

ATAXIC DISARTHRIA

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ABSTRACT

On the basis of phonetic and experimental-phonetic study of cerebellum or ataxic disarthria three syndrome variants related to local lesion of (1) cerebellum vermis, (2) intermediate and lateral cerebellum zones, (3) right cerebellum hemisphere, have been singled out.

It is well known that local lesion of the cerebellum and its conductive systems cause disorders in the fluency of speech and prosody. Furthermore, speech becomes slurred [1,2,3,4,5,6,7]. Instrumental phonetic studies of disarthria which began in the middle of the 20th century have dealt mostly with cerebellum or ataxic disarthria. According to the data obtained [5], it is characterized by the following symptoms (in order of their diminishing significance): inaccurate consonant articulation; excessive or weak prominence of stressed syllables; irregular slurred speech, vowel distortion, a shrill voice, increased sound and pause duration, voice monotony, even voice loudness and slow tempo of speech.

Our study of cerebellum disarthria was carried out with patients of three nosological groups. They comprised 5 sclerosis disseminata patients, 6 patients with local neurosurgical cerebellum diseases and 6 patients with degenerative cerebellum diseases. The total number of defective speech reactions studied was 8,039. Speech investigation included the data obtained using the auditory method of phonetic analysis as well as the results of experimental phonetic study of speech using oscillography and intonography (The instrumental part of the investigation was carried out in the Laboratory of Phonetics, headed by A.P. Belikov in Maurice Torez Institute of Foreign Languages.). The patients were given the following tasks: to prolong vowels, to reproduce string of CV syllables, rhythmic syllabic structures with different stressed syllable positions, sense-groups of different communicative types and sense-groups with different logical stress positions. Our observations confirm the data, according to which cerebellum disarthria is caused by the same phenomena of adiadochokinesia, dismetrics, asiner-gia and intentional tremor that are observed in extremities motor disorders. Speech discoordination is one of the most perceptible symptoms of local cerebellum deficiency.

First of all note should be made of speech tension which is an outcome of discoordinate work of certain muscles, when simultaneous innervation of agonists and antagonists takes place and when on the

contrary, functional sinergists don't work simultaneously. Typical of discoordination causing speech tension are cases of syllable prolongation and simultaneous unchanged or even increased syllable reduction.

Motor speech discoordination involving time delay in switching the innervation of certain muscles over to the innervation of the antagonistic ones (adiadochokinesia) brings about slowing down of speech tempo. It is easily perceived by ear and becomes more obvious in experimental phonetic studies. There are also regular instances of speech monotony when all speech segments are pronounced in averaged voice register; insufficient loudness variations, when all the segments are equally loud or equally low; averaged vowel tambre accompanied by low degree of contrastivity between A-, И- and У- vowels in word stressed positions; absence of, or on the contrary, excessive reduction of unstressed syllables and absence of tempo variations.

Defective prosody make the speech of cerebellum patients slurred, not articulate enough, i.e. disarthric. Disprosodic slurred speech is most characteristic of sclerosis disseminata patients and those with systemic degenerative cerebellum diseases. Sometimes it was registered in spontaneous speech, sometimes in reading texts, but more often in special phonetic tasks.

The results of our research make us doubt if slurred and disarthric speech in local cerebellum lesion necessarily involves brain stem structure lesion.

A characteristic symptom of cerebellum disarthria is failure in speech fluency which is generally termed as "scansion". Scansion (Lat. "scando" - measured speech) denotes metric recitation with verse emphasized rhythmic structure [8,9]. But can we say that cerebellum patient speech resembles recitation and is measures? Their similarity seems to be rather vague: abnormal speech has no metric organization, its hypermetric prominent elements are irregular, they are marked by discord and a variable set of the means used (sometimes it is duration, sometimes loudness, sometimes pitch, voice quality or a combination of several means). Therefore, defining cerebellum speech as "scansion" is not correct.

