

## CASE REPORT

**A Case of unilateral upper motor neuron dysarthria evaluated with JIN dysarthria test**

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Dysarthria is caused by abnormalities in muscle movement regulation in vocalization and speech organs. These abnormalities are caused by disorders in the central nervous system that involves breathing and vocalization/ articulation, resulting in the breakdown of speech language (Hirose, 2001). To understand the clinical implication of dysarthria, it is necessary to classify the dysarthria type based on the causative disease, to identify and isolate the symptoms from the subject's problems, and to provide appropriate evaluation and training (Luria, 2009).

Neurologically, spastic paralysis typically appears due to bilateral damage of the corticobulbar tract, and the associated articulation disorder is called spastic dysarthria (Darley, 1975). In recent years, however, unilateral damage to the corticospinal tract has been found to cause dysarthria, classified as unilateral upper motor neuron (UUMN) dysarthria, which is different from spastic dysarthria (Endo, 1986). UUMN dysarthria is characterized with mild articulation disorders, and the core symptom is the sound distortion corresponding to the impaired vocalization organ. In addition, UUMN dysarthria patients often show consonant inaccuracy/ irregularity in the auditory impression, mild hoarseness, mild nasalization, and abnormal prosody. Regardless of bilateral or unilateral injury, the core problem of upper motor neuron disorders is still spastic paralysis. When we evaluate subjects with UUMN dysarthria, we should have perspective view how spastic paralysis affects the subject's speech.

This paper reports dysarthria subject with hemiplegia due to cerebral infarction. Among several vocal articulation tests used to evaluate dysarthria in clin-

ical settings in Japan, the JIN Version of Dysarthria Test (JIN Dysarthria Test) (Doseki, 2020) was used. The test has been improved to be more bias-free than other tests, and the content of the test is made as objective as possible. The JIN Dysarthria Test is composed of the two parts; 1) vocal test that observes articulation, voice, and prosody, and 2) voice organ test that observes the movement and sensation of voice organs. The test items are limited to those necessary for speech, in order to reduce the burden on the subject. Items of each sub-test are evaluated on a 5-point scale, and the vocalization test can numerically evaluate pronunciation accuracy and overall conversation. The process of each dysarthria evaluation is simplified, and thus considered suitable to identify core problems of the subject.

In this study, we evaluated a dysarthria case with hemiplegia due to cerebral infarction using JIN Dysarthria Test for vocalization and speech organ movements, to clarify the relationship between core problems and the symptoms of the subject.

**CASE**

The subject is an 86-year-old right-handed male with Master's Degree in Education. He was a university faculty member until 65 years old and has retired. He lives with his wife in his house and activities of daily living is independent. The cognitive function was 27/30 points with Mini Mental State Examination-Japanese version.

He felt difficulty in speaking and writing, and spilled food when he was 84 years old. Two days after, his wife found the subject collapsed at the entrance of the house and he was transported to a

hospital by emergency, and he was diagnosed cerebral infarction due to cardiogenic cerebral embolism. He had his right hemiplegia and dysarthria in admission.

Two months later, when he was ready to returning home, he felt weakness in his left lower limb and could not climb the step at the entrance, so his wife requested an emergency and was administrated. He underwent various tests, but the obvious cause of his weakness was not found by brain imaging, and he was diagnosed as transient ischemic attack (TIA) and was given conservative fluid infusion treatment. His left weakness improved, and he became in the same condition as before hospitalization without any obvious paralysis. He has been currently discharged and receiving exercise and speech-language therapy at home. The JIN Dysarthria Test was performed about 2 years after the first onset his TIA attack.

## EVALUATION

In the vocal articulation test, distortions and weakening of plosives and nasal sound were observed in words, short sentences, and paragraph readings. Moreover, hypertonic utterance was present throughout the articulation test. In the voice test, the voice was quiet and the pace was slightly slow. The voice quality was rough hoarseness and strained hoarseness. The rhythm was monotonous and lacked sharpness. The maximum vocalization time was 17 seconds, but hoarseness was observed. In the prosody test, the rhythm was disturbed even when it was possible within 6 seconds. During the articulation test, the utterance was hypertonic as a whole, but the over-strain was alleviated during free conversation.

