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Diagnostic Strategies for Sensory and Efferent Motor Aphasia

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Abstract

Acquired speech disorders remain relevant in the scientific literature, given the prevalence and wide range of clinical manifestations. Sensory and efferent motor aphasia differ in various combinations of articulatory and lexical disorders, depending on the temporary organization and localization of lesions. Taking into account the importance of timely neuropsychological assessment for determining correctional and pedagogical tactics, the article discusses the current differential diagnostic aspects of sensory and efferent motor aphasia.

Keywords: aphasia, sensory aphasia, efferent motor aphasia, diagnosis of aphasia.

Introduction

Aphasia is an acquired speech disorder that occurs when the brain is damaged, due to trauma or degeneration of the brain, with a predominant localization of the lesion in the left hemisphere of the brain than in the right (Grönberg, 2022). Aphasia has distinctive features, compared with other speech disorders. For example, it differs from alalia by the loss of already formed speech; from dyslalia, in which the pronunciation of sounds suffers, aphasia is distinguished by an additional violation of the semantic side of speech. In aphasia, there are no gross speech disorders, as in dysarthria, and the decrease in intelligence is secondary, unlike the primary decrease in intelligence in mental retardation (Shishkina, 2021).

Traditionally, there are 6 forms of aphasia, based on the clinical manifestations and localization of the lesion in the brain. With damage to the temporal parts of the brain, acoustic-mnestic and acoustic-gnostic aphasia develops; localization of damage in the lower parietal parts of the brain is characteristic of semantic and afferent-motor aphasia; dynamic and efferent motor aphasia is characteristic of damage to the posterior and premotor parts of the brain (Ulugut, 2022). Taking into account the prevalence and severity of clinical symptoms of sensory and efferent motor aphasia, the article discusses the current differential diagnostic aspects of these forms of aphasia (Wilson, 2023).

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Differential diagnosis of clinical manifestations of aphasia.

Sensory aphasia

Sensory aphasia is characterized by a violation of phonemic hearing, as a result of which patients perceive someone else's speech in the form of inarticulate sounds, respectively, they are unable to distinguish and comprehend the speech addressed to them. For the first time, sensory aphasia and its connection with damage to the posterior third of the upper temporal gyrus of the left hemisphere were established by psychiatrist Wernicke (Stefaniak, 2022). Impaired understanding of speech when listening to it, the absence of obvious motor disorders, especially in the early stages after brain damage (stroke or injury), leads to the fact that patients do not immediately realize that they have a speech disorder. The same word can be perceived in different ways (Ramanan, 2022). Awareness of the disorder most often occurs somewhat later, when the inarticulate flow of sounds is replaced by a complete loss of understanding of speech (Basso, 2020).

In sensory aphasia, there is an aggravation of speech disorders, in the form of a combination of manifestations of severe acoustic-gnostic aphasia and acoustic agnosia, as a rule, with extensive damage to the left and right temporal lobes of the brain (Zanella, 2023). At the same time, in addition to the classic picture of sensory aphasia with impaired phonemic hearing, there is a marked decrease in the ability to distinguish the intonation of speech, or to distinguish the timbre of voice; patients are unable to differentiate non-verbal sound signals, for example, the sound of pouring water, the rustle of paper products, beeps or calls (Zanella, 2023).

Sensory aphasia is characterized by a violation of expressive speech, loss of auditory control over speech, because of which many literal and verbal paraphasias occur in speech. In the early post-traumatic period, the patient's speech may be completely incomprehensible to others, since it consists of a random set of sounds, syllables and phrases, which is called "jargon aphasia" or "word salad". Due to the violation of phonemic hearing, the repetition of words suffers a second time, and often the word is initially automated, globally repeats correctly, but when listening to it and during the next attempts to repeat it, a person loses not only the sound components of the word, but also its rhythmic and melodic basis (Kertesz, 2022). The duration of jargon phase, as a rule, is no more than 1.5—2 months, gradually giving way to logorrhea (verbosity) with pronounced agrammatism. In the study of nominative function in sensory aphasia, along with the correct naming, there are attempts to explain the meaning of a word or find it through a phraseological context. At a late stage of recovery, agrammatism specific to sensory aphasia comes to the fore, manifested in the lack of agreement between the members of the sentence in gender and number, in the incompleteness of the utterance, in omissions of words, substitutions of nouns with personal pronouns (Figure 1). The use of prepositions and inflections of nouns is less upset with sensory aphasia.

