

# Speech communication disorders and swallowing disorders/PGS

## Speech communication disorders and swallowing disorders in adults with neurological disabilities

When a doctor meets a patient, he should always evaluate his speech, both formally and content-wise, as well as his ability to swallow. Speech disorders and swallowing disorders can be the first symptom of a serious neurological disease, and their detection can help to correctly diagnose the underlying disease. It is essential for practice to be able to **differentiate between aphasia, speech apraxia, dysarthria, oral apraxia and communication disorder in dementia**. More detailed diagnosis and therapy of speech and swallowing disorders is then in the hands of a **clinical speech therapist**.

## Aphasia

Aphasia is an acquired speech disorder that arises on the basis of **focal** brain damage, most often **cortical** areas of the **dominant hemisphere**. In terms of location, the most common causes of aphasia are cortical lesions, namely **perisylvian areas ( Broca's and Wernicke 's areas), lesions in the fasciculus arcuatus, gyrus angularis, inferior gyrus frontalis, gyrus supramarginalis** , and lesions in the subcortical areas of the **thalamus and basal ganglia** .

The most common causes of aphasia are **vascular causes** (ischemia or hemorrhage in the ACI basin (internal carotid artery)), as well as **tumors and head trauma**.

## Symptoms

Aphasia manifests itself in the impairment of the ability to use language in all its levels. Symptoms of aphasia include **speech fluency disorders, speech comprehension disorders, paraphasia, anomia, and agrammatism. Echolalia, speech automatisms, perseveration, circumlocution, satiation, reading and writing disorders** may occur (the above symptoms of aphasia are explained in more detail in Table 1.).

| Symptom name                | Symptom description   |
|-----------------------------|---|
| Disorders of speech fluency | <ul style="list-style-type: none"> <li>▪ <b>Nonfluent speech</b> , i.e. "non-fluent" speech - cumbersome speech with a slow pace that seems monotonous, one-word messages or short sentences (usually max. 3–4 words) with errors in sentence structure (absence of verbs, prepositional phrases, etc.), even if the patient produces some phrases quite fluently. Messages are often poor in content.</li> </ul> <p><b>Example</b> (Broca's aphasia): <i>"What happened to you?"</i> - answer: <i>"Well... it's... well... I can't."</i> ( video 01 )</p> <ul style="list-style-type: none"> <li>▪ <b>Fluent speech</b> , i.e. "flowing" speech - a message of reasonable or even excessive length and speed, produced without apparent effort, but the content can be very vague or completely empty.</li> </ul> <p><b>Example</b> (anomic aphasia): <i>"Where did you work?"</i> - answer: <i>"Well, I worked in ... well, as a clerk, you see, I can't say the place."</i></p> <p><b>Example</b> (Wernicke's aphasia): <i>"What is your occupation?"</i> - answer: <i>"I tó tektilo 5 calf."</i> ( video 02 )</p> |
| Comprehension disorders     | <ul style="list-style-type: none"> <li>▪ The patient does not show the named objects, does not understand our calls, in milder cases only fails to understand more complex longer messages.</li> </ul> <p><b>Example:</b> comprehension impairment in a posterior lesion ( video 03 )</p> <p><b>Example:</b> comprehension impairment in an anterior lesion ( video 04 )</p>  |
| Paraphasia                  | <ul style="list-style-type: none"> <li>▪ <b>Semantic</b> – interchange of words close in meaning or even distant.</li> </ul> <p><b>Example:</b> instead of bread, he says <i>"roll"</i> , <i>"hat"</i> ...</p> <ul style="list-style-type: none"> <li>▪ <b>Phonemic</b> – swapping, omitting, transposing or adding phonemes in words.</li> </ul> <p><b>Example:</b> instead of bus, say <i>"aukebus"</i> .</p> <p>See video 05 for examples of paraphasias .</p>   |
| Neologisms                  | <ul style="list-style-type: none"> <li>▪ Nonexistent words.</li> </ul> <p><b>Example</b> (Wernicke's aphasia): <i>"What difficulties do you have?"</i> - answer: <i>"Five is difficult."</i></p> <ul style="list-style-type: none"> <li>▪ Speech containing almost exclusively neologisms is called jargon .</li> </ul> <p><b>Example:</b> video 06</p>   |
| Anomie                      | <ul style="list-style-type: none"> <li>▪ Difficulty updating concepts.</li> </ul> <p><b>Example:</b> pen - <i>"Well, that's, well..., that..."</i></p>  |
| Circumlocution              | <ul style="list-style-type: none"> <li>▪ The patient tries to bridge the difficulties with updating the concepts with a description.</li> </ul> <p><b>Example</b> (anomic aphasia): pen - <i>"Well, sure, I know, that's what it is, but you know what, I have it too, here, ...it's a...pen for writing!"</i></p> <p>(See also video 07. )</p>   |
| Echolalia                   | <ul style="list-style-type: none"> <li>▪ Echoic repetition of what is heard (typical of transcortical forms of aphasia).</li> </ul> <p><b>Example:</b> <i>"How are you today?"</i> - answer: <i>"How are you today?"</i></p>  |
| Speech automatisms          | <ul style="list-style-type: none"> <li>▪ Involuntary stereotyped repetition of syllables, words, phrases (in severe forms of aphasia).</li> </ul> <p><b>Example</b> (global aphasia): <i>"What's your name?"</i> - answer: <i>"Well, well, well, well!"</i> , <i>"How are you today?"</i> - answer: <i>"Well, well, well, well!"</i> , <i>"What is?"</i> – the answer: <i>"Well, well, well, well!"</i></p>   |
| Agrammatisms                | <ul style="list-style-type: none"> <li>▪ Impairment in the formation of grammatical forms, especially evident when trying to answer in a complete sentence.</li> </ul> <p><b>Example</b> (Broca's aphasia): <i>"What did you do today?"</i> - answer: <i>"Today food, I'm the post office...retirement, well, the wife also pensions, then she has lunch..."</i></p> <p>(See also video 01. )</p>   |
| Perseverance                | <ul style="list-style-type: none"> <li>▪ <b>Sticky reactions</b> - the patient reacts to new questions, tasks in quick succession in the same way (movement, gesture, word) that he used to answer the previous question.</li> </ul> <p><b>Example</b> (Broca's aphasia): <i>"Are you wearing pyjamas?"</i> - response: the patient nods his head <i>"yes"</i> . <i>"And are we in the hotel now?"</i> - answer: the patient perseveres - nods <i>"yes"</i> .</p> <p><b>Example</b> (Broca's aphasia): <i>"What is that?"</i> (pencil) - answer: <i>"Pencil."</i> <i>"And what is this?"</i> (handkerchief) - answer: <i>"Pencil."</i></p> <p>(See also video 8a and video 8b )</p>   |
| Satiation                   | <ul style="list-style-type: none"> <li>▪ <b>Alienation of the meaning of the word</b> - a pathognomonic symptom of Wernicke's aphasia, manifests itself during the examination of spoken comprehension.</li> </ul> <p><b>Example:</b> we ask the patient - <i>"Show the window!"</i> , <i>"Show the door!"</i> , <i>"Show the bed!"</i> , <i>"Show the window!"</i> (during this call, the patient begins to hesitate and points to something else)</p>   |

