PROCESSAMENTO COMUNICATIVO EM ADULTOS COM AVC UNILATERAL DE HEMISFÉRIO DIREITO: AVALIAÇÃO ATRAVÉS DE BATERIA BREVE

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Resumo

Pacientes com lesão cerebrovascular de hemisfério direito (LHD) tendem a apresentar déficits comunicativos. Este estudo visou a investigar o processamento comunicativo de pacientes com acidente vascular cerebral (AVC) de hemisfério direito. A amostra incluiu 100 participantes: 25 com LHD, 25 com AVC de hemisfério esquerdo (LHE) e 50 controles neurologicamente preservados (PNP). Os participantes responderam a um questionário de dados sociodemográficos, ao Mini Exame do Estado Mental para avaliar capacidade cognitiva geral, à Escala de Depressão Geriátrica de 15 pontos e à Escala Beck de Depressão para investigar sintomas depressivos, ao Teste dos Sinos para avaliar heminegligência, e à Escala Rankin Modificada para verificar capacidade funcional. O processamento comunicativo foi avaliado com a Bateria Montreal de Avaliação da Comunicação, versão abreviada – Bateria MAC Breve. Os escores foram comparados por *One-Way* ANOVA e Qui-quadrado. Houve diferenças significativas entre os grupos LHD e PNP em 89% das tarefas, mas não entre os grupos LHD e LHE. Além disso, o grupo LHD apresentou desempenho comunicativo inferior ao grupo PNP. Tais achados sugerem evidências de cooperação interhemisférica para os processamentos comunicativos.
Palavras-chave: AVC; Comunicação; Hemisfério direito.

PROCESAMIENTO COMUNICATIVO EN ADULTOS CON ACV UNILATERAL DEL HEMISFERIO DERECHO: EVALUACIÓN A TRAVÉS DE UNA BATERÍA BREVE

Resumen

Los pacientes con lesión cerebrovascular de hemisferio derecho (LHD) tienden a presentar déficits comunicativos. Este estudio tuvo como objetivo investigar el procesamiento comunicativo de pacientes con accidente cerebrovascular (ACV) de hemisferio derecho. La muestra incluyó 100 participantes: 25 con LHD, 25 con ACV de hemisferio izquierdo (LHI) y 50 controles neurológicamente preservados (CNP). Los participantes respondieron a un cuestionario sociodemográfico, el Mini Examen del Estado Mental para medir la capacidad cognitiva general; la Escala de Depresión Geriátrica y la Escala Beck de Depresión, para investigar los síntomas depresivos; el Test de Marcación de Campanas, para evaluar heminegligencia, y la Escala de Rankin Modificada, para verificar la capacidad funcional. El procesamiento comunicativo fue evaluado con la Batería Montreal de Evaluación de la Comunicación, versión abreviada – Batería MAC Abreviada. Las puntuaciones fueron comparadas por ANOVA de una vía y Chi-cuadrado. Hubo diferencias significativas entre los grupos LHD y CNP en 89% de las tareas, pero no entre los grupos LHD y LHI. Además, el grupo LHD presentó un desempeño comunicativo inferior al grupo CNP. Tales descubrimientos sugieren evidencias de cooperación interhemisférica para los procesamientos comunicativos.
Palabras clave: ACV, Comunicación, Hemisferio derecho.

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COMMUNICATIVE PROCESSING IN ADULTS WITH UNILATERAL RIGHT HEMISPHERE STROKE: ASSESSMENT BY MEANS OF A SHORT BATTERY

Abstract

Patients with right hemisphere brain damage (RBD) usually experience communication impairments. This study aims to investigate the communication processing in patients who suffered a stroke in the right hemisphere. The sample comprised 100 participants: 25 with RBD, 25 with left hemisphere brain damage (LBD) and 50 neurologically healthy controls (NHC). Participants answered a sociodemographic questionnaire, the Mini Mental State Examination to measure general cognitive ability, the Geriatric Depression Scale and the Beck Depression Scale to investigate depressive symptoms, the Bells Test to evaluate hemineglect and the Modified Ranking Scale to verify functional capacity. The communication processing was assessed with the use of the Montreal Communication Evaluation Battery, brief version – Brief MAC Battery. The scores were compared using a One-Way ANOVA and the Chi-squared test. There were significant differences between RBD and NHC groups in 89% of the tasks, but not between RBD and LBD groups. Furthermore, the RBD showed inferior communication skills compared to the NHC group. These findings indicate an interhemispheric cooperation for communication processing.
Key words: Stroke, communication, right hemisphere.