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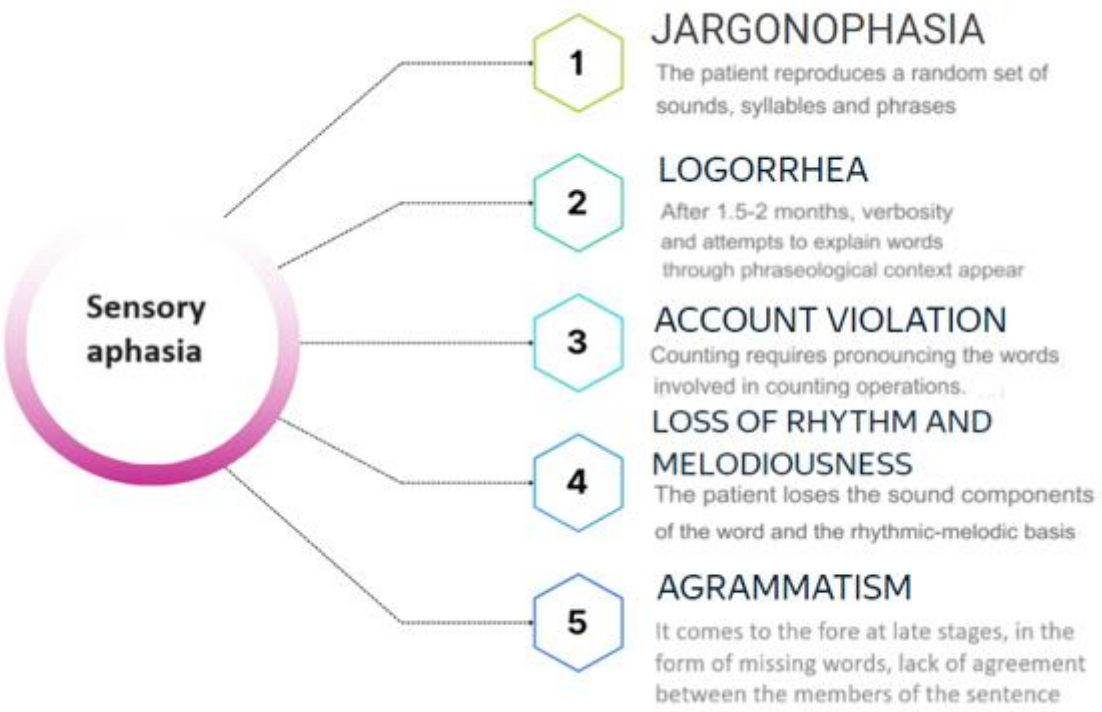

Figure 1. Temporary organization of clinical manifestations of sensory aphasia (the numbers indicate the months after the cortical lesion)

The most preserved speech function in sensory aphasia is the function of reading and writing, as it is carried out involving optical and kinesthetic control. At the same time, reading in the speech of a person with sensory aphasia is accompanied by a multitude of literal paraphasias, it becomes difficult to find the place of stress in a word, which makes it difficult to understand what is read (Grönberg, 2022). Written speech in sensory aphasia, unlike reading, is more impaired and is directly dependent on the state of phonemic hearing. Gross violations of counting in sensory aphasia are observed only at the earliest stage, since counting requires pronouncing the words included in counting operations. Patients, not understanding the instructions, can passively copy, copy examples, without performing arithmetic operations and may incorrectly write down a number (Shishkina, 2021).

With this form of aphasia, correction should be aimed at violations of expressive speech, writing and reading, and correction of phonemic hearing, taking into account preserved analyzers and brain functions.