# Classification

In our neurology, aphasias are still often divided into "**expressive**" (motor, more recently **nonfluent** ), "**perceptual**" (receptive, sensory, more recently **fluent** ) and "**mixed**" (total, **global** ). "Expressive" aphasias mainly represent anterior involvement of the brain, "perceptual" aphasia posterior involvement (the border is the **sulcus centralis** ). Patients with an "expressive" phatic disorder more often have **hemiparesis or hemiplegia** , in patients with a "perceptual" type of phatic disorder, **motor impairment is less pronounced**. The division of aphasia into "motor" (or "expressive") and "sensory" (or "perceptual") is misleading due to its simplified concept and has already been completely abandoned in world aphasiology (all patients with an "expressive" speech disorder have measures also difficulties with understanding what is spoken - at least at the level of more complex grammatical structures - just as all patients with a "perceptual" disorder naturally produce content-inadequate messages as a result of it, which can act as difficulties with "expression"). Currently, the dichotomous division of aphasia into fluent and non-fluent type and within it into subtypes according to the so-called **Boston classification is the most widely used in world aphasiology. For a clearer idea of the current division of aphasias, we present the Boston classification in Table 2. However, knowledge of the dichotomous division is sufficient for a doctor's normal clinical practice.**

| Boston Classification of Aphasias |                                   |  |                                       |               |            |        |         |               |
|-----------------------------------|-----------------------------------|--|---------------------------------------|---------------|------------|--------|---------|---------------|
| Old division of aphasias          | Boston Classification of Aphasias | Lesion   | Spontaneous speech                    | Understanding | Repetition | Naming | Writing | Reading aloud |
| Expressive - motor                | Broca's                           | <ul style="list-style-type: none"><li>▪ Obl. Broc's aree + obl. before and after it (lesions of the frontal and frontoparietal operculum)</li><li>▪ Obl. Insula and parietal supramarginal gyrus. lobe</li><li>▪ Subcortical. obl. frontal lobe</li></ul>  | Nonfluent                             | +             | –          | –      | –       | +<br>–        |
|                                   | Transcortical motor               | <ul style="list-style-type: none"><li>▪ Obl. ACA river bed, i.e. in front of Broc's area and near the supplementary motor area</li></ul>   | Nonfluent                             | +             | +          | –      | –       | +             |
| Perceptual - sensory              | Wernicke's                        | <ul style="list-style-type: none"><li>▪ Temporal. lobe – Wernicke's area + obl. adjacent to it</li></ul>   | Fluent                                | –             | –          | –      | –       | –             |
|                                   | Transcortical sensory             | <ul style="list-style-type: none"><li>▪ Temporo-parietal (and temporo-occipital) border, it can be the ACP basin</li></ul>   | Fluent                                | –             | +          | –      | –       | +             |
|                                   | Conductive                        | <ul style="list-style-type: none"><li>▪ Obl. arcuate fasciculus, supramarginal gyrus</li></ul>   | Fluent                                | +             | –          | –      | –       | +<br>–        |
|                                   | Anomic                            | <ul style="list-style-type: none"><li>▪ It has no localization value</li></ul>   | Fluent but difficulty recalling words | +             | +          | –      | +       | +             |
| Mixed                             | Global                            | <ul style="list-style-type: none"><li>▪ Extensive lesion dominant hem. (ACM watershed)</li></ul>   | Nonfluent to mute                     | –             | –          | –      | –       | –             |
|                                   | Mixed transcortical               | <ul style="list-style-type: none"><li>▪ Isolation of the speech cortex from surrounding areas</li><li>▪ Extensive lesion of the dominant hemisphere, lesion of the fronto-temporo-parietal region, or temporo-occipital regions</li><li>▪ Broca's and Wernicke's areas themselves are not affected</li></ul> | Nonfluent                             | –             | +          | –      | –       | –             |

