Clinical Case Report

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Verbal auditory agnosia in a patient with traumatic brain injury

A case report

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Abstract

Rationale: Verbal auditory agnosia is the selective inability to recognize verbal sounds. Patients with this disorder lose the ability to understand language, write from dictation, and repeat words with reserved ability to identify nonverbal sounds. However, to the best of our knowledge, there was no report about verbal auditory agnosia in adult patient with traumatic brain injury.

Patient concerns: He was able to clearly distinguish between language and nonverbal sounds, and he did not have any difficulty in identifying the environmental sounds. However, he did not follow oral commands and could not repeat and dictate words. On the other hand, he had fluent and comprehensible speech, and was able to read and understand written words and sentences.

Diagnosis: Verbal auditory agnosia

Intervention: He received speech therapy and cognitive rehabilitation during his hospitalization, and he practiced understanding of verbal language by providing written sentences together.

Outcomes: Two months after hospitalization, he regained his ability to understand some verbal words. Six months after hospitalization, his ability to understand verbal language was improved to an understandable level when speaking slowly in front of his eyes, but his comprehension of verbal sound language was still word level, not sentence level.

Lessons: This case gives us the lesson that the evaluation of auditory functions as well as cognition and language functions important for accurate diagnosis and appropriate treatment, because the verbal auditory agnosia tends to be easily misdiagnosed as hearing impairment, cognitive dysfunction and sensory aphasia.

Abbreviations: dB = decibels, DTI = diffusion tensor image, FSIQ = full-scale intelligence quotient, ICH = intracerebral hemorrhage, K-MMSE = Korean version of Mini Mental State Exam, K-WAB = Korean version of the Western Aphasia Battery, K-WAIS-IV = Korean Wechsler Adult Intelligence Scale-IV.

Keywords: aphasia, auditory agnosia, deafness, traumatic brain injury, verbal auditory agnosia

1. Introduction

Auditory agnosia is a rare neurological symptom that defined as the defective recognition of auditory stimuli in the situation of preserved hearing and language functions.[1,2] The auditory agnosia consists of 3 different forms.[1] Verbal auditory agnosia is defined as a selective reduction in the recognition of verbal sounds.[3] Nonverbal auditory agnosia is defined as a selective reduction in the recognition of nonverbal sounds.[4] Also a generalized auditory agnosia is defined as selective reduction in both nonverbal and verbal sounds.[1] These symptoms may be difficult to separate from each other, because these symptoms substantially overlap.[1,5]

Usually, patients with bilateral lesions in the auditory cortex, auditory radiation, or medial geniculate body can manifest auditory agnosia.[6] However, to the best of our knowledge, there was no report about verbal auditory agnosia in adult patient with traumatic brain injury. Here, therefore, we report a verbal agnosia patient caused by epidural and subdural hemorrhage in right temporoparietal convexity and intracerebral hemorrhage of left temporal lobe. The family of patient was informed that data concerning the case would be submitted for publication, and they provided consent. This case was approved by ethics committee of our hospital (Institutional Review Board of Daegu Fatima Hospital).

2. Case

A 65-year-old right-handed male was admitted to neurosurgery department with head injury that occurred from falling. He was diagnosed with epidural and subdural hemorrhage in right

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Figure 1. (A–C) Computed tomography (CT) and T2-weighted magnetic resonance images showing epidural and subdural hemorrhage in the right temporoparietal convexity (arrowhead) and intracerebral hemorrhage of the left temporal lobe (arrow). CT = computed tomography.

temporoparietal convexity and intracerebral hemorrhage (ICH) of left temporal lobe (Fig. 1). He had no history of previous hearing or cognitive impairment, and no chronic disease, such as diabetes and hypertension. Despite the traumatic ICH, the consciousness and vitality signs were stable, so he was treated without surgery. Three weeks after being injured, he did not show any definite motor weakness and only had difficulty walking and balancing when he was transferred to rehabilitation department for more rehabilitation. However, he did not follow oral commands and could not repeat and dictate words. On the other hand, he had fluent and comprehensible speech, and was able to read and understand written words and sentences. And he also has respond to environmental sounds. In the evaluation of the auditory function, he was able to clearly distinguish between language and nonverbal sounds, and he did not have any difficulty in identifying the environmental sounds such as, laughing sounds, music, a baby crying, instrumental sounds (piano, clocks, telephone ring), and an animal crying (cat, dog, cow, horse, pig, bird). Although brainstem auditory evoked test revealed hearing loss below 50 decibels (dB), the result could not fully explain the patient's symptoms when considering the age of the patient. He said that verbal sounds were heard in a disagreeable noise, a "buzzing," including pure tone signals.