INTRODUCTION

The left hemisphere (LH) has been reported as the most specialized hemisphere for lexical comprehension and expression since the studies of Dax and Broca (Broca, 1861; Dax, 1836). However, several evidences have pointed out the participation of the right hemisphere (RH) in the communicative process, especially from the 1950s (Joanette, Goulet & Hannequin, 1990).

Prosody, pragmatics, discourse, semantics and sarcasm comprehension are communicative components that can be altered to a greater or lesser extent in patients with RH brain damage (RBD) (Ferré, Ska, Lajoie, Bleau & Joanette, 2011). These manifestations can be observed through cluster studies, which demonstrate different combinations of impaired processing (Côté, Payer, Giroux & Joanette, 2007) and variability of communicative profiles. Moreover, the impairment rate indicates that 37% to 50% of patients with RBD do not manifest significant disturbances in any of the communicative processes (Ferré et al., 2009).

Therefore, results of several studies of communication skills in adults with RBD appear to be influenced by the heterogeneity of the manifestation of these deficits and the type of stimuli used to evaluate each communicative processing. In a study conducted by Brady, Armstrong and Mackenzie (2006) none of the patients with RBD presented conversational impairments. However, Tompkins, Baumgaertner, Lehman, and Fassbinder (2000) observed that, when compared to healthy controls, RBD patients have more difficulties to suppress or inhibit contextual interpretative significance, impairing the discursive ability. Moreover, communication impairments are not limited to RBD, they also occur in other neurological conditions, such as traumatic brain injury (Dimoska, McDonald, Pell, Tate & James, 2010) and neurodegenerative conditions (Gayraud, Lee & Barkat-Defradas, 2011) in which the brain deterioration, in most cases, is not limited to a specific hemisphere. Discursive (Ellis, Rosenbek, Rittman & Boylstein, 2004) and lexical-semantic disturbances (Cotelli et al., 2011), for example, are also common in patients with lesions in LH (LBD) and, in most comparative studies this constitutes the target population besides adults with RBD.

According to a study conducted by Rousseaux, Daveluy, and Kozlowski (2010), which compared the performance of stroke patients (RBD, LBD and frontal stroke groups) in a task of verbal and nonverbal communication, no differences were found between the groups, and all participants had lexical and pragmatic difficulties. Beausoleil, Monetta, Leblanc, and Joanette (2001) also found no differences comparing the performance of patients with RBD and LBD in a verbal fluency task. Furthermore, difficulties in interpreting metaphors were found in patients with RBD and LBD when compared with healthy controls (Gagnon Goulet, Giroux & Joanette, 2003), with no differences between patients. However, adults with RBD and LBD have major differences in emotional prosody tasks, with evident deficits in emotional prosody in RBD patients (Abbassi, Kahlaoui, Wilson & Joanette, 2011).

There are few investigations that use full batteries which focus on the communication skills of the RBD patients and compare this clinical group to a healthy control group (Fonseca et al., 2007), as well as cluster studies with RBD patients (Ferre *et al.*, 2009). On the other hand, there are performance comparisons of patients with RBD and LBD in specific and experimental communication skills tasks. However, there is a lack of studies using a complete as-

sessment battery for communicative processes, of short application period and suitable to the need to establish an initial communicative profile to identify preserved and impaired skills and to guide a more expanded and detailed assessment, also including reading and writing tasks. Hence, the present study aims to investigate the communication processing of RBD patients and compare it to the one shown by LBD adults and healthy controls, through the Montreal Communication Evaluation Battery, brief version – Brief MAC Battery. Possible differences among groups will be analyzed regarding oral and written communication processing assessed by this recently developed test.