Explanations: + relatively preserved, – disturbed.

## Differential diagnosis

**The doctor 's task at the first contact with a neurologically ill patient with a communication disorder is not to classify possible aphasia in more detail, but to diagnose it in general and differentiate it from other possible communication disorders** (see differential diagnosis in Table 3).

|  | <b>Dementia of the Alzheimer type</b>   | <b>Aphasia</b>                    | <b>Dysarthria</b> | <b>Oral apraxia</b> | <b>Apraxia of speech</b> |
|--|---|-----------------------------------|-------------------|---------------------|--------------------------|
| <b>The emergence and course of difficulties</b>                                | progressive deterioration   | sudden onset                      | sudden onset      | sudden onset        | sudden onset             |
| <b>Articulation errors</b>   | No  | non-constant                      | constant          | No                  | non-constant             |
| <b>Paraphasia</b>  | No<br>(occurrence only in later stages)   | Yes                               | No                | No                  | No                       |
| <b>Comprehension disorder</b>  | Yes   | Yes                               | No                | No                  | No                       |
| <b>Anomie</b>  | Yes   | Yes                               | No                | No                  | No                       |
| <b>Agrammatisms</b>  | No<br>(occurrence only in later stages)   | Yes                               | No                | No                  | No                       |
| <b>Alexia</b>  | partly<br>(reading aloud for a long time without being noticeable, reading with comprehension is difficult) | Yes                               | No                | No                  | No                       |
| <b>Agraphia</b>  | Yes<br>(especially in later stages)   | Yes                               | No                | No                  | No                       |
| <b>Disorders of reflexive - non-speech activities (chewing, swallowing...)</b> | No<br>(occurrence only in later stages)   | It does not have to be            | Yes               | No                  | No                       |
| <b>Disorder of respiration, phonation, nasal resonance</b>                     | No<br>(occurrence only in later stages)   | No                                | Yes               | No                  | No                       |
| <b>Social behavior</b>   | disproportionately  | adequately                        | adequately        | adequately          | adequately               |
| <b>Disorientation by place, time, person</b>                                   | Yes   | No<br>(can be in the acute stage) | No                | No                  | No                       |
| <b>Preview</b>   | No<br>(only in initial stages yes)  | mostly yes                        | Yes               | Yes                 | Yes                      |

Note: disorders can be combined with each other, relatively common is a combination of aphasia and dysarthria, nonfluent aphasia and speech apraxia, aphasia and dementia...

## Investigation

For the correct diagnosis of aphasia, it is important to evaluate **the patient's speech in the following areas** at least as a guide (for more details, guide examination in Table 4.)

**Spontaneous speech production** – we evaluate the fluency, informational value of the message, we notice whether the patient's speech does not contain stereotypes, anomia, circumlocution, paraphasia, ... (symptoms of aphasia in Table 1.).

**Naming** – impaired naming ability is typical for aphasic patients . If the patient does not have a naming disorder , it is necessary to consider other disorders of speech communication , such as speech apraxia or dysarthria (see table 3.). However, the impaired ability to name without a simultaneous, albeit discrete, disability in the other areas listed below is nevertheless not a reason for establishing a diagnosis of aphasia. An isolated naming disorder can be a symptom of the initial stage of the dementia syndrome, but also a symptom of the patient's depression or apathy (see Table 3).

**Comprehension** – the correct assessment of the patient's ability to understand is not only important for the approximate localization of brain damage in the anterior or posterior cortical area, but also for the course of further communication and treatment with the patient (e.g. the patient cannot be given informed consent to sign if he has a significant impairment of understanding, which, in addition, usually correlates with reading comprehension disorder!).

**Repetition** – unlike the above areas, repetition may not be impaired in all types of phatic disorders. However, for Broca's, Wernicke's, global and especially for conduction aphasia, impairment of the ability to repeat is typical (see Table 2). We notice not only the accuracy of repetition, but also articulation errors, phonemic paraphasias...

**Writing** – in most aphasics, writing is impaired to a greater or lesser extent, manifested by substitutions of letters (paragraphs), omission of words, perseverations of words, slippage of words or even the production of completely meaningless words. In the most severe cases, the patient only produces meaningless dashes. Acquired writing disorder (agraphia) can occur in isolation, but very often occurs in conjunction with aphasia.