Efferent motor aphasia

Efferent motor aphasia is a violation of speech activity, due to damage to the premotor parts of the frontal lobes of the brain. It is traditionally characterized by the loss of

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sequentially dynamic speech patterns, including speech perseverance (constant return to an already expressed thought, rhythmic repetition of individual sounds and words), and loss of smoothness of pronouncing words. In other words, patients are able to pronounce a phoneme or a word, however, the difficulties of denervation do not allow them to pronounce the next element (speech retardation).

Localization and volume of cortical lesions have a significant impact on the nature of clinical manifestations of efferent motor aphasia. Most often, the anterior branch of the left medial cerebral artery is affected, causing a combination of a violation of the sequential pattern of speech with kinetic apraxia (lack of ability to reproduce motor programs). The temporary organization of clinical characteristics in efferent motor aphasia, which is regulated by the premotor zones of the cerebral cortex, is distributed as follows: in the early stages after the lesion, one's own speech is most often absent, the patient is unable to repeat words and syllables, however, if there is a hint of the first syllables, he is able to automatically pronounce an implied or completely different word (absence naming functions). The patient is able to preserve the pronunciation of individual sounds (Stefaniak, 2022). In the future, the pathological inertia of speech stereotypes is aggravated, lexical permutations and involuntary repetitions of sounds, syllables and words, lack of order and subordination of words in sentences and phrases. There is a "telegraphic style" or expressive agrammatism, with the loss of verbs, nouns, adverbs; the inertia of verbal choice is often complemented by characteristic pauses and pronounced word stretching. Such long pauses, based on the inertia of the choice of lexical means, may resemble amnestic difficulties (Shishkina, 2021). Damage to the premotor cortex does not allow for the full implementation of timely switching of articular acts, which significantly complicates or completely excludes oral speech.

Efferent motor aphasia, unlike sensory aphasia, can have various symptomatic variants and clinical combinations, such as impaired ability to repeat a series of sounds, perseveration of sounds, expressive agrammatism against the background of impaired internal speech function, or verbal paraphrases with long pauses and stretching, without gross agrammatism (Kertesz, 2022). Sometimes there is a variant with correct grammatical formatting of speech, without emphasis on stressed syllables, with a disorder of rhythmicity and melody of speech, lack of intonation color, without literary paraphasias in oral speech. The absence of intonation color, stringiness and monotony of speech, against the background of the preserved function of the sound structure of the syllable, is a distinctive feature of efferent motor aphasia (Ramanan, 2022).

Efferent motor aphasia is accompanied by pronounced agraphy, the ability to write independently (exclusively under dictation by syllables) is lost. Severe forms of efferent motor aphasia, writing words is impossible even with repeated correct repetition of words, the ability to add words of their already selected letters is frustrated. Patients cannot find the

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right letter to write, or are prone to randomly rearranging letters in words (Basso, 2020). Lighter clinical variants of the course involve writing words under dictation, but with the absence of vowels or consonants, rearrangement of syllables and letters, perseverations of the same syllables or letters from previous letters (Monnelly, 2023). As the recovery progresses, the independent written compilation of a small text passage is accompanied by pronounced agrammatism, with case and generic inflections, and a violation of the consistency of words in sentences and phrases. In the practice of a speech therapist and neuropsychologist, written agrammatism in patients with efferent motor aphasia refers to disorders that are difficult to correct (Zanella, 2023).

The loss of the ability to program the sound and letter composition of words leads to a guessing type of reading in severe forms, or to reading words or individual phrases without awareness, read in milder forms of violation. Sometimes there is no correct grammatical accompaniment of composed phrases, with the reading function preserved and the ability to write short phrases and sentences. If the patient lacks the rhythm and melody of speech, the ability to write and read is usually not impaired (Mikhailenko, 2015).

