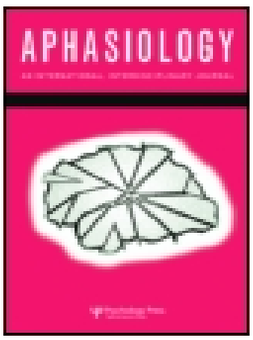

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Post-stroke Aphasia in Spanish language: the effect of demographic variables

Rafael Gonzalez[a], Macarena Rojas[a] and Alfredo Ardila[b,c]

[a]Departamento de Neurología y Neurocirugía, Hospital Clínico de la Universidad de Chile, Santiago, Chile; [b]Institute of Linguistics and Intercultural Communication, Sechenov University, Moscow, Russia; [c]Psychology Doctoral Program, Albizu University, Miami, FL, USA

ABSTRACT

Background: The pattern of post-stroke aphasia in Spanish speakers has not previously been reported. Furthermore, the association between aphasia type and demographic variables is not clearly understood.

Aims: To investigate the incidence and type of aphasia in first-ever acute stroke during the early chronic and later chronic periods in native Spanish speakers and the effect of demographic variables.

Methods & Procedures: Spanish versions of Western Aphasia Battery and Boston Diagnostic Aphasia Examination were used for language assessment. Lesion localization was done by using computerized axial tomography and magnetic resonance imaging. Final simple included 243 (97.98%) right-handed, and five (2.02%) left-handed participants; 143 men and 105 women with a mean age of 58.68 years.

Outcomes & Results: The types of aphasia included – 14.1% Broca's, 15.3% Wernicke's, 10.1% Conduction, 9.3% Transcortical Sensory, 1.6% Transcortical Motor, 28.2% Anomic, 4.8% Global, and 16.5% Mixed non-fluent. Wernicke's aphasia, along with Transcortical Sensory aphasia was more frequently observed in older people. Broca's aphasia was more prevalent but less severe in women than in men. Auditory Comprehension and Naming negatively correlated with age, while schooling positively correlated with Auditory Comprehension. Time since onset did not significantly affect the type of aphasia. Schooling correlated with the severity of Anomic aphasia.

Conclusions: The most common type of aphasia in our sample was Anomic aphasia. Older people had an increased probability to present a fluent type of aphasia. Broca's aphasia was more frequent but less severe in women.

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Aphasia; Spanish language; aphasia severity; western Aphasia battery

Introduction

Controversies in the literature continue regarding the distribution of post-stroke aphasia subtypes (Hoffmann & Chen, 2013). Cross-linguistic differences both in frequency, as well as aphasia clinical manifestations, have been acknowledged in the literature for a long time (Ardila, 2014; Bastiaanse et al., 2011, 1996; Bates & Wulfeck, 1989; Bates et al., 1991; Paradis, 2001).

CONTACT Alfredo Ardila ardilaalfredo@gmail.com Psychology Doctoral Program, Albizu University, 12230 NW 8th Street, Miami 33182, USA

The analysis of aphasia across different languages is not only theoretically important but also clinically relevant. The effect of different demographic variables, including age and gender, has been studied and it has been frequently suggested that the female gender (Sundet, 1988) and older age (Bhatnagar et al., 2002) increase the probability of presenting a fluent type of aphasia. However, a recent view in this context has emphasized the significance of age as a variable rather than gender (Wallentin & Torun, 2018).

Existing literature suggests that education can affect the characteristics and symptoms of aphasia. People with higher education have been observed to suffer less severe aphasia and also tend to recover faster compared to their lower educated counterparts (Connor et al., 2001; González-Fernandez et al., 2011) and increased cognitive reserve in higher educated participants has been proposed as a possible explanation for this finding (Staff et al., 2004). Nonetheless, left cerebral "dominance" remains the rule in both people with higher and lower education (Coppens et al., 1998; Lecours et al., 1987). Some degree of word-finding difficulty and reduction in speech output as well as sizeable production of phonemic paraphasias have been reported in right-stroke illiterate patients by Lecours et al. (1988).

In general, the association between education and aphasia typology remains unsettled in contemporary aphasia literature. Therefore, it would be relevant to further analyze if the level of education indeed has a significant effect on the aphasia symptomatology.