**Reading** – is impaired in a large part of aphasics. If reading is not formally impaired, so-called reading comprehension is often impaired (the patient does not assign meaning to the word read, is unable to reproduce the exact content of the read text, answers questions related to the text inaccurately). A reading disorder (alexia) can also occur in isolation without a phatic disorder. Examination of the ability to read aloud with comprehension is essential for the differential diagnosis of pure Wernicke's aphasia and so-called pure verbal deafness. In the first case, reading comprehension is significantly impaired, in the second it is preserved.

| The investigated area  | Difficulty of the task   |  |  |
|--|--|--|--|
|  | easy   | moderately difficult   | difficult  |
| <ul style="list-style-type: none"> <li>Spontaneous speech production</li> </ul> Disorders of spontaneous speech production, see video 1 and 2 .  | <ul style="list-style-type: none"> <li>"What is your name?"</li> <li>"Where do you live?"</li> <li>"Where are you now?"</li> <li>"What's your trouble?"</li> </ul>   | —  | —  |
| <ul style="list-style-type: none"> <li>Naming</li> </ul> See video 5 for naming errors .   | <ul style="list-style-type: none"> <li>"What is it?"</li> </ul> We present real objects for naming, point to parts of the body, etc.   | —  | <ul style="list-style-type: none"> <li>"Name as many animals as possible in a minute!"</li> </ul> Performance below 20 is substandard.   |
| <ul style="list-style-type: none"> <li>Understanding</li> </ul> (During the examination, watch out for possible limb apraxia, neglect syndrome! We do not tell! You cannot, for example, ask the patient to give us a hand and give him your hand at the same time.)<br><br>For comprehension disorders, see video 3 and 4 . | <ul style="list-style-type: none"> <li>"Show...!"</li> </ul> We name objects around the patient, parts of the body, etc.<br>(If, due to limb apraxia, the patient is unable to perform the intended hand movement towards the object, we ask him to look at the named object.)<br><br><ul style="list-style-type: none"> <li>"Raise your hand!"</li> <li>"Close your eyes!"</li> <li>"Stick out your tongue!"</li> </ul> | <ul style="list-style-type: none"> <li>"Is your name XY?"</li> <li>"Are we home now?"</li> <li>"Do you have blonde hair?"</li> <li>"Am I a man?"</li> <li>"Can it snow in August?"</li> <li>"Does the bread opener cut?"</li> </ul> The patient answers yes/no, or by nodding the head or an agreed gesture. | <ul style="list-style-type: none"> <li>"Show your right ear with your left hand!"</li> <li>"Show the door first, then the table, and finally the chair."</li> <li>"After you touch your nose, touch your mouth and chin!"</li> <li>"If there's a small child in this room, raise your hand!"</li> <li>"Don't touch the ear, but touch the nose or belly."</li> </ul> |
| <ul style="list-style-type: none"> <li>Repetition</li> </ul> Replay failures see video 9 and 10 .  | <ul style="list-style-type: none"> <li>"Repeat after me!" (sounds, syllables, words)</li> </ul>  | <ul style="list-style-type: none"> <li>"Repeat after me!" (sentences)</li> </ul>   | <ul style="list-style-type: none"> <li>"Repeat after me!" (sentence)</li> </ul>  |
| <ul style="list-style-type: none"> <li>Writing</li> </ul> Typing error see video 11 and 12 .   | <ul style="list-style-type: none"> <li>"Sign yourself!"</li> <li>"Write your address!"</li> </ul>  | <ul style="list-style-type: none"> <li>"Write!"</li> </ul> We dictate syllables, words, sentences.<br><br><ul style="list-style-type: none"> <li>"Write what it is!"</li> </ul> We present subjects.   | <ul style="list-style-type: none"> <li>"Write the text on a postcard that you would send to your family from vacation!"</li> </ul>   |
| <ul style="list-style-type: none"> <li>Reading</li> </ul> Reading disorder see video 13 and 14 .   | <ul style="list-style-type: none"> <li>"Read aloud and do what it says!"</li> </ul> We present text like: Raise your hand., Close your eyes., Point to the table and to the window., If there is a chair in this room, bang on the table!  | —  | <ul style="list-style-type: none"> <li>"Read this article aloud to me and tell me what it's about!" (newspaper article, etc.)</li> </ul> (If the patient is unable to narrate on his own due to severely impaired expression, we ask him questions about the text.)  |

Note: If the patient already fails to comply with the easy task of the examined area, it is not necessary, for reasons of time, to examine the patient with more demanding tasks.

## Apraxia of speech

**Apraxia** is the loss of the ability to perform more complex purposeful movements and activities, even if the momentum is not disturbed. The patient cannot, for example, dress, unlock the door with a key, etc. If we give him objects related to the activity, he does not know what to do with them, for example, he puts his shirt on his leg and so on. It, therefore, means the loss of learned movement stereotypes. There are several types of apraxia, in general, we recognize structural, ideational and ideomotor apraxia:

- Constructional apraxia** – the patient cannot build, fold or draw objects, while his mechanical skills, for example with a pencil and paper, are not violated.
- Ideative apraxia** – the patient lacks an idea, a plan of movement. At the same time, the cognition of the subject is not violated.
- Ideomotor apraxia** – the patient knows the purpose of the object and the way of its use, but the performance is done

incorrectly - it changes the order of individual parts of the required movement; repeats one and the same movement; involves unwanted muscle groups etc., but fails to properly combine the movements into the necessary series. With a severe lesion, he does not complete the operation, he only makes a hint of it.

