The Social Sciences 10 (5): 566-570, 2015
ISSN: 1818-5800

Semantico-Phonological Disorders in Patients with Wernicke's Aphasia

Elena Anatolyevna Gorobets, Ravza Ekzamovna Kulsharipova and
Nailya Zufarovna Lotfullina
Kazan Federal University, 18 Kremlyovskaya Street, Kazan, Russia

Abstract: The study presents the neurolinguistic analysis of semantic disorders caused by the specific perception of addressed speech by the patients with Wernicke's aphasia provoked by stroke. The sample of patients included 14 people (8 men and 6 women, aged 45-69) with dominant left hemisphere. All of them had lesions (caused by strokes) in Wernicke's area according to the data of MRI. The research was conducted during the acute period. The disorders were revealed by analyzing spontaneous dialogues with patients on matters of their everyday life and with the help of conversation analysis. The baseline neurocognitive tests (Mini-Mental State Examination, Montreal Cognitive Assessment) were used to exclude general cognitive impairment. The research was conducted at the Department of Neurology No. 1 in the Republic Clinical Hospital No. 2 (Kazan, Russia); this hospital is a clinical base of Kazan Federal University.

Key words: Fluent aphasia, receptive aphasia, Wernicke's aphasia, semantic-phonological disorders, speech disorders, stroke, high frequency words, low frequency words, echolalia

INTRODUCTION

Aphasia causes a number of important problems in various spheres. Problems with language significantly decrease the quality of life and the development of detailed diagnostics and rehabilitation is really urgent. This is especially important in the case of aphasia provoked by strokes because the number of strokes grows very fast; besides, it gradually becomes the illness of young people. Aphasia appears in 25-30% cases of strokes.

The research aims to analyze semantic disorders caused by difficulties of oral speech perception in patients with receptive (Wernicke's, fluent or according to Luria's classification which is more frequently used in Russia-sensory) aphasia.

The receptive aphasia is usually connected with lesions in Wernicke's area the posterior section of the superior temporal gyrus in the dominant cerebral hemisphere. It is named after Carl Wernicke, a German neuropsychiatrist, who found a link between this area and the type of speech disorder when a patient who has not lost his hearing can not understand oral speech of other people.

The topical diagnostics with the help of new methods of neuroimaging showed that the area responsible for the perception is possibly located more broadly in the temporal lobe and sometimes even in the Broca's area. The problem of topical diagnostics is also closely connected with the dominant hemisphere. If the right hemisphere is used for language (f-MRI; functional Magneting Resonance Imaging, one of the most evidential methods of neurovisualization shows that it is very individual in different people), the lesions in the Wernicke's area in the left hemisphere may not influence the understanding of addressed oral speech at all or influence it only a little (Maeshima *et al*., 2004; Koivisto and Laine, 2000). Besides, it has several times been mentioned that the right hemisphere helps to convey the acoustic form of words and their semantics as an acoustic gestalt, excluding the intermediate phases of decoding.

The sample of patients with Wernicke's aphasia or its elements included 14 people (8 men and 6 women, 45-69 years old) with dominant left hemisphere. All of them had had strokes and had lesions in Wernicke's area according to the data of MRI. The research was conducted in the acute period. All patients were Russian-speaking monolinguals and according to their close relatives, they hadn't had any problems with speaking and understanding before the stroke. None of the patients from this sample had hearing problems in the period of interview or had had them before stroke.

The disorders were revealed by analyzing spontaneous dialogues with patients connected with their everyday life. The conversation (a qualitative

Corresponding Author: Elena Anatolyevna Gorobets, Kazan Federal University, 18 Kremlyovskaya Street, Kazan, Russia

methodology for the analysis of naturally occurring speech produced in everyday interaction) is applied in research and treatment of patients with aphasia (Beeke *et al*., 2007). To exclude general cognitive impairment we used neurocognitive tests: MMSE (Mini-Mental State Examination) and MoCA (The Montreal Cognitive Assessment).

The research was conducted at the Department of Neurology No. 1 in the Republic Clinical Hospital No. 2 (Kazan, Russia); this hospital is a clinical base of Kazan Federal University.

