or visual analyzer for the written word for perception and subsequent processing of perceived speech or writing in the nervous system);
- **efferentation** (neurons innervating muscles involved in speech or writing);
- **muscular apparatus** involved in speech or writing;
- **cerebellum, extrapyramidal structures and other subcortical regulatory systems;**
- **association cortical areas.**

Division of Speech Disorders

- **Aphasia' - *impairment in the production or understanding of speech. We distinguish between several types of this acquired defect*** according to the fluency of speech (fluent (Wernicke's), nonfluent (Broca's), or global). The extent of the impairment depends on the affected areas in the brain.
- **Dysphasia** - is a **congenital disorder** of speech of varying extent. Dysphasias include, for example, dyslalia.
- **Dysarthria** - a disorder of articulation, with a disorder of the innervation of the vocal cords or defects of the structures involved in pronunciation (tongue, lips, teeth, etc.).
- **Aphonia, dysphonia** - hoarse or whispered speech in disturbed innervation of the larynx or vocal cords.
- **Rhinolalia, nasolalia** - "nasal speech" in palsy of the soft palate.
- **Dyslalia** - slurred speech in children with delayed speech development.
- **Balbuties** - stuttering, usually of neurotic origin (functional).
- **Mutism** - muteness, mostly psychogenic.
- **Atactic (Chanted) speech in disorders of the cerebellum.**
- **Monotonous speech in Parkinson's syndrome as part of hypokinesia.**

Aphasia

Broca's (Nonfluent, expressive, motor)

This is a disorder of expression. The patient speaks little, articulates poorly, speech is not fluent, poor expression, sometimes a sentence consists of only one word. Word order is often wrong. The patient understands well and complies with instructions. He is fully aware of his handicap. The cause is a lesion of the corticosubcortical landscape of the frontal or insular dominant hemisphere. At the same time there is hemiparesis.

Wernicke's (Fluent, Perceptive, Sensory)

Comprehension disorder. The patient talks a lot, articulates well, speech is fluent. The patient creates new words that do not make sense, the expression is thus confused and forms a so-called "word salad". The sick person does not understand, he does not respond to instructions. He is not aware of the handicap. The cause is a lesion of the perisylvian landscape of the temporal dominant hemisphere. At the same time, there is a sensitive parietal disorder, hemianopsia, alexia, agraphia.

Global

Combination of Broca's and Wernicke's aphasia in more extensive lesions of the frontal, parietal and superior temporal regions. At the same time, hemiplegia, hemihypesthesia, hemianopsia are common.

Conductive

The patient speaks fluently and understands fairly well. However, he creates new words by shuffling letters or shuffles words around in a sentence (paraphasia). The patient has a problem with repeating speech. It may be a consequence of modification of Wernicke's aphasia.

Amnesic

The patient forgets commonly used concepts. But he chooses the right one from the several options offered. He understands well. It occurs when the deeper structures of the dominant temporal lobe are damaged. (According to some authors, however, all types of aphasia manifest themselves after a certain time under the image of amnesic aphasia and therefore this type has no localization clinical value.

Evidence of dominant hemisphere

Speech functions are primarily stored in the dominant hemisphere. In 80% of the population it is the left hemisphere, in 17% the right hemisphere, and in 3% of the population we are unable to determine it. However, it is not an unequivocal rule that all right-handed people have a dominant left hemisphere and vice versa. Therefore, there are objective examinations that prove the dominant hemisphere.

Wada Test

The principle consists in the intra-arterial application of *amytal sodium* to the basin of the *a. cerebri media* of one hemisphere. It is then disabled for a few minutes.

Dichotic Hearing Test

The auditory pathway ends in both – the homolateral and the contralateral hemisphere. However, the crossed path is more significant and therefore, when the other ear is deafened, both hemispheres (temporal lobes) can be tested separately.

Symbolic functions They are specific to humans and are the result of higher nervous activity.^[1]

Split symbolic functions ^[1]

Phatic function

These include the ability to speak, read, write, calculate and think in abstract terms including semantics (the meaning of words).

Gnostic function

They are the result of a higher synthesis of sensory perception. They make it possible to recognize objects by sight, hearing and touch.

Practical features

It includes the ability to perform more complex purposeful movements

Symbolic Functions and Hemispheric Dominance ^[1]

Dominant Hemisphere

It is primarily responsible for phatic, less practical and least Gnostic functions. The dominant hemisphere mainly provides the following functions:

- Speech
- Reading
- Writing
- Counting
- Comprehension and repetition (words, sentences)
- Logical and analytical thinking

Non-dominant Hemisphere

It ensures visual and spatial perception, behavior and orientation in the contralateral half of space. The majority of the population has a non-dominant right hemisphere, so this hemisphere will ensure the perception of the left half of space. Furthermore, the non-dominant hemisphere adds an affective and emotional component to speech.

Partition of Symbolic Function Disorders

Acalculia^[2]

Number processing disorder in dominant parietal lobe lesions.