## Mechanism of origin

Apraxia is caused by a disorder of the association areas of the dominant hemisphere and sometimes also due to severe hepatic failure. It belongs to a set of symptoms that arise when the parietal lobe is damaged in addition to the postcentral gyrus, the so-called "parietal syndrome".

## Dysarthria and swallowing disorders

Dysarthria is neurogenic **disorder motor motor production of speech sounds at the non-symbolic level**. Dysarthria is a speech disorder, not of language as a system. Unlike aphasia, there are no impairments in understanding, naming, syntax, or grammar... (differential diagnosis given in the table 3). Dysarthria results from paresis, impaired muscle tone or impaired coordination of the muscles involved in speech production. Damage to the motor system that leads to dysarthria, can occur anywhere along the pathway from the brain to the muscle itself.

Dysarthria is often accompanied by **dysphagia (swallowing disorder)**, which is why we also mention it in this chapter.

### Symptoms and classification

Among the symptoms of dysarthria are disturbances respiration, articulation, phonation, nasal resonance, and prosody. Dysarthria is divided into six types according to the place of origin, namely central (spastic), peripheral (weak), cerebellar (atactic), extrapyramidal-hypokinetic, extrapyramidal-hyperkinetic, mixed (see Table 5 for details). Some authors also mention cortical dysarthria, but this is currently considered a speech apraxia (differential diagnosis of dysarthria and other communication disorders in Table 3).

Tab. 5. Dysarthria – types and symptoms

| type of dysarthria   | lesion  | common underlying disease  | symptoms  |   |  |  |   |
|--|---|--|---|---|--|--|---|
|  |   |  | momentum of articulatory muscles and articulation   | phonation   | reflexes and function of the soft palate, nasal resonance  | prosody                                | swallowing  |
| <b>central</b> (spastic) (video 15 ( <a href="https://el.lf1.cuni.cz/p24425151/">https://el.lf1.cuni.cz/p24425151/</a> ) – unilateral upper motoneuron lesion)   | <b>upper motor neuron</b> (especially <b>bilateral</b> damage to the corticobulbar tract – <b>pseudobulbar syndrome</b> ) | <b>CMP, head trauma, tumor, infection</b> (neurologically: central type of paresis – spasticity, hyperreflexia, weakened muscle strength, limitation of range and speed of movement) | In a <b>unilateral lesion</b> the tongue turns towards the affected side<br>Pronunciation: well-worn but understandable, the prognosis of the adaptation is good<br><br>In a <b>bilateral lesion</b> is a severe limitation of range and speed of movements<br>Pronunciation: inaccurate and distorted pronunciation of consonants and vowels | <b>rough, strangled</b> voice produced with effort, unnaturally deep, voice power limited   | limited elevation of the palate during phonation, <b>gag reflex</b> at first <b>does not have to be equipped, later may be hyperactive</b><br>May be hypernasality | there is no dynamism, obvious monotony | <ul style="list-style-type: none"><li>▪ <b>in a right hemisphere lesion</b> there is a significantly higher incidence of laryngeal penetration, <b>aspiration and silent aspiration</b> (aspiration without reflex cough) than for damage in the left hemisphere</li><li>▪ <b>higher incidence of aspiration</b> is also in <b>anterior lesions</b></li><li>▪ upper esophageal sphincter dysfunction may be present</li></ul> |
| type of dysarthria   | lesion  | common underlying disease  | symptoms  |   |  |  |   |
|  |   |  | momentum of articulatory muscles and articulation   | phonation   | reflexes and function of the soft palate, nasal resonance  | prosody                                | swallowing  |
| <b>peripheral</b> (weak) (video 16 ( <a href="https://el.lf1.cuni.cz/p76411350/">https://el.lf1.cuni.cz/p76411350/</a> ) a 17 ( <a href="https://el.lf1.cuni.cz/p38406549/">https://el.lf1.cuni.cz/p38406549/</a> )) | <b>lower motor neuron</b> (bulbar syndrome)   | <b>Brainstem CMP, myasthenia gravis, tumor, trauma, viral infection</b> (poliomyelitis)<br><br>(neurologically: peripheral type of paresis – muscle hypotonia, weakness, atrophy)    | puckering and parting of the lips is dragged, the mouth may still be slightly open, <b>obvious fasciculation and atrophy of the tongue</b><br>Pronunciation: imprecise, sloppy  | breathy voice, inspiratory stridor, <b>abnormally short phrases</b> – Seeman's sign (in myasthenia gravis): <b>during longer speech (counting 1-100) development of dysphonia to aphonia,</b> | Weakened function of the soft palate, <b>gag reflex</b> little or <b>nonrecallable</b><br>Very pronounced hypernasality!   | <b>monotony</b>                        | <ul style="list-style-type: none"><li>▪ <b>disturbed chewing</b></li><li>▪ <b>aspiration</b> during or after swallowing</li><li>▪ accumulation of food residues in the pyriform sinuses</li><li>▪ delayed relaxation of the upper esophageal sphincter</li></ul>  |