Prosodic disorders make cerebellum speech phonetically non-normative. Non-normative features are first of all traced in quantitative characteristics of prosodic parameters that are not appropriate for the given situation: increased duration of stressed and unstressed syllables in rhythmic structures, increased vowel and consonant duration, a higher

degree of loudness and melodic expressiveness of speech, etc. These disprosodic features, especially when in discord with each other (e.g., syllable duration increases with a simultaneous increase in its qualitative reduction) make the speech not only tense and not distinct enough, but also abnormal in view of the given speech situation and context. Secondly, cerebellum discoordination can lead to a situation when prosodic parameters of phonetic units no longer correspond to the aim of the speech act. When asked to reproduce a string of equally stressed syllables in a maximum fast tempo the patient arranges them in rhythmic structures; trying to reproduce an affirmative sensegroup the patient uses a wrong melodic structure and changes it into an affirmative one; using melodic means of sense emphasis instead of dynamic ones the patient distorts the logical structure of the utterance. Taking into account the prosodic disorders described above, we can single out three variants of cerebellum disarthria. Most significant for the first variant was tense and slurred speech accompanied by voice tremor in pronouncing continuant vowels, a low degree of loudness though without scansion. The patients found it more difficult to repeat phonetic tasks after the investigator rather than to perform the task with the help of a speech instruction. The degree of disarthria worsened considerably in ortho-clinostatic test: the results of all the tasks were worse in sitting position and even more so in standing position as compared to lying position. This first variant of disarthria was most vivid with a female patient with cerebellum vermis lesion (the group of patients with degenerative cerebellum and conductive systems diseases). The second variant of cerebellum disarthria was registered in the majority of degenerative cerebellum cases and sclerosis disseminata cases that are caused by a bilateral deficiency in intermediate and lateral cerebellum zones. First and foremost the syndrome brought about disorders in speech fluency (syllable - to syllable and scandent speech) which were accompanied by slow tempo of speech, frequent increase in voice loudness and inaccurate production of Russian prosodic norms. The patients were worse at repeating neurophonetic tasks, made more errors than in performing the tasks when assisted with a speech instruction. Disarthric syndrome worsened under ortho-clinostatic test conditions. The third variant of cerebellum disarthria observed in our material, was typical of the neurosurgical group of patients with unilateral lesion of the right cerebellum hemisphere which is functionally related to dominant left hemisphere of the cerebrum. It was revealed in slow, slurred, tense, syllable-to-syllable, monotonous speech. No intention in the prolongation of vowels was observed. Speech loudness was often normal. The characteristic feature was the use of prosodic speech norms. The patients were better at repeating the phonetic tasks than at their realization according to the speech instruction, which made these patients significantly different from those of variants I and II. Ortho-clinostatic tests yielded negative results. There are grounds to believe that this variant of cerebellum disarthria is caused by deficiency in the lateral zone of the right cerebellum hemisphere. Affecting the motor programmes of the secondary as-

sociative praxic cortex, generalization of which are formed under the influence of language phonetic norms, pathological cerebellum affects of this kind cause particularly severe prosodic disorders in spontaneous speech. These disorders diminish when the patient produced an utterance trying to imitate the investigator's speech patterns. In all the three groups of patients task complication aggravated disarthric disorders. In utterances of automatic character as in counting to 20, week days enumerating and so on, motor speech ataxia was observed only with 3 patients; in reciting, characterized by regular prosodic structure, motor speech ataxia was more frequent (8 patients) though had a mild form; In reading and retelling prosaic texts where the prosodic structure is less regular, motor speech ataxia had a higher degree; in experimental-phonetic tasks performing motor speech ataxia had the most severe form and was registered with 15 patients out of the 17 examined.

The variants of cerebellum disarthria outlined in our investigation and the structural - functional considerations discussed call forth a further accumulation and analysis of the factual material. However, we can say even at present that phonetic and experimental studies contribute to the diagnosis of cerebellum local lesion and widen our knowledge about the cerebellum functions.

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