In the present study, we investigated the incidence and type of aphasia in first-ever acute stroke patients who were speakers of the Spanish language. An attempt was also made to explore if age, sex, time since onset, and educational level had any impact on clinical type of aphasia.

Methods

Participants

We assessed and treated the aphasic patients in the Cognitive Communicative Speech Language Pathology Unit at the Clinical Hospital University of Chile in Santiago (*Unidad de Patología del Habla y Lenguaje Cognitiva Comunicativa del Departamento de Neurología y Neurocirugía del Hospital Clínico de la Universidad de Chile*). Our unit receives patients presenting speech and language disorders associated with stroke. We have been collecting aphasic patients for over a period of 11 years (2008–2019). This study was initiated with prior approval from the Institutional Ethics Committee.

In our Unit, there is a database with 1404 entries. We used the following procedure to select the participants in this report: initially, we collected all the patients that were assessed using the Spanish revised version of the Western Aphasia Battery (SWAB-R) (González et al., 2015; translated and adapted to Spanish by; González, 2008), and the Boston Diagnostic Aphasia Examination, Spanish version (SBDAE) (Goodglass, 2005). We found 915 patients with aphasia out of 1404 (65.17%). In a second stage, only those patients having the initial evaluation with the SWAB-R Part 1 were selected (615 patients). Later, only those patients with a vascular etiology were accepted, corresponding to 286/615 entries (46.50%). Finally, the following inclusion criteria were used: (1) adult (>18 years) literate participants with aphasia due to first-ever left hemisphere stroke; (2) conscious (according to WHO definition) at the time of language assessment; and (3) native Spanish speakers. We also used the following exclusion criteria: (1) aphasia caused by intracranial hemorrhage (patients with cerebral hemorrhages were not included to keep the sample relatively homogenous;

frequently, cerebral hemorrhages produce a diffuse and extended effect); (2) pre-morbid psychiatric pathologies; (3) pre-morbid dementia significant cognitive disturbances, congruent with a dementia process; (4) significant non-linguistic cognitive disturbance impairing the language evaluation. From this 286-patient sample, 38 were removed from the study simply because they did not fulfill the inclusion criteria. The final sample for the current study included 248 vascular aphasic patients.

Handedness was determined based on the direct clinical observation and/or a brief questionnaire answered by a close family member or by the patient him/herself, when it was possible. We received 243 (97.98%) right-handed, and five (2.02%) left-handed participants. In our aphasia sample, there were 143 men and 105 women with a mean age of 58.68 years (SD = 15.45). Our participants had a mean level of education of 12.94 years (SD = 4.50), corresponding approximately to high school according to the Chilean education system. The mean time that they were evaluated in average was 6.38 months (SD = 12.63) after the aphasia onset. All the patients had localized strokes according to CT or MRI scans.

Language examination

Two different aphasia test batteries were administered:

(1) The Western Aphasia Battery Revised (SWAB-R), Spanish version. It was used to determine the aphasia severity and we only used four subtests: Spontaneous Speech, Auditory Verbal Comprehension, Repetition, and Naming. An Aphasia Quotient (AQ) is calculated based in these four scores. According to the AQ, aphasia severity is interpreted as follows: 0–25 = very severe, 26–50 = severe, 51–75 = moderate, and 76–above = mild. In our sample, the mean AQ was 59.00 (SD = 30.11).
(2) The Boston Diagnostic Aphasia Examination, Spanish version (SBDAE) (Goodglass, 2005), used in determining the type of aphasia.

Statistical analyses

Initially, the means and SD in the four subtests included in the AQ were calculated. The software IBM SPSS STATISTCS 25 was used. Later, the distribution of the different types of aphasia according to age, schooling, handedness and time since onset were demographic variables we determined. In a further step, Pearson correlations between AQ and the four aphasia subtests with demographic variables was calculated. One-way ANOVA, comparing the associations between different demographic variables on the type of aphasia, was developed in order to find the effect of demographic variables. Finally, AQs for women and men in different aphasia types was established to determine the potential sex effect on the aphasia type.

