

The effect of bilingualism on the severity of aphasia in people after stroke in the acute stage

(overview essay)

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Abstract: *If an individual premorbidly controls one of the languages better, one would expect that this difference would be reflected in the degree of impairment of these languages. We call this pattern parallel healing, and it works this way for many patients. For this reason, it was determined that the aim of the research is to describe the influence of bilingualism, diglossia of the “Po nashymu” dialect on the degree (severity) of aphasia after a stroke (CVA) in patients in the acute stage.*

Material and method: *The research is quantitative in nature. The standardized MASTcz screening test was used for data collection, which is freely available for download on the Brno University Hospital website (Aphasia Screening: MASTcz – Brno University Hospital, 2008). The research sample consists of 22 people who are in the acute stage after a stroke. 8 people are bilingual, 14 people are monolingual.*

Results: *Bilinguals do not achieve a higher average score in the total language index (CJI) of the MASTcz test than the control group. Bilinguals show a higher average age (76.5) at the onset of CVA than monolinguals (69.14), but this difference is not statistically significant. MAST performance decreases with increasing age, correlation is weak, negative, statistically significant difference not confirmed due to small sample size.*

Discussion: *The research was inspired by the study of Paplikar (2019), which is based on the assumption that bilingualism results in better cognitive outcomes in patients after CVA. He hypothesizes that this protective effect is due to lifelong use of two languages and switching between them, suppressing the potential competition of another language during production. The results of our research did not statistically significantly show that less severe degrees of aphasia develop in bilingual people in the acute stage after CVA than in monolingual people, but bilingual people showed a higher average age at the onset of CVA than monolingual people. The results were greatly influenced by the insufficient number of probands and also by their disproportionate distribution.*

Keywords: *aphasia, bilingualism, stroke, acute stage*

1 Introduction

According to Grosjean (2019, p. 15), bilingualism is defined as “the use of two or more languages (or dialects) in everyday life”. Since linguists are not able to completely differentiate dialect and language, we estimate that there are roughly 6000–7000 languages in the world (Lachout, 2017). Experts are mainly interested in individual bilingualism, when an individual uses another language in addition to the language of the majority society (Morgensternová, 2011). The opposite of individual bilingualism is social or collective bilingualism, which is defined by Lachout (2017) as a phenomenon where a speaker in a certain society and in one area is constantly interacting with multiple languages. Morgensternová (2011) states that the term diglossia is also used for social bilingualism, which originally refers to two forms of the same language. Today it is also used in the meaning of two languages used in society for a different function. According to her, an example can be, for example, Welsh, which is used in a family environment and a circle of friends, but in formal contacts English is preferred. According to Kropáčová (2006), an example of diglossia in our country is the “Po nashymu” dialect, which some residents even consider their mother tongue (Bogoczova, 1993), for example written Czech and colloquial Czech are not considered bilingual. For this reason, diglossia “Po nashymu” became the subject of our research.

1.1 Bilingualism and the aging process

Studies hypothesize that, due to the cognitive benefit, bilingualism provides a delay in the onset of dementia in old age. In connection with this phenomenon, there is talk of the so-called cognitive reserve (Bialystoková, Baracová 2019), which represents the plastic properties of the brain at the molecular, cellular or network level, which are activated in response to the stressors of aging or pathology, while preserving cognition (McQuail, 2021). Bialystok (2007) investigated the effect of lifelong bilingualism on maintaining cognitive functions and delaying the onset of dementia symptoms in old age. The bilingual group showed symptoms of dementia up to 4 years later on average, in contrast to the monolingual individuals. Borsa (2018) and his colleagues investigated that a greater amount of (daily) exposure to a second language will naturally lead to a more frequent requirement to control potential interference from competing languages, thereby increasing the performance of cognitive control. The more we switch between languages, the more likely we are to mitigate the effects of classical aging.