METHOD

Design

This is a cross-sectional, quasi-experimental and comparative between- subjects study.

Participants

The sample was comprised by 100 subjects, distributed in three groups: 25 with RBD, 25 with LBD, and 50 neurologically healthy controls (NHC), selected by convenience. The participants had an exclusive and primary brain damage, had been diagnosed through a clinical neurological and neuro-imaging assessment (EEG or CT scan), and had no other neurological or psychiatric conditions, aged between 19 and 75 years, and had at least one year of education. Only participants that were right-handed, had Brazilian Portuguese as their first language, and did not show any aphasia in the clinical neurological assessment were included in the study. Moreover, the participants could not present a previous psychiatric or neurological condition, nor have used antipsychotic medications before the stroke. Visual and auditory disturbances had to be corrected during the assessment.

Participants from the three groups were matched considering education, age, and reading and writing frequency habits. Participants of the NHC group should also: 1) present an adequate score on the Mini-Mental State Examination (MMSE), in which the cut-off points were < 22 for one to five years of education, < 23 for six to 11 years, and <24 for 12 years or more (Kochhann, Varela, Lisboa & Chaves, 2010); and 2) not present significant depressive symptoms in the Beck Depression Inventory – BDI (adapted by Cunha, 2001), that is to say, scoring up to 19 points. The brain damaged patients were recruited from public and private hospitals across the states of Rio Grande do Sul and Santa Catarina. Likewise, participants from the NHC were recruited from community and business centers in the same states.

Instruments

The instruments used were a questionnaire for sociodemographic and general health data and a self-report scale for reading and writing frequency habits. Participants also responded to the following tests:

1. Mini-Mental State Examination (MMSE): screening test used to assess the general cognitive condition, whose scores range from 0 to 30 points. The test already has an adapted and validated version for the Brazilian population (Chaves & Izquierdo, 1992);

2. Geriatric Depression Scale – GDS-15 (adapted by Almeida & Almeida, 1999): used to assess depressive symptoms in the RBD and LBD groups. It has 15 dichotomic questions ("yes" or "no"), whose scores range from 0 to 1 points, obtaining a total of 15 points.

3. Beck Depression Inventory (BDI): this test was used to assess depressive symptoms in the NCC group. It is a 21 items scale, in which each item comprises four alternatives ranging from 0 to 3 points, totalling 63 points. The test has a Brazilian Portuguese adaptation and shows evidence of adequate psychometric qualities for this population (Cunha, 2001).

4. Bells Test (adapted by Fonseca et al., in press): it was applied to investigate hemineglect among the stroke patients. The test is presented on a A4 size sheet of paper that contains many symbols, 35 of which are pseudorandomly distributed. The subject is instructed to use a pencil to mark every bell he finds. Hemineglect is detected if most of the bells are not marked and the marked ones are located at the paper's edges. The test is currently being validated in Brasil.

5. Modified Rankin Scale (MRS) (Rankin, 1957): it examines functional and independence skills. This is a Likert scale, whose scores range from 0 to 6 points (from no disability symptoms to death), that assesses the level of functional impairment of the stroke patient. The MRS presents adequate levels of validity and accuracy (Caneda, Fernandes, Almeida & Mugnol, 2006).

6. Montreal Communication Evaluation Battery – brief version (Brief MAC Battery, adapted by Casarin et al., 2014): test used to assess communication skills (discourse, pragmatic-inferential, lexical-semantic, and prosodic), and reading, and writing skills through 10 subtests:

- Conversational Discourse: the participant is instructed to talk about specific themes, such as family or work, for four minutes. The score is determined by 22 items related to four indexes (discourse expression, discourse comprehension, nonverbal behavior, and linguistic and emotional prosody).

- Narrative Discourse: after reading paragraphs of a story, the patient is asked to retell them. At the end, the participant reports what he understood about the story,

provides a title, and answers comprehension questions. It is verified whether there has been a correct processing of the inference and in which moment was it perceived (while or after reading the story, retelling the full story, providing the title, or answering the comprehension questions).

- Interpretation of Metaphors: the participant must explain the meaning of metaphors and idiomatic expressions.