Results

In our current study, the distribution of the aphasia types was the following: 12 patients (4.8%) Global, 35 (14.11%) Broca's, 38 (15.32%) Wernicke's, 25 (10.08%) conduction, 23 (9.27%) transcortical sensory, 4 (1.61%) transcortical motor, 70 (28.22%) anomic, and 41 (16.53%) mixed non-fluent. No cases of mixed transcortical aphasia (isolation aphasia) were documented. Mixed non-fluent aphasia refers to those patients with a significantly impaired

expressive language and auditory comprehension deficits (below 50%). In Broca's aphasia Auditory Comprehension is above 50%, while in global aphasia Auditory Comprehension is below 25%.

Table 1 presents the scores in the different aphasia subtests of the SWAB-R according to the aphasia type.

Using these four language characteristics (Spontaneous Speech, Auditory Verbal Comprehension, Repetition, and Naming), it is evident that the language profile in different aphasia types is significantly different. Global aphasia appears as the most severe aphasia, whereas Anomic aphasia represents the mildest type of aphasia. Spontaneous speech is best preserved in Conduction aphasia and most affected in global and mixed non-fluent aphasia. Additionally, Auditory Comprehension is relatively well preserved in Broca's, Conduction and Anomic aphasia, while Repetition is good in Anomic and Transcortical Sensory aphasia, but significantly impaired in Global, Mixed, and Wernicke's aphasia. Naming also is particularly impaired in Global, Mixed, and Wernicke's aphasia.

The effect of demographic variables

Table 2 presents the aphasia type distribution according to the demographic variables

Moreover, Wernicke's aphasia, as well as Transcortical Sensory aphasia was more frequently observed in older people. No apparent differences in the distribution, according to the years of education was observed, with the exception of Wernicke's aphasia, appearing in people with relatively lower education compared to the other aphasia types. Because of the limited amount of left-handed participants included in our sample (five), it is not easy to point to any trend in handedness and aphasia; the only types of aphasia observed in our left-handers were Wernicke's and Anomic. Time since onset of aphasia was variable, ranging from 2.62 in Transcortical Motor aphasia to 9.39 in Mixed non-fluent aphasia.

In addition, one way ANOVAs were used to compare the effect of age, schooling, and time since aphasia onset on the type of aphasia. Only age was statistically significant, supporting previous findings that indeed Wernicke's aphasia–as well as Transcortical Sensory aphasia – is observed on average in people older than the aphasia found in younger age groups.

AQ and the four subtests used to calculate it were correlated with the demographic variables (Table 3). Only three correlations were statistically significant: age negatively correlated with Auditory Comprehension and Naming, Schooling positively correlated with Auditory Comprehension.

Gender and Aphasia

AQs were calculated both for men and women and ANOVAs were used to analyze the effect of sex on aphasia; AQs were considered for each type of aphasia. A Tukey's analysis was also performed to determine which differences were significant (Table 4).

The most evident difference between men and women is observed in Broca's aphasia; this type of aphasia appears significantly more severe in men that in women. For the other types of aphasia, the severity is relatively similar.

The most severe type of aphasia was Global aphasia, followed by Mixed non-fluent aphasia. Anomic aphasia appears as the least severe followed by Conduction aphasia. In both women and men, Wernicke's aphasia was more severe than Broca's aphasia and Transcortical aphasia.

Table 1. AQ scores in different subtests according to the aphasia type.

Variables	Whole Sample (248)	Broca's (35)	Wernicke's (38)	Conduction (25)	Transc. Sensory (23)	Transc. Motor (4)	Amnesic (70)	Global (12)	Mixed non-fluent (41)
AQ (/100) (SD)	59.00 (30.11)	68.03 (23.75)	44.80 (18.32)	72.08 (13.27)	62.25 (20.68)	43.83 (34.36)	87.76 (8.42)	4.18 (2.60)	23.06 (13.51)
Spontaneous speech (/20) (SD)	11.47 (6.09)	12.20 (5.56)	10.74 (2.91)	14.12 (2.93)	12.83 (3.20)	6.75 (5.56)	17.07 (1.75)	0.58 (0.51)	3.22 (2.72)
Auditory comprehension (/200) (SD)	145.36 (53.31)	176.20 (17.53)	119.58 (48.98)	172.76 (20.87)	126.13 (49.61)	101.25 (91.96)	185.30 (15.49)	28.25 (25.03)	107.41 (38.89)
Repetition (/100) (SD)	55.46 (37.22)	65.66 (32.28)	29.00 (24.91)	62.92 (22.11)	72.74 (27.58)	63.00 (35.04)	89.34 (11.20)	0.92 (2.23)	14.39 (21.79)
Naming (/100) (SD)	52.17 (36.14)	64.40 (30.56)	27.84 (27.36)	69.88 (19.86)	47.17 (27.66)	38.00 (44.15)	86.10 (13.08)	0.00 (0.00)	15.00 (17.55)

