

Study on language comprehension in aphasic subjects¹

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Abstract

Introduction: Aphasia is a disorder which stems from cerebral lesion and impairs both language expression and comprehension. **Objective:** to investigate language comprehension in aphasic individuals through the comprehension test battery of Montreal Toulouse Test (alpha version). **Study Design:** A retrospective, descriptive, qualitative-quantitative research involving 60 subjects, ranging from 40-70 years old. Data crossing including comprehension of: spoken words (SWC), written words (WWC), spoken simple phrases (SSPC), written simple phrases (WSPC), spoken complex phrases (SCPC) and written complex phrases (WCPC). **Results:** the higher the SWC, the higher the WWC; the higher the SSPC and SCPC, the higher the WSPC and WCPC and vice versa; comparing spoken and written comprehension: the higher the WC, the higher the PC; the higher the SPC, the higher the CPC and vice-versa; no correlation between age and gender was found. **Conclusion:** the comprehension of simple structures benefits the comprehension of complex structures and the difficulty in the comprehension of simple structures associates with the difficulty in comprehension of complex structures.

Key words: language; comprehension; aphasia.

Resumen

Introducción: La afasia es un trastorno que se deriva de una lesión cerebral y afecta tanto la expresión como la comprensión del lenguaje. **Objetivo:** investigar la comprensión del lenguaje en los individuos afásicos a través de la batería de pruebas de comprensión Montreal Toulouse Test

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(versión alpha). **Diseño del estudio:** este es un estudio retrospectivo, descriptivo y cualitativo-cuantitativo que analiza la comprensión de 60 sujetos, con edades comprendidas entre los 40 y 70 años de edad. Los datos se refieren a la comprensión de: palabras habladas (SWC), palabras escritas (WWC), frases simples habladas (SSPC), frases simples escritas (WSPC), frases complejas habladas (SCPC) y frases complejas escritas (WCPC). **Resultados:** cuanto mayor es la comprensión de SWC, mayor es la comprensión de WWC. Cuanto mayor es la comprensión de SSPC y de SCPC, mayor es la comprensión de WSPC y de WCPC y viceversa; al comparar la comprensión oral y la escrita se ha encontrado lo siguiente: cuanto mayor es la comprensión de WC, mayor es la de PC, mientras mayor sea la comprensión de las SPC, mayor será la de CPC, y viceversa. No se observó relación entre edad y género. **Conclusión:** la comprensión de las estructuras simples beneficia la comprensión de las estructuras complejas y la dificultad para la comprensión de las estructuras simples está asociada con la dificultad en la comprensión de las estructuras complejas.

Palabras clave: lenguaje; comprensión, afasia.

Introduction

Communication is a dynamic process which comprises various dimensions, involving context and subject. Under this perspective, the language brain functioning, audition, speech production, motor coordination of phonoarticulatory organs and laryngeal movements, among other tasks, includes factors which directly affect the viability and quality of the communication.

According to the diagnostic criteria of DSM-IV (APA, 1994), communication disorders, both receptive and expressive, comprise the group of difficulties in the receptive and expressive language which interfere with academic and occupational tasks, as well as with social life. Stemming from cerebral lesion, aphasia is a language disorder which affects, in different degrees, all aspects of language. It is a symptom of a neural-physiological impairment characterized by a cerebral focal lesion and comprehension impairment of all language modalities (Hedge, 2001; Mac-Kay, 2003).

Aphasia impairs the ability to select words to express one's thoughts and, similarly, it also impairs the expression of thoughts through words, and the recognition of words for the comprehension of phrases and paragraphs. If comprehension is affected, reading and listening are likely to be impaired on the same level (Musso et al., 1999).

An aphasic patient may show fluent or non-fluent speech. Non-fluency is characterized by agrammatism, reduction in emission and phonological alterations, whereas fluency shows more evident semantic compromising (Radanovic et al., 2001).

Comprehension may be compromised when there are semantic and morphological alterations of the spoken words (verbs, substantives, pronouns, adjectives, prepositions,

conjunctions and articles) in the ability of reading comprehension of sentences and texts (Radanovic et al., 2001).

Under this perspective, we propose to reflect over the need of a more comprehensive description of the aspects of language comprehension in aphasic individuals, as an indicative factor for a differential diagnosis and rehabilitation prognosis in the realm of aphasias.

Review of literature

The differential diagnosis among the cortical-type syndromes is based on four abilities of language and speech: naming, conversational speech fluency, listening comprehension and word/phrase repetition (Helm-Estabrooks and Albert, 1991).