CORRELATION OF THE ACOUSTIC AND SEMANTIC IMAGES IN SPEECH WITHOUT PATHOLOGIES

According to the doctrine of F. de Saussure, the sign is a harmonious unity of acoustic image and concept, i.e., the signifier and the signified. In linguistic semiotics, the word is the basic sign in the process of communication the decoding of the meaning from the acoustic image happens somewhat automatically. It is possible to say that the particular set of sounds prompts the correct category.

As a rule, native speakers, due to their cognitive experience can successfully implement this lexico-semantic operation; they can also represent the nomination which corresponds to the acoustic image. When the speech centers indistinctly control the correspondence of the sound and its semantic, a person can fail in understanding speech addressed to him/her.

In the language itself, there is a well-known principle of the asymmetric dualism of the linguistic sign (the idea of S.O. Kartsevsky, Geneva linguistic school). The sign and its meaning correlate with each other but their areas don't cover each other fully.

Each sign is a result of a cross of two thought phenomena. The signifier and the signified are always modified in different contexts of reality; each of them tries to exceed its limits which pushes forward linguistic evolution.

As a result in the unity between form and content, a specific violation of this correlation occurs. The phonological form of a word gives a different reflection, because it may be identical or practically identical in its sounding. Norman and Flinta describes this mechanism with the help of language game description. These linguistic facts are interesting for the interpretation of the dynamics of cognitive experience as well as speech specificity of alexithymic patients (Esin *et al*., 2014).

In the situation of pathological speech, these facts can show the primacy of certain associations in comparison with the stereotypical or normalized. Speech centers produce the reflection, according to the phonation (such mechanisms are actively used in poetic speech for instance, the effect of paronymic attraction).

The scientists of Kazan linguistic school described the phenomenon of word phonemography which shed light on the reflection of the semasiologic view of the person through the audio circuit of the words. Similar phonations evoked in the human mind a fairly wide range of possible nominations with regard to the life experience of the personality and his/her verbal associative lexicon. It also showed the concepts that were closer and familiar to him/her because they came as the first reaction.

IRRELEVANCE OF THE ACOUSTIC AND SEMANTIC IMAGES IN PATIENTS WITH WERNICKE'S APHASIA

The specific of low frequency words and high frequency words recognition: The linguistic analysis of the mistakes that people make in their oral speech shows that they have lost the capacity to identify the lexical units. In most cases, they can understand only parts of phrases and words with different degrees of perversion.

Spoken word production has been researched frequently (Laganaro *et al*., 2013; Goldrick and Rapp, 2007; Walker and Local, 2013). The sign, according to Kartsevsky, includes two opposite centers of semiologic functions. One of them unites formal meanings, the other is connected with semantics. The patients with sensor aphasia usually don't have problems with the former center but the process of sign recognition stops in the semantic centre.

If the question or the sentence contains the words or syllables that are alike in some aspects, the meaning of high frequency words is being lost in the stream of addresses speech. Example no. 1:

- (What did you have for breakfast?)
- (But how, how… I don't know what I ate tomorrow (Patient male, 64 years old)

The words zavtra (tomorrow) and zavtrak (breakfast) have practically the same pronunciation but the context (What did you have for) predicts the word zavtrak not zavtra which is obvious for all Russian-speakers. The patient understands that he cannot know what he will eat tomorrow but he doesn't recognize the frequently used word zavtrak in the standard context and doesn't percept the preposition before it. The disorders of correlation between the acoustic image and the semantic image produced by it are evident. There is a certain

correlation here (and we cannot say that the patient does not perceive the information at all or that he is absolutely unable to find a meaning in addressed words) but it is not correct.

In some cases, the patient recognizes a high frequency word in place of a less frequent one. It happens when the reaction to the acoustic image in the patient's cognitive experience is more usual. Example No. 2:

- Did you do it by accident?
- (surprised) No. I'm not a teapot (Patient O., male, 58 years old)

The word nechayanno was acceted by a patient as ne chaynik. These words have two syllables ne chay in common and the patient recognizes a kitchen utensil where he should have perceived a more abstract word. Example No. 3:

- Is this your pajamas?
- I'm not Zhanna. My name is… (Patient female, 54 years old)

The word pizhama contains the combination of sounds which patient recognized as one of the syllables in proper female name Zhanna. Example No. 4:

- Well, I felt dizziness… I knew that I should call… for help but…
- Did you become confused?
- Not, I didn't become confused. No, I was at home. I haven' had such a problem yet to get lost… (Patient G., male, 55 years old)

The words rasteryalis and poteryalis have different prefixes with different meaning. The patient doesn't percept this detail.