- Interpretation of Speech Acts: the participant must explain what the protagonists of different stories mean – implicit information (non-literal) or explicit (literal).

- Verbal Fluency: the participant evokes as many words as he can, which are not forenames and numbers during 150 seconds. The quantity and types of searching strategies employed, the number and types of errors, the evocation speed (number of words per second) and the distribution of evoked words in each block are assessed.

- Semantic Judgement: the participant must judge if the pairs of words have any semantic connection and justify their answers.

- Emotional Prosody: from a stimulus sentence, the participant listens to three different situations in which the sentence can be used. Then, the participant should repeat it with adequate emotional intonations for each situation.

- Reading: the participant reads a text out loud, explains what was understood and provides a title for it. Furthermore, the amount of errors and in which quadrant occurred (right or left) are recorded.

- Writing: the participant must write a sentence, which the examiner reads, and, afterwards, signs his complete name on the same sheet of paper. In the first task, writing preserved of double letters is analyzed, as well as writing preserved of the letters "m", "n" and "o", appropriate use of graphic space, grammatical adequacy and respect to horizontality. In the second task, the preserved writing automatism and the correct use of graphic space were observed.

- Agnosia Questionnaire: evaluates subjective complaints of communication difficulties in the clinical population. It consists of three questions about awareness of the communication difficulties in the family and occupational contexts.

Procedure

This research was approved by the Pontifícia Universidade Católica do Rio Grande do Sul's Ethical Research Committee (nº 10/05134). The participation in this study was voluntary and occurred after signing the informed consent form. The evaluations were conducted in two sessions of approximately 90 minutes each, in which the participants responded to the tests individually.

Data Analysis

The sample was normally distributed according to the Kolmogorov-Smirnov test. The quantitative data about the sociodemographic characteristics (age, education, reading and writing frequency habits, and economic status) and cognitive and communicative performance (MMSE and Brief MAC Battery) were compared between the groups using a One-Way ANOVA with a *post hoc* Bonferroni correction. The comparison of categorical variables between groups (sex, intensity of depressive symptoms, anosognosia, hemineglect, hemiplegia, hemiparesis, lesion site, and qualitative data from the Brief MAC Battery) was performed by a qui-squared test. The Student *t* Test for independent samples was used specifically to compare the scores of the RBD and LBD groups in the MRS and time postinjury. The data were analyzed by using the SPSS v. 17 software for Windows and the results were considered significant when $p \leq .05$.

RESULTS

Initially, sociodemographic and clinical characteristics of the participants will be presented. Further comparisons will be made between groups in the scores of the Brief MAC Battery. Table 1 presents the sociodemographic and clinical characteristics of each group. The sociodemographic characteristics include age, education, frequency of reading and writing habits, and economic status. It is emphasized that the clinical groups were evaluated with specific instruments.

The groups did not show significant differences in the sociodemographic and clinical characteristics, except in the MMSE score. In addition, depressive symptoms were higher in brain damaged groups than in the NHC group, but there were no differences between the RBD and LBD groups. The RBD group had significantly more participants with hemiplegia than the LBD group. The groups' performance scores in the Brief MAC Battery are shown in Table 2. The tasks were grouped according to the dominant processing.

According to Table 2, there were significant differences in all of the evaluated tasks. Compared to NHC group, patients with RBD had worse results in 18 variables of the Brief MAC Battery, while patients with LBD group demonstrated poorer performance in 12 variables. However, there were no significant differences between RBD and LBD groups. Table 3 presents the results of the comparison between groups in the qualitative variables of the Narrative Discourse and Writing tasks of the Brief MAC Battery.