In the evaluation of cognition, he obtained a score of 5/30 on Korean version of Mini Mental State Exam (K-MMSE) through verbal communication. In the evaluation of language function with Korean version of the Western Aphasia Battery (K-WAB), he had severe deficits in auditory comprehension (0/200) and repetition (8/100), but there showed good spontaneous speech (17/20) and naming (83/100) and relatively conserved reading (61/100) and writing (76/100) abilities.(Table 1) According to his K-WAB test results, he was diagnosed with Wernicke's aphasia, but it was not typical. His language impairment differed from Wernicke's aphasia in naming, reading, expression, and spontaneous writing. Therefore, auditory comprehension subtest was performed again by writing, and he received a score of 161/200. In addition, He received a score of 22/30 on the K-MMSE test and a full-scale intelligence quotient (FSIQ) score of 82 on Korean Wechsler Adult Intelligence Scale-IV (K-WAIS-IV) test through written communication (Table 1). Therefore, we concluded that he had no severe cognitive dysfunction and hearing impairment, and his language impairment was different from Wernicke's aphasia. Then, he was diagnosed as verbal auditory agnosia with mild cognitive impairment due to traumatic brain injury. He received speech therapy and cognitive rehabilitation during his hospitalization, and he practiced understanding of verbal language by providing written sentences together. Two months after hospitalization, he regained his ability to understand some verbal words. Follow-up language function test with K-WAB was performed by usual methods, not in writing, and there were some improvements in auditory comprehension (38/200) and repetition (10/100). Six months

Table 1

Results of Korean version of Mini Mental State Exam (K-MMSE), Korean version of the Western Aphasia Battery (K-WAB), and Korean Wechsler Adult Intelligence Scale-IV (K-WAIS-IV).

	Initial examination		Follow-up examination
	By verbal communication	By written communication	By verbal communication
Subsets of K-WAB			
Spontaneous speech	17/20		18/20
Auditory comprehension	0/200	161/200	38/200
Repetition	8/100		10/100
Naming	83/100		92/100
Reading	61/100		78/100
Writing	76/100		80.5/100
K-MMSE	5/30	22/30	
FSIQ on K-WAIS-IV		82	

FSIQ = full-scale intelligence quotient, K-MMSE = Korean version of Mini Mental State Exam, K-WAB = Korean version of the Western Aphasia Battery, K-WAIS-IV = Korean Wechsler Adult Intelligence Scale-IV.

after hospitalization, his ability to understand verbal language was improved to an understandable level when speaking slowly in front of his eyes, but his comprehension of verbal sound language was still word level, not sentence level.

3. Discussion

The nonverbal and verbal sounds are accepted and recognized in the following order; the outer and middle ear, cochlea, cochlear nerve, auditory pathway of the brainstem, inferior colliculus of the midbrain, medial geniculate body, auditory radiation, and auditory cortex in the cerebrum.[6] However, auditory agnosia has also been reported following unilateral damage to the primary auditory cortex, although it typically caused by damage of the bilateral superior temporal lobe.[1] In our case, it is also likely that traumatic ICH in the left temporal lobe is thought as a major cause of verbal auditory agnosia. However, it could be possible that since there was epidural and subdural hemorrhage was occurred in right temporoparietal lobe, the auditory agnosia that occurred by the bilateral auditory pathways were finally involved. Considering recent studies which reported that the secondary pathway in the right hemisphere rather than the left might have played a role subconsciously in music sounds,[7] the conserved hearing ability of musical sounds in our case patients suggests that the damage of the left hemisphere is more likely to be the main cause of auditory agnosia than the right side. However, patient did not agree with diffusion tensor image (DTI), we could not identify the definite location of damaged auditory pathway in brain hemisphere.

In the human brain, there are 2 auditory pathways; the primary auditory pathway and the secondary auditory pathway.[1] The primary auditory pathway is related to auditory perception, whereas the secondary auditory pathway is related to maintaining nonspecific auditory perception and arousal. In patients with verbal auditory agnosia, the secondary auditory pathway probably contributes to hearing but it is not absolutely necessary for auditory perception. So, the explanation for verbal auditory agnosia is that there is damage of the primary auditory pathway, but not the secondary auditory pathway.

In patients with verbal auditory agnosia, it has been reported that perception training with familiar musical sounds could be applied.[1,8] This training method suggests that rhythmic and musical sounds can be used as a treatment method for patients with verbal auditory agnosia who have a preserved secondary auditory pathway despite the injured primary auditory pathway.[1,6,8]

Collectively, this case gives us the lesson that the evaluation of auditory functions as well as cognition and language functions important for accurate diagnosis and appropriate treatment, because the verbal auditory agnosia tends to be easily misdiagnosed as hearing impairment, cognitive dysfunction and sensory aphasia.

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