Sometimes high frequency words are replaced with low frequency words. Example No. 5:

- Don't you feel dizziness?
- What? Once again…

The interviewer repeats his question:

- I can't understand… what… puddle? What is it puddle?
- Not puddle, dizziness. Don't you feel dizziness?
- No, no, I can't understand what I should… (Patient Ch., male, 61 years old)

The low frequency word may appear in anomalous form the patient tries to understand the meaning but he doesn't remember a particular grammar form or type of word formation. Example No. 6:

- You've got a higher education. And what institute did you graduate from? (The patient doesn't answer)
- Did you study at the institute?
- Why a prostitute? I'm a mother, a wife, I'm married… all my life… no. (Patient R., female, 45 years old)

Unexpectedly, the patient doesn't get the word institute a high frequency word but she instead understands it as prostitute-a low frequency word.

At first glance, it seems rather strange that the patient is able to recognize the low frequency word luzhitsa from the context that he doesn't understand in general but he is not capable to perceive and understand the high frequency word kruzhitsya. Nevertheless, there are works which describe such situations. For instance, Hoffman *et al.* (2011) present the results of the test they gave to two patients with aphasia (the type of aphasia is not defined but the patients had a significant semantic deficit) caused by stroke. The researchers came to the conclusion that low frequency words are connected with one or two associations, they are rather concrete and high frequency words are associated with plenty of signs different contexts and thus, it is more complicated to get their meaning because even in the undamaged brain these words sometimes can invite plenty of contexts and meanings.

We agree with this explanation and with this statement and the examples described above prove it. Luzhitsa and prostitute are low frequency words, they have rather narrow semantic connections; just on the contrary, kruzhitsya and institut are high frequency words used in different contexts and they cause semantic problems in patients with receptive deficit.

Echolalia (echophrasia, repetitional responces): In some cases, we can see a manifestation of echolalia (echophrasia, repetitional responses) which is often observed in patients with sensor aphasia. There is a considerable amount of research calling for more detailed investigation of echolalia, especially in the sphere of clinical linguistics (McCarthy and Warrington, 2001). Echolalia can be the manifestation not only of receptive aphasia but also of the autistic spectrum, Hungtington disease, frontotemporal dementia etc. As such, echolalia stands for uncontrolled repetition of words and phrases told by other people, often without clear understanding of their meaning. Example No. 7:

- What book is it?
- Vase, book, vase, book…
- Tell me, please, what book is it?
- It is a book… book… book… (Patient G., male, 63 years old)

The patient does not understand the question and tries to repeat the last words of the phrase in the way he was able to distinguish them. He does not understand the meaning of vas (pronoun) and of the very frequent speech token Chto eto za which means kakoj (what). This example contains not only echolalic features. The position of vas and za causes vocalization which makes the phonation that is very similar to the phonation of vasa: vas za, vasa.

It is very difficult to differentiate between normal repetition and pathological echoing. For instance, sometimes patients may repeat the interviewers' words because they are too weak and stressed to answer immediately and in the process of repetition they have extra time for thinking. At least, they are able to produce an adequate answer. The indicators of pathological echoing are the following: the patient doesn't give an answer even after several repetitions; the patient neither changes the person of verbs nor uses the appropriate pronouns. Example No. 8:

- How did you get here?
- You get here
- How did you get here, to the hospital
- Here to the hospital
- How old are you?
- How old are you… How old are you… How old… omelet, omelet… (Patient U., female, 69 years old)

It seems that the patient repeats the words absolutely without understanding. It becomes obvious when she begins to repeat omlet, omlet in spite of the fact that at first she repeated the question in a right way. She doesn't change the person of verb (popali vmesto popala) and uses vam instead of mne.