With the voice organ test, the lips and tongue were significantly atrophied, and decreased tension suitability, reduced range, deviation, and difficulty in motor segregation of lips and tongue were observed. Furthermore, the vocalization organs were generally overstressed, as indicated in the articulation tests. With the coordinated movement test, several movements were slightly weak, including saliva swallowing, sucking movement, throat clearing, and tongue tapping. The sensory test was normal.

The results of the tests indicated that pronunciation accuracy was stage 5 (no problem) and conversation was 26/35 points as an overall symptom, which was stage 3 (sometimes modulated/occasionally disturbed).

## DISCUSSIONS

The findings from the test of the subject showed almost no mistakes in articulation in speech, but the subject presented with hypertonic during tasks such as reading aloud and repeating. Voice/prosody showed decreased voice volume, decreased speech speed, strained hoarseness, and rough hoarseness. Moreover, articulation organ movement test revealed reduction of range, deviation, difficulty in separation movement, etc., showing the characteristics of spastic paralysis. Based on these findings, the subject was diagnosed as UUMN dysarthria.

UUMN dysarthria is defined by unilateral damage to the corticobulbar tract and, the core problem of the patient is spastic paralysis, like spastic dysarthria. Spastic paralysis manifests as central motor paralysis, with increased muscle tone and unusually high resistance when passively exercising muscles or muscles groups. As a point of interest, flaccid paralysis, considered to be the opposite of spastic paralysis, is likened to peripheral motor paralysis, but there is an essential difference between the two. Peripheral motor paralysis is often quantitative paralysis, whereas central motor paralysis is qualitative paralysis. In peripheral motor paralysis, symptoms are caused by muscle weakness due to flaccid paralysis, which is the core problem of the patient. It is important to rely on qualitative judgment rather than quantitative judgment. Therefore, for patients with UUMN dysarthria, it is essential to analyze how spastic paralysis affects each speech symptom and vocalization organ. Mere analysis of symptoms may not be sufficient. More importantly, it is essential to clarify how much speech intelligibility and naturalness affect speech intelligibility.

In this case, pronunciation accuracy was maintained, but overall conversation integrity was reduced, and it was considered that speech and prosody disorders were the primary symptoms rather than articulation, which is represented as the intelligibility. This was derived from the fact that the JIN Dysarthria Test can compare symptoms with objective indicators and numerical values. In conventional tests, speech intelligibility and naturalness are subjective evaluations, which is why there are variations among testers (Doseki, 2020). However, in the JIN Dysarthria Test, it is possible to compare numerical values for speech intelligibility as pronunciation accuracy, and naturalness and abnormalities as conversational as a whole. From there, we can reach a more essential problem of the patient. When this case was analyzed from this point, it was considered that spastic paralysis, which

is a central problem, had a background and had a clear effect on vocalization and organ movement. The subject showed few mistakes in articulation in terms of vocalization. As unilateral motor paralysis has almost no effect in articulation (Nishio, 2006), the results of the JIN Dysarthria Test of the subject objectively proved that the pronunciation accuracy (speech intelligibility) was judged to be “no problem.” Organ movements also showed deviation, range reduction, and difficulty in separation movements, but they were not considered to affect the aforementioned articulation. In contrast, voice/prosody disorders such as strained, rough hoarseness, decreased voice volume, and decreased speech speed were conspicuous, and the JIN Dysarthria Test showed that overall conversation (naturalness and abnormality) was “occasionally modulated/sometimes disturbed.” In other words, even if it was a unilateral injury, the effect as spastic paralysis is definitely appearing. Through the results of the JIN Dysarthria Test of this case, it is suggested that the core problem of UUMN dysarthria is a disorder of voice and prosody.

## CONCLUSIONS

With the JIN Dysarthria Test of this case, it was possible to objectively determine that the most influential factor in the unclear utterance of UUMN dysar-

thria was the whole conversation; that is, the degree of naturalness and the degree of abnormality. It was therefore suggested that hypertonia caused by spastic paralysis, which is the core problem of this type, may affect speech and prosody disorders. It was also found that, even if the muscle tone was increased during the movement of the vocalization organ, there was almost no effect on the vocal articulation.

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