1.2 Bilingualism and aphasia

If an individual premorbidly has a better command of one of the languages, one would expect that this difference would also be reflected in the degree of impairment of these languages. We call such a formula parallel healing and it works in this way for a number of patients (Kuzmina, 2019). However, it is not the only formula for recovery. Albert Pitres (1896, in Fabbro, 2001a) described, first in his publication on bilingualism and aphasia, the following recovery patterns:

- **parallel**, where both languages recover simultaneously;
- **selective**, when both languages are affected, but only one returns to its original state;
- **gradual**, where the first language improves before the second, and gradual, where the second language improves before the first. This diversity stems from the complex structure of the multilingual language system, which is shaped by a complex interplay of influencing factors such as age of language acquisition, frequency of language use, premorbid knowledge, and linguistic similarity between languages (Kuzmina, 2019).

There are also other types, such as antagonistic recovery, where at first only one language is available, but after the other begins to recover, the first gradually disappears. This process can be repeated several times within 24 hours and is then referred to as alternating antagonism (Paradis, 2004). There is also a mixed recovery. It mixes elements from different languages within one sentence and individuals also resort to pathological switching (Fabbro, 2001b). Word mixing occurs mainly to avoid word retrieval difficulties for multilingual people with aphasia (Goral, 2019). Pitres' gradual recovery could be likened to differential, where one language recovers much better than the other relative to premorbid fluency. Either the language that was used the least before the injury recovers best or recovers to a greater extent than expected (Paradis, 2004). According to a meta-analysis by Kuzmin (2019), there are significant differences between early and late bilinguals. Specifically, late bilinguals who acquired their second language after the age of seven showed significantly better overall performance in the L1 than in the later acquired language. In contrast, early bilinguals who acquired their languages before the age of seven showed comparable results in both languages. Furthermore, this study confirmed more frequent, significantly better preservation of L1 compared to L2.

2 Research objectives

The aim of the research is to describe the influence of bilingualism (diglossia of the “Po nashymu” dialect) on the degree (severity) of aphasia in people after a stroke in the acute stage.

As part of the research objective, the main hypothesis was established: In bilingual persons in the acute stage after CVA, less severe degrees of aphasia develop than in monolingual persons.

After studying the theoretical starting points and based on the goal of the research, hypotheses were drawn up.

Hypotheses:

H1: Bilingual persons with aphasia achieve better results on the total language index of the MAST test than monolingual persons with aphasia.

H2: Bilingual persons with aphasia have a higher average age at onset of CVA than monolingual persons with aphasia.

H3: The age of the proband affects the overall language index in the MASTcz test in the acute stage.

3 Material and methods

The research is quantitative in nature. The standardized MASTcz screening test was used for data collection, which is freely available for download on the Brno University Hospital website (Aphasia Screening: MASTcz – Brno University Hospital, 2008). The Mississippi Aphasia Screening Test (its Czech version) is used to examine disorders of phatic functions. It was primarily developed as a rapid diagnostic tool in the acute stage of the disease, the administration of which should take between five and ten minutes (Obereignerů, 2017). This test detects aphasia, alexia and agraphia already in the initial phase of the disease. Before the actual testing, we must find out and fill in anamnestic data such as name, surname, year of birth, education, date of onset of the disorder, health restrictions that can distort the examination, etc. (Cséfalvay, Košťálová, 2013).

3.1 Research set

The research group consists of a group of bilingual persons with aphasia and one control group of monolingual persons with aphasia in the acute stage. A total of 9 women and 13 men with a total average age of 71.82 years and an average length of education of 11.31 years participated in the survey (see table 1). The aim of the research was to describe the extent to which bilingualism and other variables (gender, age and education) influence aphasia arising in persons after CVA. Only people with

CVA as the cause of aphasia were selected. Furthermore, the maximum duration of the presence of the fault was determined, i.e. that only persons with aphasia in the acute stage were selected, i.e. in an intensive care unit or inpatient ward of a hospital. Outpatients were excluded. Another exclusion criterion was a history of neurodegenerative disease in persons with aphasia. The geographical area of data collection was defined on the Czech-Polish border, specifically the regional area of Těšín. Bilingual persons were defined as individuals who use the Czech language and another language in their family environment or when speaking with a close circle of people. In the area defined by us, it is most often Polish and the dialect “Po nashymu”. In order to avoid disputes about diglossia in the case of dialect, it was ascertained whether the proband attended, for example, a school with Polish as the teaching language.