The inertia of speech processes characteristic of efferent motor aphasia causes speech comprehension disorders. Patients do not distinguish correctly expressed sentences from incorrect statements, do not recognize the hidden meaning of proverbs and sayings by ear, any polysemous words are classified by the patient as incorrect, due to the difficulty of switching from one lexical meaning of a word to another, figurative meaning (Ulugut, 2022). Patients are not able to show a series of 3-4 pictures, repeating the previous buildings, which is due to a secondary disorder of auditory and speech memory. The rapid pace of tasks for recognizing body parts or object images confuse the patient, causing perseverations. Despite the simplicity of the instructions for showing a single subject image, patients need to make long pauses between each spoken word (Wilson, 2023).

Thus, unlike sensory aphasia, efferent-motor aphasia is characterized by a wide range of combinations of clinical forms, various options for the temporary organization of symptoms, which should be taken into account during primary speech therapy and neuropsychological assessment, for timely determination of therapeutic and correctional tactics.

Diagnostic tactics for sensory and efferent motor aphasia.

What is common to the two forms of aphasia is a bedside examination. The components of a bedside language examination include assessment of spontaneous speech, naming, repetition, comprehension, reading and writing. Although a bedside examination can usually reveal the type of aphasia, formal cognitive testing conducted by a neuropsychologist or speech therapist may be important to determine the exact level of dysfunction, plan therapy, and assess the patient's recovery potential (Table 1).

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Given the dependence of the form of aphasia on the area of brain damage, as well as the dependence of the prevalence of clinical symptoms on the size of the cortical regions involved in the pathological process, any form of aphasia should be accompanied by imaging tests both immediately after exposure to the traumatic factor and some time after the injury (Stefaniak, 2022). In particular, neuroimaging by computer and magnetic resonance imaging is necessary to locate and diagnose the cause of aphasia (Monnelly, 2023). Computed tomography effectively demonstrates acute bleeding and most ischemic lesions lasting more than 48 hours; however, it can miss lesions that occurred less than 48 hours, and MRI with diffusion-weighted imaging detects cortical lesions as early as an hour after its onset. Contrast enhancement may be required to demonstrate tumors using both CT and MRI. Thin sections of the cerebral lobes may show atrophy or sclerosis (Todd, 2008). At a time when gross tissue atrophy is difficult to detect, positron emission tomography and single-photon emission computed tomography can be useful for detecting hypometabolism or decreased cerebral blood flow, including the left medial cerebral artery, which is affected by efferent motor aphasia (Mesulam, 2022). Electroencephalography is sometimes used. In addition, functional MRI is increasingly being used to study the normal activation of speech structures in healthy people. In scientific research, these methods have also proved useful in elucidating patterns of recovery from neurological injuries such as stroke with aphasia. Although early studies have shown that homologous regions of the right hemisphere can contribute to speech recovery, recent studies have shown that activation of the neighboring cortex of the left hemisphere is associated with a more complete restoration of language function (Radanovic, 2021).

In addition to interventional treatment methods, surgical interventions for subdural hematoma or brain tumor, neuropsychological testing and speech therapy assessment are important in the early stages of the development of aphasia of any form, which are useful for choosing corrective therapy for any form of aphasia (Alferova, 2018). Speech and language therapy is the basis for the treatment of patients with aphasia. The timing and nature of interventions for aphasia vary widely. Blind studies are limited and recovery is somewhat the norm, but several studies have shown that speech and language therapy does improve clinical outcomes in patients with aphasia. The difficulties of patients vary, and individual programs are often important (Mikhailenko, 2015). In general, experts agree on the importance of speech therapy for aphasia. Studies have shown that intensive speech therapy may be more effective than a longer course of sporadic therapy (Skeel, 2009). Recent studies have shown that intensive treatment with a speech therapist, for several hours a day several days a week, is more effective than the same number of shorter sessions stretched over a longer period (Basso, 2022).