In a study comprising 192 subjects, the researchers describe frontal lesions and expression aphasia with alterations of syntax, grammar, expressive discourse and reduction in verbal fluency; temporal lesions with more severe impairment of language and alterations in naming, reading, writing and mainly in comprehension; and parietal lesions with major alterations in reading and writing, spatial notion and identification of body parts (Mansur et al 2001).

With the aim of analyzing the performance of normal subjects using Boston aphasia diagnostic test, adapted to Portuguese, focusing mainly on spoken comprehension and its relation with age and schooling, 162 normal and 69 aphasic individuals were analyzed in order to determine scores of word discrimination, word identification, identification of body parts and complex linguistic modifiers, indicative of aphasia in the Brazilian population. Beyond measuring these scores, the authors also concluded that the cultural differences of the population must also be taken into account (Mansur et al., 2001; Mansur et al., 2005).

Some authors cite 3 reasons that make the verification of characteristics of a vascular aphasia difficult: 1. Lack of records on characteristics of aphasia in patients with focal lesion. 2. Evolution of language and precarious testing which fail in distinguishing dysarthria from aphasia diagnoses, Broca or global aphasia. 3. Occurrence and severity of vascular aphasia.

Based on this argument, a study aiming to determine the characteristics of aphasia in its initial phase was carried out. The subjects were evaluated using Montreal Toulouse Test and some Boston sub-tests. Some indicative data were found for global aphasia and with no classification in 50% of subjects, and classical aphasias, such as Wernicke, Broca,

Transcortical and Subcortical less frequently. Regarding the age, patients with ischemic vascular cerebral accident (VAC) history and conductive aphasia were younger and those diagnosed with Subcortical aphasia were older. Gender was not statistically significant. The presence of former VACs was more frequent in aphasia with no classification (Godefroy et al., 2002).

Another study followed the evolution of primary progressive aphasia and reported the occurrence of other syndromes in 49 patients in a 10-year period. Each patient underwent a neurological evaluation every 6 months and a battery of psychological and linguistic tests every 12 months. Among the linguistic tests applied were the verbal fluency test and Montreal Toulouse test, besides a reduced version of the Token test. Six or seven years following the onset of the disease, it was found that the patients lost autonomy and frontal-temporal dementia appeared. The authors cite normal speech fluency and high mini mental rate as signs of autonomy preservation. (Rhun et al., 2005).

Two groups, aphasic and non-aphasic, were compared regarding the data on the VCA etiology, epidemiological characteristics and risk factors, and the occurrence of thrombosis between these groups was verified. The findings were: higher age in aphasic patients in comparison with non-aphasic, no correlation between gender and incidence, severity or fluency; a higher occurrence of cardioembolism in aphasic patients.

On investigating language comprehension in patients with Wernicke aphasia, using the Token Test to evaluate and pet scan to monitor the lesion regions, it was verified that the posterior part of the right superior temporal lobe is a crucial area to reconstruct language comprehension and its improvement is related to linguistic and non-linguistic factors, such as attention, memory, motivation, and working memory (Musso et al, 1999).

On comparing comprehension of passive phrases between normal subjects and individuals with Broca aphasia, no difference in performance was found between the control group and another aphasic group performance was lower than the first. Some difficulties in comprehension reflected the demands of the linguistic processing used in the syntax analysis, regardless of the aphasia clinical classification (Dick et al, 2001).

In a study analyzing the comprehension and production of negative sentences in aphasic patients of different nationalities (English, German, Norwegian) with agrammatism no significant difference was found regarding comprehension when negative phrases were compared with affirmative (Rispens et al, 2001).

In analysis of language comprehension for both linguistic and non-linguistic stimuli through visual test, aphasic subjects showed lower performance for linguistic and non-

linguistic aspects, interpretation of pantomime associated with lesions in the inferior frontal lobe, pre-motor and motor cortex and also to a portion of the somato-sensorial and caudal cortex, whereas reading comprehension related to lesions in the anterior superior temporal lobe anterior insula and inferior parietal lobe. This is indicative that the important areas for production also associate with comprehension (Saygin et al., 2004).

The comprehension of active and passive sentences in 38 patients with Broca aphasia and lesion in the pre frontal BA 44 and 45 of Broadman was heterogeneous. It seems that there are no simple forms of comprehension impairment in patients with Broca aphasia and this is due to the variation of its comprehension level and large cognitive and linguistic heterogeneity in this task (Caramazza et al, 2005).

Multidimensional scores with different forms of responses were compared as regard communication and showed that in severe cases of comprehension in aphasic subjects, low results in both multidimensional and right-wrong scores may occur (Odekar and Hallowell, 2005).

The aim of this work is to study language comprehension of aphasic individuals from the Rehabilitation Service of Irmandade da Santa Casa de Misericórdia de São Paulo, through tests of spoken and written comprehension of simple and complex words / phrases of the Montreal Toulouse Protocol (alpha version).