Table 1: *Charakteristics of Research set*

	Number (men/women)	Age Φ/ $\tilde{x}$ (min – max)	Number of years of education	CJI Φ/ $\tilde{x}$ (min – max)
Set	22	71.82 / 71.5	11.31 / 12	44.36 / 48
	13 / 9	(42–90)		(2–98)

3.1.1 Research set of bilingual persons

The research sample consists of 8 people, of which there are 4 men and 4 women, with an average age of 76.5 years, with a minimum age of 63 and a maximum of 90 (see table no. 2). The average duration of education was 10.87 years, when 8 persons had completed primary education, of which 1 person completed their education in secondary school without a high school diploma and 4 people with a high school diploma. As a second language, the probands indicated the dialect “Po nashymu” (they completed their basic education at a Polish elementary school).

Table 2: *Charakteristics of the biligual set*

	Number (men/women)	Age Φ/ $\tilde{x}$ (min – max)	Number of years of education
Set	8	76.5 / 79	10.87 / 10.5
	4 / 4	(63–90)	

3.1.2 Control set

The control group consists of a total of 14 monolingual persons with aphasia, of which 9 are men and 5 are women (see table no. 3). The average age of these probands is 69.14 years, with a minimum age of 42 years and a maximum of 87 years. The average

duration of education was 11.92 years, when 3 people completed only primary education, 8 people completed secondary education without a school diploma, 3 people completed secondary school with a school diploma, and of this number, 1 person with a university education.

Table 3: *Charakteristics of the Control set*

	Number (men/women)	Age $\Phi/\tilde{x}$ (min – max)	Number of years of education
Set	14	69.14 / 69	10.57 / 12
	9 / 5	(42–87)	

3.2 Organization and course of research

The research was carried out in the period from the beginning of May 2021 until January 2022 at the Třinec Hospital (funded organization), and Karvinská mining hospital (Join-stock company) in the neurological ICU department, the neurological department and the rehabilitation department. The testing always took place in the form of an examination with the MASTcz test under the guidance of clinical speech therapists. The implementation of the research took place in the researcher’s free time or during the semester practice, which was carried out at the research site. Testing time for both monolinguals and bilinguals took approximately 10–15 minutes. Data collection was affected by government measures due to the Covid-19 pandemic, which prevented testing in some hospital wards and thus limited the research sample.

3.3 Data evaluation methods

The resulting values from the MASTcz test were entered into an Excel table and then evaluated in the statistical program RStudio. Non-parametric tests (Mann-Whitney test, Kruskal-Wallis test, Spearman rank correlation coefficient) and descriptive statistics were used to evaluate the data.

3.4 Ethical aspects of research

The research took place at the Třinec Hospital, f.o. and Karvinská hornické hospital, j.s.c., where the approvals of hospital management were requested in advance to permit and enable research. In this research, the protection of all processed personal data was ensured.

4 Results

Since the data do not follow a normal distribution, non-parametric tests are used. The level of statistical significance was set at 0.05.

4.1 Testing of hypothesis

H1: Bilingual persons with aphasia achieve better results in the overall language index of the MASTcz test than monolingual persons with aphasia.

By the degree of variability, we monitor the similarity and difference between the two monitored groups, which is described in graph no. 1. Group 1 refers to monolingual persons with aphasia and group 2 refers to bilingual persons with aphasia. According to numerical table no. 4, we see that the average and median CJI scores of both groups are different and speak rather in favour of monolingual people.