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Table 1. Key aspects of differential diagnosis of sensory and efferent motor aphasia

Aphasia form / Sign	Sensory aphasia	Efferent motor aphasia
Localization of the lesion	Posterior third of the superior temporal gyrus of the left hemisphere	Premotor cortex, anterior branch of the left middle cerebral artery
The underlying mechanism of pathological phenomena	Phonemic hearing disorder	Inertia of speech processes
Kinesthetic apraxia	Not diagnosed	Diagnosed
Temporal organization of manifestation	Clearly traceable	Not traceable
Combinations of different symptoms	Not diagnosed	Characteristically, there are a large number of combinations of symptoms
Dependence of clinical phenomena on the location and size of the cortical lesion	Not diagnosed	Diagnosed
Reading function	Mostly intact, there are literary paraphasias, counting disorders in the early stages	Guessing type of reading or reading short sentences without comprehension
Writing function	Mostly intact	Severe agraphia, agrammatism
Speech understanding	Mostly intact	Complete or partial disorder of understanding
Naming function	Retained	Absent
Long pauses and stretching, speech retardation	Not diagnosed	Diagnosed
Jargonophasia, logorrhea	Not diagnosed	Not diagnosed
Rhythmic-melodic basis of speech	Disrupted	Disrupted

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Intonation ability	Absent	Absent

Features of correctional work in sensory and efferent motor aphasia

In case of efferent motor aphasia, it is proposed to apply a neuropsychological intervention program to overcome the psychophysiological mechanisms involved in the patient's body (Radanovic, 2021). The program is aimed at: overcoming pathological inertia at its various levels of affectation (material level, perception level and verbal level); restoring consistent motor organization (verbal and non-verbal); restoring adequate somatosensory recognition (verbal and non-verbal); to ensure the functional reorganization of writing, reading and calculation; each of the stages includes several sub-stages and consists of tasks of varying degrees of complexity (Grönberg, 2022). In particular, efforts are aimed at restoring narrative speech, sound and syllabic structure. The basis for such interventions is a sense of language, and attempts to catch rhyming words (Marini, 2007). Pantomimic imitation of movements with objects helps to overcome pathological inertia in efferent motor aphasia, and to teach the selection of the right words, subject drawings are played out, the purpose of the object is guessed (Kubyshenko, 2016).

In case of sensory aphasia, the purpose of correctional and pedagogical work is to restore understanding of speech and to restore the correctness of the pronunciation act a second time. Stage 1 of corrective intervention is the inhibition of copious unproductive speech. To do this, you need to switch your attention from speech to other activities. A non–verbal method is proposed - drawing, construction, board games, classification of subject images (Todd, 2008). Verbal methods are short remarks by the teacher related to the actions of the patient himself. The connection of the patient's objective actions with the instructions of a speech therapist, communication is also used through drawing, gestures, singing, and the method of facial expressions. Stage 2 – learning to listen to spoken language. Small texts are offered to the patient for perception. Read by a speech therapist, the patient is asked to select a plot picture corresponding to the text from the 3 lying in front of him (Wilson, 2023). To facilitate this, the method of introduction into the context is used (before reading the story, the patient is informed what this story will be about). Stage 3 – teaching the patient to distinguish specific words from his own speech (Ulugut, 2022). The method of classifying objects by the named word is used (put vegetables, fruits). Then work is underway on the phrase (Code, 2021). The patient listens to the frau, correlates it with the plot picture, tries to count the number of words in the phrase, correlate these words with the proposed plot pictures. Phrases should not be very long, no more than 3-5 words. Stage 4 is the work of restoring phonemic perception. The main method is the method of correlating sound with its articulation by means of relying on its oral image and connection with the corresponding letter (sound–articuleme-letter) (Crosson, 2008). Algorithm – a familiar word that has been

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worked out before is taken. Stage 5 – proceeds to a conscious quantitative and qualitative analysis of the audible phrase. Determines not only the number of words in a phrase, the sequence, but also pays attention to letter analysis (Kubyshenko, 2016).

It should be noted that any form of aphasia is accompanied by depression and psychoemotional disorders, and additional psychological support is an important condition for the success of corrective intervention (Alferova, 2018).

Conclusion.

Constant updating of knowledge about differential diagnostic algorithms of various forms of aphasia is a key aspect of neuropsychological and speech therapy assessment. The comparative characteristics of sensory and efferent motor aphasia are quite extensive, they usually have a clear outline of symptoms, which makes it possible to determine the tactics of correctional and pedagogical intervention in an early period, according to a specific form of aphasia.

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