Method

Data was collected in two phases: in the first phase, patient records with aphasia condition, registered and selected at the Rehabilitation Service of the Psychiatric Department of Irmandade da Santa Casa de Misericórdia de São Paulo, underwent language evaluation performed between April 2007 and June 2007; in the second phase, the subjects were selected from both sexes, age ranging between 40 to 70 years old, with language assessment, including Montreal Toulouse Tests (alpha version).

From the data base, the following Montreal Toulouse test battery was selected: 1) guided interview; 2) comprehension of spoken words and simple and complex phrases; 3) written comprehension of words and simple and complex phrases. These procedures, described in the protocol of the test answers (Appendix 1), were registered in patients' medical records.

From the evaluation, the crossing of the following data was performed:

- oral word comprehension (SWC) with written word comprehension (WWC),

- oral simple phrase comprehension (OSPC) with written simple phrase comprehension (WSPC),
- oral phrase comprehension (SCPC) with written complex phrase comprehension (WCPC),
- oral word comprehension (SWC) with spoken simple phrase comprehension (OSPC),
- oral word comprehension (SWC) with spoken complex phrase comprehension (SCPC),
- oral simple phrase comprehension (OSPC) with spoken complex phrase comprehension (SCPC),
- written word comprehension (WWC) with written simple phrase comprehension (WSPC),
- written word comprehension (WWC) with written complex phrase comprehension (WCPC),
- written simple phrase comprehension (WSPC) with written complex phrase comprehension (WCPC).

The following non-parametric tests were used for data analyses: Spearman Correlation Test, Friedman Test, Wilcoxon Test, Mann-Whitney Test and Kruskal-Wallis Test. The significance rate applied was 5% and the statistically significant value are marked bold and with an asterisk.

Due to their regular attendance at the Speech Therapy Department of Irmandade de Misericórdia da Santa Casa de São Paulo, a signed consent form was already obtained from each individual, including the employment of language tests to be analyzed in this study.

This study was approved by the Ethics Committee of FCMSCSP (project 389/07).

Results

Twenty eight aphasic subjects were selected but one withdrew before the data was collected. Of the 27 subjects, 19 showed diagnosis related to expressive aphasia and 8 showed diagnosis related to mixed aphasia. A more accurate classification of aphasia was not possible due to incomplete medical records.

Table 1 shows the results of Spearman Correlation Test for comprehension tests and the correlation coefficient value (ρ) and whether it is significant (p -value).

Table 1. Spearman Correlation for the comprehension test battery

Rho (p-value)	WC	SPC	CPC	WWC	WSPC	WCPC
WC	1.000 (-)					
SPC	0.708 (<0.001*)	1.000 (-)				
CPC	0.609 (0.001*)	0.484 (0.009*)	1.000 (-)			
WWC	0.417 (0.027*)	0.475 (0.011*)	0.565 (0.002*)	1.000 (-)		
WSPC	0.616 (<0.001*)	0.570 (0.002*)	0.577 (0.001*)	0.794 (<0.001*)	1.000 (-)	
WCPC	0.502 (0.007*)	0.520 (0.005*)	0.641 (<0.001*)	0.759 (<0.001*)	0.872 (<0.001*)	1.000 (-)

The correlation coefficient values show the strength of the relation between two variables (Munro, 2004): 0 – 0,25 = very low; 0,26 – 0,49 = low; 0,50 – 0,69 = moderate; 0,7 – 0,89 = high; 0,9 – 1,00 = very high.

The data from **Table 1** show that all variables are interrelated; the relation between SWC and WWC is the lowest, and between the WSPC and WCPC is the highest.

Thus, we can state that:

- SWC is significantly associated with all other tasks/tests, this relation is high for SSPC, moderate for SCPC and WSPC and WCPC; and low for WWC,
- SSPC is significantly related to all other tasks/tests, this relation is moderate for WSPC and WCPC; and low for WWC and SCPC,
- SCPC is significantly associated with all other tasks/tests, this relation is moderate for the written comprehension battery,
- WWC is significantly association with all other tasks/tests, this relation is high for WSPC and WCPC,
- WSPC and WCPC are significantly related, this relation is high.

Table 2 shows the comparative results between spoken and written comprehension of words and simple and complex phrases.

Table 2. Comparison between spoken and written comprehension of words and phrases

	Aphasic		
	S	p-value	Wilcoxon
Words	6.23	0.013*	
phrases	31.50	<0.001*	SPC = CPC; SPC ≠ WSPC; SPC ≠ WCPC; CPC = WSPC; CPC ≠ WCPC; WSPC = WCPC

words= spoken comprehension is better

For the aphasic individuals, a significant statistical difference was observed between SPC and WSPC, SPC and WCPC, CPC and WCPC, with a better performance in the spoken modality.