|   |   |   |   | after a short pause the patient is able to phonate again  |  |  |   |
|---|---|---|---|---|--|--|---|
| type of dysarthria  | lesion  | common underlying disease   | symptoms  |   |  |  |   |
|   |   |   | momentum of articulatory muscles and articulation   | phonation   | reflexes and function of the soft palate, nasal resonance  | prosody  | swallowing  |
| <b>cerebellar</b> (atactic) (video 18 ( <a href="https://el.lf1.cuni.cz/p95053214">https://el.lf1.cuni.cz/p95053214</a> ) a 19 ( <a href="https://el.lf1.cuni.cz/p57048413/">https://el.lf1.cuni.cz/p57048413/</a> ))         | <b>cerebellum and its pathways</b>            | <b>CMP, trauma, tumor, alcohol intoxication, multiple sclerosis</b> (neurologically: cerebellar syndrome – ataxia, bradykinesia, adiadochokinesia, hypotonia, intention tremor) | Dragged Accuracy, rhythm and tempo of articulatory movements, <b>adiadochokinesia of the tongue</b> Pronunciation: imprecise, <b>occasional articulatory collapses, stretching of vowels</b>  | a harsh, raw voice may be present   | Mostly intact, nasal resonance may be fluctuating  | <b>unreasonable variability of voice power, „chanted" speech</b> , unnatural emphasis on unstressed syllables, words |   |
| type of dysarthria  | lesion  | common underlying disease   | symptoms  |   |  |  |   |
|   |   |   | momentum of articulatory muscles and articulation   | phonation   | reflexes and function of the soft palate, nasal resonance  | prosody  | swallowing  |
| <b>Extrapyramidal-hypokinetic</b> (video 20 ( <a href="https://el.lf1.cuni.cz/p19034612/">https://el.lf1.cuni.cz/p19034612/</a> ) a 21 ( <a href="https://el.lf1.cuni.cz/p71029811/">https://el.lf1.cuni.cz/p71029811/</a> )) | <b>basal ganglia, extrapyramidal pathways</b> | <b>Parkinson's disease, parkinsonism</b> (neurologically: tremor, rigidity, bradykinesia, hypokinesia)  | Reduced speed and range of motion Pronunciation: <ul style="list-style-type: none"><li>▪ <b>palilalia</b> – sudden repetition of words, phrases</li><li>▪ <b>„short barks“</b> – a rapidly spoken amalgamation of several words separated by pauses</li></ul>           | rough, low-slung, breathable, <b>quieter, trembling voice</b> , most patients show laryngeal dysfunction  | <b>Limited soft palate elevation</b> , ten percent of patients show <b>signs of hypernasality</b>  | <b>Monotony, fluctuating pace of speech, sometimes very accelerated</b> – tachyphemia                                | <ul style="list-style-type: none"><li>▪ significantly <b>prolonged oral phase</b> of food intake</li><li>▪ delayed involvement of the swallowing reflex → <b>aspiration</b> (it may not be obvious - without aspiration pneumonia and other external conspicuousness)</li><li>▪ possible restriction of pharyngeal peristalsis</li><li>▪ the possibility of esophageal hypomotility</li></ul>   |
| type of dysarthria  | lesion  | common underlying disease   | symptoms  |   |  |  |   |
|   |   |   | momentum of articulatory muscles and articulation   | phonation   | reflexes and function of the soft palate, nasal resonance  | prosody  | swallowing  |
| <b>Extrapyramidal-hypokinetic</b> (video 22 ( <a href="https://el.lf1.cuni.cz/p33016010/">https://el.lf1.cuni.cz/p33016010/</a> ) a 23 ( <a href="https://el.lf1.cuni.cz/p85002209/">https://el.lf1.cuni.cz/p85002209/</a> )) | <b>basal ganglia, extrapyramidal tracts</b>   | <b>Sydenham's chorea, Huntington's chorea, ballismus, dystonia, athetosis, focal dyskinesia</b>   | <b>Chorea: hypotonia and involuntary movements</b> of the articulatory muscles, dragged retention of tongue protrusion Pronunciation: unexpected articulatory collapses <b>Dystonia, athetosis: uncoordinated</b> articulatory movements, <b>unpredictable</b> mistakes | <b>Chorea: dragged coordination of phonation and respiration</b> , fluctuating volume, sometimes choked voice, lowered voice pitch <b>Dystonia, athetosis: trembling, rough</b> , choked voice, <b>intermittent phonation (convulsion)</b> , fluctuating volume, poor coordination of phonation with articulation | <b>Chorea:</b> over forty percent of patients have <b>hypernasality</b> <b>Dystonia, athetosis:</b> dragged formation of the oropharyngeal closure – <b>unreasonable involuntary movements</b> , a third of patients have <b>hypernasality</b> | <b>Chorea:</b> reduced accent<br><br><b>Dystonia, athetosis:</b> fluctuating dynamics                                | <b>Chorea:</b> significantly impaired oral phase of food intake <ul style="list-style-type: none"><li>▪ <b>risk of aspiration is high</b></li><li>▪ pharyngeal peristalsis may be weakened</li><li>▪ the possibility of esophageal dysmotility</li></ul> <b>Dystonia, athetosis:</b> <ul style="list-style-type: none"><li>▪ the biggest difficulties are <b>in the oral phase</b> of the food intake – difficulty keeping the bite in the mouth due to poor lip closure and difficulty</li></ul> |

|  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  | controlling the bite in the mouth due to involuntary movements |
|--|--|--|--|--|--|--|--|