Agraphia ^[2]

It accompanies expressive aphasia. Movement patterns for writing are missing, the own movement of the limbs is not violated. It occurs in the case of a lesion of the dominant parietal lobe.

Agnosia ^[2]

It is a disorder of cognition through the senses.

Tactile agnosia (stereoagnosia)

Impaired recognition of objects by touch. It happens bilaterally. In the case of unilateral involvement (hemiastereognosia), the posterior part of the corpus callosum is affected (tactile gnosis is stored in the parietal lobes, if a part of the corpus callosum is cut, the parietal lobes lose part of the interhemispheric connections). The disease can imitate stereohypesthesia and stereoanesthesia, which arise from lesions of somatosensory structures.

Auditory Agnosia

It is very rare. Auditory gnosis is located bilaterally in Heschl's convolutions with many commissural connections. For auditory agnosia, a bilateral lesion of area 41, 42, 22 and the corresponding white matter is therefore necessary. The patient cannot distinguish typical sounds such as the sound of a passing car or the sound of running water.

Visual Agnosia

The patient cannot recognize what is seen, but can identify things by hearing or touch. It is necessary to rule out bilateral elementary lesions of the visual cortex. This is done by means of the blink reflex or an optomotor response involving the area parastriata. The cause of visual agnosia is often heart attacks in the basin of the posterior cerebral artery. A form of visual agnosia is "prosoagnosia", when the patient cannot recognize faces, but identifies a person by voice. **Alexia'**

Inability to read and understand what is written. Basically a special form of visual agnosia. The cause is thrombosis of the left posterior cerebral artery with malacia of the dominant occipital lobe (including the white matter connecting the hemispheres)

The combination of acalculia, agraphia and agnosia is the so-called *Gerstmann syndrome*. The patient cannot tell the fingers apart and confuses the right and left sides. The patient articulates and understands speech normally. It arises from a lesion of area 39 (gyrus angularis) due to vascular causes or during expansive processes.

Amusia

It is characterized by the loss of the ability to communicate using rhythm, tones and melody. Both hemispheres participate in music. In the non-dominant hemisphere, the pitch (frequency) of the tone is encoded. Therefore, when the non-dominant hemisphere is affected, the patient reproduces music monotonously. The more professional and experienced the musician is, the more engaged the dominant hemisphere is.

Motor amnesia

- Oral - inability to make sounds with the mouth and vocal cords.
- Instrumental - inability to play a musical instrument including tapping out a beat.
- Inability to use notation (editor's note: the author probably means writing the melody into notes from an ideational idea).

Sensory amnesia

- Inability to distinguish pitch.
- Inability to distinguish tone color, sound of instruments and melody.
- Inability to read sheet music.

===Apraxia <ref name="Ambler"> With apraxia, the patient is unable to perform learned, coordinated movements with intact mobility. If we want to perform a targeted movement, we must first have an idea to perform the movement, then a plan to perform it, and then execute the movement. A person with apraxia has a problem in one or more of these steps. More severe forms of apraxia occur with a lesion of the dominant hemisphere, lighter forms with a lesion of the non-dominant hemisphere.

Motor Apraxia^[1]

In this apraxia, the plan of how to perform the movement is preserved, but the execution is impaired. This is, for example, bad fastening of buttons or difficulty inserting the key into the lock.

Ideomotor apraxia ^[2]

The patient lacks a movement plan. For example, he uses the key in the opposite direction, cannot comb his hair, etc.

Construction Apraxia ^[2]

The patient cannot assemble cubes, pictures, draw geometric figures, etc. When the lesion is in cooperation with both parietal lobes.

Dressing Apraxia ^[2]

With a lesion in the cooperation of both parietal lobes.

Apraxia ideational ^[1]

The patient does not have a plan or an initial idea for performing the movement. He doesn't understand what we want from him. It is most often associated with atrophy (Alzheimer's muscle) and deep lesions of the parieto-occipital white matter.^[2]

Disorders from a lesion of the speech non-dominant hemisphere ^[2]

Hemiasomatognosia'

Left-sided hemiplegia in neglect syndrome. The patient considers the left limbs to be foreign, belonging to someone else. There is often a conjugate deviation of the eyes and head homolateral to the plegia.

Anosognosia'

The patient is not aware of his illness, e.g. hemiplegia. Often in extensive encephalomalacia in the non-dominant hemisphere.

Syndrome of cutting the corporis callosi ^[2]

The corpus callosum is sometimes transected therapeutically in intractable epilepsies. This artificially creates a disconnection syndrome, or split brain syndrome. Each hemisphere works independently, but only the dominant one (mostly the left one) has the ability to communicate verbally or in writing. In reality, it looks like this. The patient is unable to read from the left half of the visual field. After reading tasks from the right visual field, the patient is unable to perform this task with the left limbs.

In children under the age of ten, the consequences are less, for example, impaired orientation in space, dyspraxia, the feeling that the left hand does not belong to the child (alien hand).

Anterior callosotomy induces gross memory disturbances.

Links

Related Articles

- Symbolic Functions
- Speech disorders

References

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