Table 2. Distribution of the different types of aphasia according to demographic variables.

Variable	Broca (35)	Wernicke (38)	Conduction (25)	Transc. Sensory (23)	Transc. Motor (4)	Amnesic (70)	Global (12)	Mixed non-fluent (41)
Age (years) (SD)	56.06 (15.93)	64.00 (15.04)	52.36 (16.72)	66.43 (14.64)	54.25 (11.44)	58.21 (14.26)	57,83 (13,40)	56.66 (15.94)
Schooling (years) (SD)	12.94 (4.50)	10.89 (5.21)	13.52 (4.11)	13.22 (5.06)	13,25 (2.99)	13,31 (4.05)	12,75 (4.37)	13,00 (4.91)
Right handedness (%)	35 (100%)	37 (97.36%)	25 (100%)	23 (100%)	4 (100%)	66 (94.28%)	12 (100%)	41 (100%)
Time since onset (months) (SD)	6.38 (12.63)	5.77 (11.76)	6.41 (9.60)	4.05 (4.27)	2.62 (1.97)	5,47 (12.65)	4,64 (2.50)	9,39 (11.06)

Table 3. Pearson correlation between AQ and the four aphasia subtests and demographic variables.

Variable	AQ	Spontaneous speech	Auditory comprehension	Repetition	Naming
Age	−0.092	−0.052	−0.151*	−0.054	−0.128*
Sex	−0.046	−0.069	−0.007	−.0004	−0.065
Schooling	0.076	0.031	0.130*	0.067	0.098
Time since onset	−0.034	−0.064	0.012	−0.002	−0.043

*p < 0.05; **p < 0.01

Discussion

According to our results, the most frequent type of aphasia was Anomic aphasia, accounting for over one-fourth of the cases. Both Broca's and Wernicke's aphasia individually represented about 15% of the cases. The most infrequent type was Transcortical Motor aphasia. Table 5 compares current results with two previous large aphasia studies: the Copenhagen Aphasia Study (Pedersen et al., 2004), and Kolkata Aphasia Study (Lahiri et al., 2019). The comparison, however, is problematic due to the differences in time since onset. In the Copenhagen Aphasia Study, the most frequent type of aphasia one year after the stroke is also Anomic aphasia. Global aphasia is initially represented in about one third of the cases. In our study, Global aphasia is only about 5%; it should be considered that we included the subtype "mixed non-fluent", probably considered as Global in the other series. In the Kolkata Aphasia Study, Broca's aphasia was extremely frequent, consisting of close to 40% of the total number. Noteworthy, in the three series the very same assessment instrument was used – the Western Aphasia Battery – although we used it only to determine aphasia severity; for classifying aphasia into subtypes we used the Boston Diagnostic Aphasia Examination. It could be hypothesized that the language characteristics may have been at least partially responsible for the differences in aphasia distribution observed in the three studies: the Danish language is a North Germanic language, Bengali (the language in the Kolkata Aphasia Study) is an Indo-Aryan language, and Spanish is a Romance language. However, many other studies would be required to support this hypothesis.