**Mixed dysarthria is caused by lesions of more than one system, e.g. central-peripheral type (in ALS), cerebellar-central (in multiple sclerosis), cerebellar-central-hyperkinetic (in Wilson's disease), cerebellar-central-peripheral (in olivopontocerebellar atrophy), hypokinetic-central-cerebellar (in progressive supranuclear palsy).**

### Examination

For the diagnosis of dysarthria, at least an indicative assessment of the patient's speech in the areas of**respiration, articulation, phonation, nasal resonance and prosody** is essential. Because dysarthria is often associated with a swallowing disorder (however, it often occurs in combination with aphasia!!), **it is also necessary to roughly examine swallowing** (more detailed examination in Table 6). The detected symptoms will help us to more accurately determine the location of the lesion and thus to diagnose the underlying disease (see table 5).

**Respiration** – we evaluate in silence and during speech. We note the frequency of breaths, their depth, the regularity of breath, the method of breaths (through the nose, mouth) and possible stridor. We evaluate the length of the phrase uttered in one breath.

**Articulation** – we evaluate not only the symmetry and primary mobility and strength of the articulatory organs (lips, tongue, jaw, soft palate), but also the ability of diadochokinesis and the articulation of continuous speech (we also note facial expressions, facial symmetry).

**Phonation** – we evaluate the ability to put on and hold the voice and control its pitch and strength. In case of uncertainty regarding the etiology of dysphonia or aphonia, we recommend consulting with an ENT doctor. It is not only a diagnosis of possible paresis of one or both vocal cords or dysphonia of another etiology (tumor, trauma, psychogenic origin, etc.), but also a differential diagnosis of spastic dysphonia as focal dystonia from a more serious neurological disease.

**Resonance** – increased nasal resonance („open mumbling“), which often occurs in dysarthria, means a pathological leakage of air through the nose during the articulation of non-nasal sounds (Czech nasals are only M, N, Ň). It is usually caused by insufficiency of the oropharyngeal closure, for example, in paresis of the soft palate (central, peripheral) or in other neurological diseases (myasthenia gravis, extrapyramidal disease, etc.).

**Prosody** – by prosody we mean dynamics (the ability to change the pitch of the voice in speech), rhythm (observing the length of syllables), phrasing (dividing the speech into sentence sections using pauses and melody), stress (differentiating the force of the syllable of a word or beat) and tempo.

**Swallowing** – incorrect evaluation of the swallowing state can lead to an immediate threat to the patient's life due to aspiration or to a significant deterioration of his health status due to malnutrition or dehydration. The cranial nerves V. , VII., IX., X., XI., a XII. are involved in the correct course of the complex act of swallowing. Therefore, damage to any of the above nerves can cause a swallowing disorder. It has been repeatedly proven that neurologically ill patients are at a very high risk of so-called silent aspiration (the patient aspirates without coughing or other visible signs of inhaling a mouthful) due, among other things, to impaired sensitivity in the upper part of the aerodigestive tract.In a large proportion of patients who aspirate, aspiration is not diagnosed during routine clinical examination! If a swallowing disorder is suspected, it is therefore advisable to initiate a videofluoroscopic examination (i.e. a special fluoroscopic examination of the act of swallowing, which from the analysis of the dynamic recording enables a detailed analysis of the preparatory, oral and pharyngeal phases of swallowing, allows 100% exclusion of aspiration, subject to compliance with certain standards, and further enables the quantification of some symptoms; the results of the examination are essential for planning subsequent swallowing rehabilitation). If X-ray workplaces lack this technical equipment, it is necessary to carry out a routine X-ray examination of the act of swallowing, which at least excludes or confirms the imminent risk of aspiration. A possible alternative to videofluoroscopy is a videoendoscopic examination of the act of swallowing, which is performed at some ENT departments.