Table 1.
Sociodemographic and clinical characterization of the groups

	Stroke		NHC	F/X^2	*p*	*Post hoc*
	RBD	LBD				
	M±SD	*M±SD*	*M±SD*			
Age (years)	56.48±12.88	56.88±12.59	53.02±12.53	1.06	.35	
Education (years)	9.52±5.75	9.60±3.83	11.44±4.27	2.10	.13	
Reading and writing	11.60±7.19	12.76±7.86	14.28±5.68	1.43	.24	
Economic status	25.50±7.58	27.00±7.28	26.48±6.78	.28	.75	
MMSE	24.67±3.67	25.48±2.16	28.12±1.97	18.59	**.00**	(RBD = LBD) < NHC***
Depression A/Mi/Mo/AS	11/6/3/5	17/3/4/1	45/5/0/0	24.72	**.00**	-
Sex F/M[A]	14/11	13/12	26/24	.12	.94	-
MRS[B]	1.61±1.50	1.00±1.11	-	4.41	.13	-
Time postinjury (months)[B]	19.74±19.34	16.98±16.02	-	1.66	.62	-
Anosognosia Yes/No[A]	12/13	8/17	-	1.33	.39	-
Hemineglect Yes/No[A]	5/20	3/22	-	.60	.70	-
Hemiplegia Yes/No[A]	6/19	0/25	-	6.82	**.01**	-
Hemiparesis Yes/No[A]	10/15	9/16	-	.09	.77	-
Lesion site[A] C/S/Mixed/NR	9/5/5/6	7/9/6/3	-	2.48	.48	-

Note. RBD = Patients with right hemisphere brain damage; LBD = Patients with left hemisphere brain damage; NHC = Neurologically healthy control group; MMSE = Mini-Mental State Examination; A = Absence of depressive symptoms; Mi = Presence of mild depressive symptoms; Mo = Presence of moderate depressive symptoms; S = Presence of severe depressive symptoms; The depression categorization was based in the GDS-15 scores, for RBD and LBD patients, and the BDI, for NHC, because they were part in the Brief MAC Battery standardization process; MRS = Modified Rankin Scale; C = Cortical; S = Subcortical; NR = Not reported; * = $p \leq .05$; ** = $p \leq .01$; *** = $p \leq .001$; [A] = Data were analyzed using the chi-squared test; [B] = Data were analyzed using the *t* Student Test for independent samples. Other data were examined using the One-Way ANOVA with *post hoc* Bonferroni.

DISCUSSION

This study proposed to investigate the communication processing in patients with RBD using the Brief MAC Battery. Therefore, the performance of these patients with LBD and healthy controls was compared. Overall, the RBD group differed from healthy controls in at least one task of all communicative processes, whereas the most frequent and representative differences were simple dissociations (unilateral lesion vs. absence of lesion) in nonverval behavior index, interpretation of new metaphors (choice of alternatives), semantic judgement (semantic relationship explanation), emotional prosody production, sentence writing, and signature. Even though most of the tasks revealed differences between clinical groups and healthy controls, only one task (reading) showed differences between LBD patients and healthy controls.

When examining each processing, it was found that both brain damaged groups had a significantly inferior performance when compared to the healthy controls. According to Tompkins et al. (2000), discourse impairments of RBD patients are more difficult to perceive if the cognitive demands are not too challenging. However, these difficulties become apparent when considering various interpretative or competitive clues, which aid the performance during a conversation or when an event or story is narrated. The RBD patients, unlike the LBD patients, differed from the healthy controls in nonverbal behavior, that is to say, they showed a greater difficulty to maintain eye contact, a lack of facial expression and/or inadequacy when changing the subject during a conversation. Similar results were found by Rousseaux et al. (2010) in a comparison between RBD, LBD, and frontal brain damaged patients, in which the first group had the worst scores. Nevertheless, the present study had a reduced time for the task (four minutes), which may have contributed to not having found a difference between patients in the other characteristics of the conversational discourse. In a study conducted by Fonseca et al. (2007), RBD patients and healthy controls had different performances in a similar task, but with longer administration time in the expanded version of the MAC Battery.