Table 3 shows the comparative results between comprehension and gender, and this variable did not show any effect.

Table 3. Gender comparison

	M	p-value
WC	0.77	0.379
CFS	0.57	0.451
CFC	0.00	1.000
CPE	0.03	0.860
CFSE	0.00	1.000
CFCE	0.06	0.808

Spearman Correlation Test was applied in each comprehension task in order to verify whether the increase in age improves or worsens performance (Table 4).

Table 4. Spearman Correlation – effect of age

rho (p-value)	aphasic
WC	-0.246 (0.270)
SPC	-0.176 (0.434)
CPC	-0.154 (0.493)
WWC	0,224 (0.316)
WSPC	0.078 (0.730)
WCPC	-0.047 (0.835)

No significant linear relation among the batteries was observed. In spoken simple phrase comprehension, a trend of decrease in performance with aging was noted.

Discussion

A precise classification of aphasia was not possible due to lack of more comprehensive medical records. These same difficulties are related in a previous study aiming at classifying vascular aphasia (Godefroy et al, 2002).

On comparing spoken and written modalities, it was observed that the higher the SWC, SSPC and SCPC, the higher the WWC and WSPC; and the contrary also occurs.

In the comparison of sole spoken comprehension, it was observed that the higher the SWC, the higher the SSPC and vice-versa; and the higher the SSPC, the higher the SCPC and vice-versa. The higher the SWC, the higher the SCPC, and vice-versa.

Regarding the comparison in written comprehension, it was observed that the higher the WWC, the higher the WSPC, and vice-versa; and also the higher the WSPC, the higher the WCPC, and vice-versa. The higher the WWC, the higher the WCPC, and vice-versa.

These data are in accordance with other works (Dick et al, 2001; Rispen et al, 2001; Yasuda et al, 2000) as regarding the homogeneity in the responses of phrase comprehension test, mainly in aphasic subjects.

There are no findings in literature comparing data of spoken and written comprehension which corroborates the necessity to improve the means to evaluate language (Odekar and Hallowell, 2005).

No significant relation was found when comprehension and gender were correlated. This corroborates previous studies (Engelter et al, 2006; Falcone and Chong, 2007) which revealed biological differences between men and women as regarding hormonal aspects and life expectancy, although gender alone can not be correlated without taking the genetic and socio-economical factors of stroke into consideration.

Whether the increase of age improves or worsens the performance of each comprehension task could not be proven though it was observed a tendency to a lower performance in the comprehension of simple spoken phrases with age. Nevertheless, this might also happen in healthy individuals. Similarly to findings from other works (Engelter

et al, 2006; Falcone and Chong, 2007), it can be inferred from this study that age in aphasic individuals can not be considered a determinant factor for comprehension.

The comprehension of simple structures of words and phrases benefits the comprehension of complex structures; and the difficulty in the comprehension of simple structures directly relates with the difficulty in the comprehension of complex structures. This corroborates findings in Literature (Hedge, 2001; Mansur et al, 2002; Yasuda et al, 2000) which characterize aphasia as a language disorder.

Conclusions

This investigation aimed at carrying out a study on language comprehension in aphasic subjects through the employment of spoken and written tests of comprehension of words and simple and complex phrases of the Montreal Toulouse Test (alpha version).

From the findings of the present study we can suggest that:

- Comparing spoken and written comprehension: it was observed that the higher the SWC, the higher the WWC, and vice-versa; the higher the SSPC, the higher the WSPC, and vice-versa.
- Contrasting responses related to spoken comprehension, it was observed that the higher the SWC, the higher the SSPC and vice-versa; the higher the SSPC, the higher the SCPC and vice-versa.
- Comparing written comprehension, it was observed that the higher the WWC, the higher the WSPC and vice-versa, the higher the WSPC, the higher the WCPC and vice-versa.

In complex phrases, both spoken and written, it was observed that the aphasic subjects showed evidences through their responses that the higher SCPC, the higher the WCPC and vice-versa;

Therefore, there are signs of a continuous relationship starting from the word to more complex phrases, both for spoken and written language. This continuity reveals that the comprehension of simpler structures benefits the comprehension of more complex structures and that the difficulty in comprehension of simple structures directly relates with the difficulty in comprehension of complex structures.

On comparing the comprehension test battery and gender, no gender effect was observed.

The findings of this study did not indicate age as a determinant factor for comprehension. Finally, our conclusion met the characterization of aphasia as a language disorder as described in the specialized literature

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