One of the patients was able to distinguish separate words from the addressed speech and she didn't want to concentrate in order to understand the whole context. She thought out the residual part and answered the question practically immediately. She was sure that she understands everybody's speech and became rather annoyed when the interviewer offered her language tests. Example No. 9:

- Please, look at the picture and tell me what is to the right of the wardrobe
- What is it, what is it, for, what for? I can, I can describe this picture very well. I can't see anything difficult here. I can describe [it], I can
- That is good. Please, tell me what is to the right of the wardrobe
- Well, I say: wardrobe. A wardrobe is here, here it is. I can do it, I understand everything, something is wrong with my head, with my head but I am not out of my mind, am I? (Patient M., female, 64 years old)

The interviewer wrote his request and gave it to the patient. She read the instruction very quickly and showed the things which were to the right of the wardrobe.

The patient's relatives noticed that she didn't understand them well and besides, she even didn't want to listen attentively, because she was absolutely sure that she understood everything.

Then the interviewer offered this patient two internationally acclaimed neurocognitive tests: MMSE and MoCA in order to differentiate the problems of patient with cognitive impairment (Esin *et al*., 2014). The patient coped with all tasks that weren't connected with perception of speech (she didn't listen to the instructions but read them in the test; she drew the clock absolutely correctly; she wrote a grammatically correct sentence, she named the animals well, etc.).

CONCLUSION

Semantic-phonological disorders in patients with sensory aphasia are explained by the abnormal correlation between the acoustic and semantic image. The patients receive the addressed speech but they don't interpret the signs in a right way. The interaction between phonological processes and semantic processes is corrupted.

The spontaneous speech of 10 patients was fluent, grammatically correct and contained almost no phonemic paraphasia but their answers to the questions given by interviewers were very poor. The four patients had several motor problems (agrammatical speech, phonemic paraphasia, permutations).

The speech of four patients was characterized by prominent echolalia and there were several features of it in three patients.

The degree of word frequency influences the result of perception. In some cases more common words are recognized easier. Just on the contrary, frequent words can be replaced with low frequency words even if they are absent in the speaker's phrase. It happens because the number of semantic connections of rare words is limited, so they come to the patient's mind quicker, even if the context is not suitable.

The violation in the correlation of phonological and semantic images from the standpoint of general linguistics can be explained by the asymmetric dualism of the linguistic sign which is seen more apparently in the pathological speech than in normal speech.

ACKNOWLEDGEMENT

The researchers is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

REFERENCES

Beeke, S., J. Maxim and R. Wilkinson, 2007. Using conversation analysis to assess and treat people with aphasia. Seminars Speech Lang., 28: 136-147.

Esin, R., E. Gorobets, N. Tokareva, R. Karimullina, I. Khairullin and L. Mingazova, 2014. Diagnostic criteria for dementia, moderate and mild neurocognitive disorders in neurological patients: Linguistic parts of baseline neurocognitive tests. Proceedings of the SGEM Conference on Psychology and Psychiatry, Sociology and Healthcare, Education, September 3-9, 2014, Bulgaria, pp: 121-128.

Goldrick, M. and B. Rapp, 2007. Lexical and post-lexical phonological representations in spoken production. Cognition, 102: 219-260.

Hoffman, P., E. Jefferies and M.A.L. Ralph, 2011. Remembering zeal but not thing: Reverse frequency effects as a consequence of deregulated semantic processing. Neuropsychologia, 49: 580-584.

Koivisto, M. and M. Laine, 2000. What is right and what is left in semantic processing: A reply to Chiarello. Laterality: Asymmetries Body Brain Cognit., 5: 29-33.

Laganaro, M., G. Python and U. Toepel, 2013. Dynamics of phonological-phonetic encoding in word production: Evidence from diverging ERPs between stroke patients and controls. Brain Language, 126: 123-132.

Maeshima, S., A. Osawa, Y. Nakayama and J. Miki, 2004. Transcortical sensory aphasia following infarction in the left frontal lobe. Eur. Neurol., 52: 125-128.

McCarthy, R.A. and E.K. Warrington, 2001. Repeating without semantics: Surface dysphasia? Neurocase, 7: 77-87.

Walker, G. and J. Local, 2013. On the intersection of phonetic detail and the organization of interaction: Clinical connections. Clin. Ling. Phonetics, 27: 770-783.