Graph 1: CJI score values of the bilingual and monolingual group

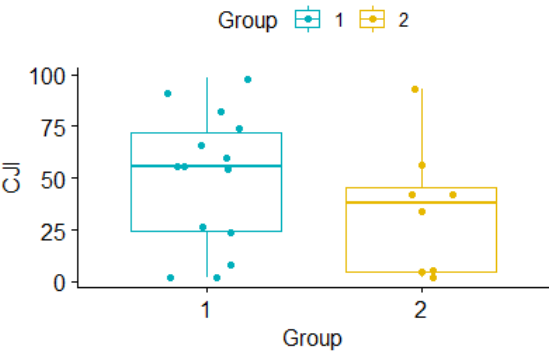


Table 4: Hodnoty CJI skóre

	Minimum	Maximum	Median	Average	Standard deviation
CJI monolingual persons	2.00	98.00	55.50	49.86	32.39
CJI bilingual persons	2.00	93.00	38.00	34.75	31.29
CJI whole group	2.00	98.00	48.00	44.36	

To verify the hypothesis H1, we used the Mann-Whitney U-test, when the values $U = 71.5$, $Z = -1.0255$ and the probability value $p\text{-value} = 0.3051$, which means that it is greater than 0.05 and there is no significant statistical difference between the tested groups in overall performance in the MASTcz test.

H2: Bilingual persons with aphasia have a higher average age at onset of CVA than monolingual persons with aphasia.

In graph no. 2 and in table no. 5 we can observe the distribution of age values of both groups, where group 1 again represents monolingual individuals and group 2 bilingual individuals.

Graph 2: *Age of bilingual and monolingual persons*

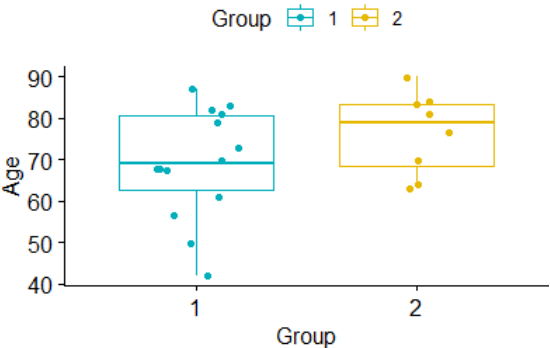


Table 5: *Age values of the bilingual and monolingual group*

	Minimum	Maximum	Median	Average	Standard deviation
Monolingual group	42	87	69	69.14	13.1
Bilingual group	63	90	79	76.5	12.37

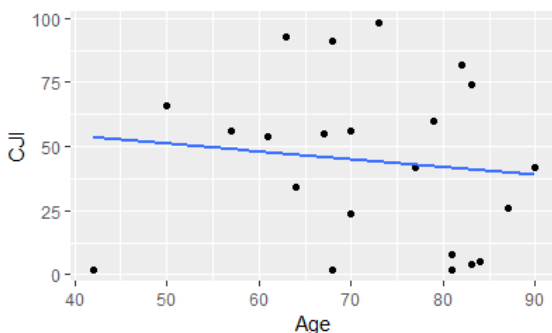
We used non-parametric U-test methods for testing and the following values were found: $U = 37.5$ and $Z = 1.2299$. From this result we can conclude that the probability value $p\text{-value} = 0.2187$ and is therefore greater than 0.05 – the level of significance. It means that we cannot reject the null hypothesis or confirm the alternative hypothesis because the difference between the two groups in the mean age is not statistically significantly different.

H3: The age of the proband affects the overall language index in the MASTcz test in the acute stage.

When testing this hypothesis, we used the non-parametric test Spearman’s rank correlation coefficient. From the calculations, we found the value of the coefficient $r_{sp} = -0.16$ and the probability value $p\text{-value} = 0.4754$. We can speak of a negative or even downward weaker correlation between the two variables. On dot graph No. 3,

we can observe this very small decrease in performance with increasing age, which is not statistically significant, however.