In our study, we found that age was correlated with Auditory comprehension, and, additionally, aphasias with auditory comprehension defects – Wernicke's aphasia and Transcortical Sensory aphasia – were observed in people older than the aphasia found in other age groups. Different studies have suggested that age can be a significant variable in the aphasia type. Code and Rowley (1987), as an example, reported that non-fluent male patients were significantly younger than fluent male patients. We also found that Broca's aphasia patients were younger that Wernicke's aphasia patients. Our results in general support previous reports indicating that the average age in Wernicke's aphasia is higher than in other aphasia types (Ellis & Urban, 2016; Harasymiw et al., 1981; Kertesz & Sheppard, 1981; Obler et al., 1978). Schooling was associated with Auditory Comprehension and correlated with the severity of Anomic aphasia.

The effect of gender on aphasia has been suggested in the aphasia literature. For instance, De Renzi et al. (1980) reported three general conclusions: (1) the frequency of language disorders is similar in males and females; (2) non-fluent aphasia is more frequent in males; (3) patients with Broca's aphasia are younger than individuals with Wernicke's aphasia. Regarding the first conclusion we found that aphasia in general was more frequent in men than in women: 143 men and 105 women. We also found that Broca's aphasia was more frequent in women (18% of the cases) than in men (11% of the cases), yet the severity was

Table 4. AQs for women and men in different aphasia types.

Variables	Broca	Wernicke	Conduction	Transcortical (both motor and sensory)	Amnesic	Global	Mixed non-fluent
WOMEN (n)	(19)	(16)	(6)	(11)	(31)	(5)	(17)
AQ /100 (SD)	78.83 (19.81)	41.55 (20.77)	68.67 (13.45)	60.44 (21.53)	87.42 (10.41)	4.86 (3.10)	23.90 (16.05)
MEN (n)	(16)	(22)	(25)	(19)	(39)	(7)	(24)
AQ /100 (SD)	55.21 (22.00)	47.16 (16.41)	73.15 (13.39)	58.89 (25.11)	88.03 (6.55)	3.69 (2.31)	22.46 (11.72)

Table 5. Distribution (in percentages) of aphasia types in three different studies, based in three different languages: Danish, Bengali, and Spanish ([1] Pedersen et al., 2004; [2]Lahiri et al., 2019). In the Copenhagen Aphasia Study 84 patients were followed up after one year; 33 (39%) did not present aphasia anymore, and only 51 (61%) remained with language difficulties. Sex ratio was the following: In the Copenhagen Aphasia study 112 (42%) of the 270 total aphasia patients were males. In the Kolkata Aphasia Study there were 64 women (31%) and 144 men (69%). In the Santiago Aphasia Study 58% of the patients were men.

	Copenhagen Aphasia Study[1]		Kolkata Aphasia Study[2]	Santiago Aphasia Study
	On admission (n = 203)	One year later (n = 51)	7–14 days (n = 208)	6.38 months ± 12.63 (n = 248)
Broca	12	21.6	38.5	14.1
Wernicke	16	7.8	12.5	15.3
Conduction	5	9.8	1.4	10.1
Trans. Sensory	7	0	3.8	9.3
Trans. Motor	2	2	9.6	1.6
Amnesic/Anomic	25	47.0	4.3	28.2
Global	32	11.8	27.9	4.8
Mixed NF	–	-	–	16.5
Isolation		2	0	1.9

lower in women: AQ was 55.21 in men and 78.83 in women. In a recent meta-analysis, Wallentin and Torun (2018) found 25 studies with a total of 48,362 stroke patients and in a second analysis, data was extracted from an American health database (with over 1,900,000 stroke patients). Both analyses revealed significantly larger aphasia rates in women than in men (1.1–1.14 ratio). When age and stroke severity were included as covariates, gender failed to explain any aphasia rate difference above and beyond that which is explained by age differences at time of stroke. In conclusion, sex does not seem to play a significant role in aphasia type, when large series of patients are examined. Our results suggest sex is a factor affecting the severity of Broca's aphasia, but not really the aphasia distribution.

The effect of handedness on aphasia has been controversial (e.g., Gloning, 1977; Vargha-Khadem et al., 1985). However, most frequently no relationships between handedness and aphasia type has been found (Code & Rowley, 1987). In our sample the number of left-handers was too small to draw any solid conclusion.

In conclusion, the study of aphasia in large samples across different languages can significant contribute to understand the variables potentially affecting both aphasia profile and aphasia severity.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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