| The investigated area | Method of examination   |
|-----------------------|---|
| articulation          | <ul style="list-style-type: none"> <li>▪ <b>masticatory muscles (n. V. ):</b></li> </ul> <p>assessment of jaw <b>symmetry</b> (in the case of a unilateral lesion of the lower motor neuron (DMN), the deviation of the jaw to the same side as the lesion, in the case of a bilateral lesion of the upper motor neuron (HMN), chewing movements are severely limited) <b>examination:</b> opening, pressing the jaws against resistance, lateral movements of the jaws against resistance, rotational movements of the jaws</p> <ul style="list-style-type: none"> <li>▪ <b>facial muscles (n. VII.):</b></li> </ul> <p>assessment of face <b>symmetry</b> (asymmetry in one half of the face – DMN lesion on the same side) <b>examination:</b> forehead furrowing, eyebrows, tightly pursed lips, smile, clenching of teeth, pursed lips, pulling the corners of the lips down, rapid alternation of pout and smile</p> <ul style="list-style-type: none"> <li>▪ <b>tongue muscles (n. XII.):</b></li> </ul> <p>assessment of <b>the appearance and symmetry at rest</b> (in the case of a unilateral DMN lesion, atrophy, fasciculation and twisting of the tongue to the side of the lesion) and <b>while crawling</b> of the tongue (in the case of a unilateral DMN lesion, atrophy, fasciculation and twisting of the tongue to the side of the lesion, in the HMN lesion, the tongue twists to the side opposite to the lesion, in the case of a bilateral lesion, the patient does not curl the tongue at all), assessment of <b>muscle tension</b> (in DMN lesion weakened, in HMN lesion increased to spasticity) <b>examination: observation</b> of the tongue at rest, during protrusion and retraction, displacement of the tongue with the spatula to the sides and upwards (evaluation of tone), moving the tip of the tongue to the right/left corner (if successful, try to repeat these movements in rapid succession), elevation of the tongue behind the upper incisors or the upper lip when the jaw is open, arching the back of the tongue in the mouth, circling the tongue around the lips when the jaw is open Complex articulation: interview with the patient or a request for rapid repetition of syllables „pa-ta-ka“ or „na-mi“</p>  |
| phonation             | <ul style="list-style-type: none"> <li>▪ <b>muscles of the larynx (n. IX. a X., XI.):</b></li> </ul> <p>a DMN lesion causes complete vocal cord paresis on the same side as the lesion, complete vocal cord paresis due to HMN lesion is very rare <b>examination:</b> prolonged phonation of „Ä“ (shorter phonation time than 15 sec is pathological), we will ask to sing a song or a scale, about changing the strength of the voice („siren“), by counting from one to 100</p>  |
| nasal resonance       | <ul style="list-style-type: none"> <li>▪ <b>muscles of the soft palate (n. V. , IX., X.):</b></li> </ul> <p>assessment of <b>symmetry</b> of the palatal arches at rest, evaluation of symmetry and elevation during phonation, when eliciting a gag reflex (with a lesion of the HMN, the gag reflex is evoked or even hyperevoked, even though elevation of the soft palate during phonation is important, with a lesion of the DMN both the ability of the gag reflex and the elevation of the palate during phonation are important), however, beware of overestimating the gag reflex! – even patients who have it recollectable may be at risk of aspiration! – see swallowing <b>examination:</b> prolonged and repeated phonation of „Ä“, examination of the gag reflex, evaluation of the degree of nasal timbre of the voice - Gutzmann's A-I test: the patient alternately pronounces a pair of sounds "A-I" with the nostrils open and closed - with physiological nasal resonance, there should be no audible difference between the sound of the sounds with the nostrils open and closed</p>   |
| swallowing            | <ul style="list-style-type: none"> <li>▪ <b>qualitative examination:</b> <ul style="list-style-type: none"> <li>▪ function evaluation of <b>n. V. , VII., IX., X., XI., XII.</b> (see above) – when a deficit is detected, it is necessary to consider a swallowing disorder</li> <li>▪ watch out for silent aspiration - if a swallowing disorder is suspected, we recommend a <b>videofluoroscopy" or at least a common X-ray examination of the act of swallowing!</b></li> <li>▪ assessment <b>sensitivity in the mouth, on the soft palate' (on the m. palate are trigger points for triggering the swallowing reflex) and the posterior pharyngeal wall</b></li> <li>▪ <b>indicative evaluation of the course of the oropharyngeal phase of swallowing:</b> we lightly spread the fingers of one hand on the patient's neck (index finger under the chin, middle finger on the tongue, ring finger on the thyroid cartilage, little finger under the thyroid cartilage) and ask the patient to swallow - for correct swallowing, it is necessary to feel the <b>movement of the tongue</b> (index finger), <b>jasylums, distinct elevation and advancement of the larynx</b> (the whole process - the beginning is signaled by the movement of the tongue - should not last more than 1, max. 2 seconds)</li> <li>▪ evaluation of voice quality immediately <b>after swallowing and after several deep breaths after swallowing</b> – if a „gurgling voice“, is heard, a mouthful, liquid has entered the airways above the vocal cords!</li> </ul> </li> <li>▪ <b>quantitative examination:</b> <ul style="list-style-type: none"> <li>▪ <b>Swallowing Volume Test (SVT):</b> have the patient drink water in one gulp (<b>men 30 ml, women 20 ml</b>).A healthy person should be able to swallow this amount at once. In case of failure ask the patient to try again. Explain to the patient that he does not need to worry about choking, if he is unable to swallow the given amount of water at once, the water will automatically be divided into several sips. Note any abnormalities - concerns about swallowing, coughing, runny nose, mouth...</li> <li>▪ <b>Swallowing Speed Test (SST):</b> ask the patient to fluently without interruption drink a glass of water. The norm is <b>10 ml/s</b>. Note abnormalities - drinking takes too long, cough, runny nose...</li> </ul> </li> </ul> |

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Author's note: nsome patients are examined in the videos with tasks or modifications of tasks from the Czech experimental version of the test A. Kertesze Western Aphasia Battery (New York, 1982). This version of the test was used by the author based on verbal permission of P. Kulišťák, the tutor of the Czech translation.