Graph 3: *Effect of age on the overall language index*



5 Discussion

The topic of the influence of bilingualism on aphasia has been addressed by several studies in the world in recent years. Our work is originally inspired by the Indian research of Paplikar (2019), which is based on the assumption that bilingualism results in better cognitive outcomes in post-CVA patients. He hypothesizes that this protective effect is due to lifelong use of two languages and switching between them, suppressing the potential competition of another language during production. This study differs from previous research in that it does not relate to migration, which may be a confounding factor. In total, 38 bilingual and 27 monolingual patients were tested. They had to meet the requirement that at least 3 months had passed since their CVA (the final average was 11.5 months). Addenbrooke's Cognitive Examination – Revised (ACE-R), validated for use in local languages and for different levels of education, was used to assess the performance of language areas and other cognitive functions. After taking into account confounding variables such as age, gender, education, etc., the results of the two groups were compared. The severity of the ACE-R language subtest score was significantly higher in monolingual patients compared to bilinguals (7.0 vs. 14.4 when the maximum score was 40, p value = 0.008, effect size = -0.691). Bilingual patients also performed significantly better in attention, memory and visuospatial areas. Another study supporting the fact that the severity of aphasia after CVA is less in bilingual persons was presented by Lahiri (2021). It aimed to analyze the effect of bilingualism on recovery from aphasia in the acute stage after CVA. 155 monolingual and 53 bilingual patients with aphasia were selected in the study, of which 120 monolingual and 43 bilingual patients were finally studied. Inclusion criteria were alertness during testing, literacy, age over

18 years, and native Bengali speakers. Furthermore, the absence of dementia, cognitive impairment affecting language assessment, premorbid psychiatric disorders preventing communication, alcohol and drug abuse, and aphasia as a result of an intracranial lesion. Testing was done using the Bengali version of WAB in the acute stage, specifically 90–100 days after CVA. Severity was assessed by calculating the aphasia quotient (AQ). When analyzing the results, it was found that the bilingual group had better results in terms of patient recovery, and this was the case with subcortical and mixed cortico-subcortical CVAs. With respect to gender, the bilingual group also had better results, especially men.

The aim of the research was to try to describe the influence of bilingualism (diglossia of the “Po nashymu” dialect) on the degree (severity) of aphasia in people after a stroke in the acute stage. Based on the obtained results, we cannot unequivocally confirm or refute our main hypothesis, and thus we are unable to claim that bilingualism has an effect on the degree (severity) of aphasia after a stroke in the acute stage in our research. A limitation was the very small sample size in both groups of the research population. **The main findings of the research include:**

- Bilinguals do not achieve a higher average score in the total language index (CJI) of the MASTcz test than the control group.
- **Bilingual persons show a higher average age (76.5) at the onset of CMP than monolingual persons (69.14), but this difference is not statistically significant, but is confirmed by foreign studies.**
- MAST performance decreases with increasing age, correlation is weak, negative, statistically significant difference not confirmed due to small sample size.

6 Conclusion

In the Těšín region, the “Po nashymu” dialect, which combines elements of the Czech, German, Polish, and Slovak languages, is usually used in everyday communication. In connection with the aging of the population and the frequent occurrence of cerebrovascular accidents, the connection of aphasia with bilingualism seems more and more likely. Although not many experts deal with the topic of bilingual aphasia in our country, it is gaining importance. From a scientific point of view, the study of aphasia in bilinguals can help us clarify the distribution and operation of language functions in the brain, and also shed light on the differences between monolingual and multilingual individuals. The results of our research did not statistically significantly show that less severe degrees of aphasia develop in bilingual people in the acute stage than in monolingual people, but bilingual people have a higher average age at the onset of CVA, which is also supported by foreign studies. The results were greatly influenced by the insufficient number of probands and also by their disproportionate

distribution. The question of further research is the expansion of the research set, by which we could obtain more relevant results.

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