Table 2.
Performance of the groups in the communicative tasks of the Brief MAC Battery

Processing	Stroke		NHC	*F*	*p*	*Post hoc*
	RBD	LBD				
	M±SD	*M±SD*	*M±DP*			
Discursive						
Conversational Discourse						
Total score (max. 44)	39.12±2.91	40.29±3.04	42.00±2.06	11.53	**.00**	(RBD = LBD) < NHC***
Expression (max. 16)	12.58±1.98	13.00±2.32	14.40±1.75	8.50	**.00**	(RBD = LBD) < NHC***
Comprehension (max. 8)	7.58±0.97	7.67±0.80	7.90±.36	2.14	.12	
Nonverbal behavior (max. 6)	5.52±1.08	5.76±.70	5.96±.28	3.56	**.03**	RBD < NHC*
Emotional prosody (máx. 14)	13.35±.88	13.81±.51	13.74±.69	2.99	.06	
Narrative Discourse						
Partial recount (essentials) (max. 18)	9.44±4.27	8.52±4.10	9.78±4.41	.67	.51	
Partial recount (presents) (max. 26)	11.88±6.08	10.52±5.62	12.72±6.22	1.05	.36	
Full recount (max. 2)	1.36±.70	1.29±.69	1.64±.56	3.12	.06	
Questions (máx. 12)	6.32±4.03	6.04±4.34	9.14±2.59	9.06	**.00**	(RBD = LBD) < NHC***
Pragmatic-Inferential						
Interpretation of metaphors						
Explanation (new metaphors) (max. 6)	3.72±1.49	3.36±1.58	4.64±1.40	7.42	.00	(RBD = LBD) < NHC**
Explanation (idiom. expressions) (max. 6)	3.76±1.56	3.56±2.16	4.42±1.53	2.54	.08	
Acts of speech						
Explanation (directs) (max. 6)	3.88±1.62	3.76±1.74	4.96±1.38	6.92	**.00**	(RBD = LBD) < NHC**
Explanation (indirects) (max. 6)	4.68±1.35	4.64±1.73	5.46±.89	5.06	**.01**	(RBD = LBD) < NHC*
Lexical-Semantic						
Free verbal fluency						
Total score	32.36±19.79	32.83±19.14	50.36±21.42	9.31	**.00**	(RBD = LBD) < NHC**
Errors	1.88±2.88	1.75±3.21	2.52±2.48	.81	.45	
Search strategy	7.16±5.08	7.17±4.31	11.24±5.45	7.90	**.00**	(RBD = LBD) < NHC**
Speed evocation	.22±.13	.22±.13	.33±.14	8.83	**.00**	(RBD = LBD) < NHC**
Distribution words	6.54±3.98	6.61±3.81	10.09±4.27	9.13	**.00**	(RBD = LBD) < NHC**
Semantic judgment						
Identification (max. 6)	5.52±.77	5.36±.95	5.70±.79	1.47	.24	
Explanation (max. 6)	3.80±2.12	4.32±1.99	5.24±1.56	5.74	**.00**	RBD < NHC**
Prosodic						
Emotional prosody						
Production (max. 6)	2.60±2.27	2.87±2.30	3.84±1.91	3.52	.03	RBD < NHC*
Reading and Writing						
Reading						
Time(s)	68.78±33.19	78.55±68.49	46.56±9.97	6.54	.00	LBD □ NHC**
Errors (left)	1.00±1.61	1.39±2.15	.60±.83	2.47	.09	
Errors (rigth)	1.68±3.53	1.26±1.84	1.02±1.81	.65	.53	
Writing						
Dictation (max. 5)	3.50±1.50	3.68±1.41	4.30±.79	4.73	.01	RBD < NHC*
Signature (max. 2)	1.75±.61	1.84±.55	2.00±.00	3.42	.04	RBD < NHC*

Note. RBD = Patients with right hemisphere brain damage; LBD = Patients with left hemisphere brain damage; NHC = Neurologically healthy control group; * = $p \leq .05$; ** = $p \leq .01$; *** = $p \leq .001$.

Table 3.
Qualitative analysis of the Narrative Discourse and Writing tasks

	Stroke		NHC	X^2	p	
	RBD (%)	LBD (%)	(%)			
Narrative Discourse						
Full recount (scores 0 and 1)	52	58	32	6.51	.15	
Title (scores 0 and 1)	68	71	60	14.01	**.01**	(RBD = LBD) < NHC**
Presence of inferential processing (scores 0 and 1)	56	50	82	9.68	**.01**	LBD < NHC**
Dictation						
Double letters (scores 0 and 1)	71	68	90	6.58	**.04**	(RBD = LBD) < NHC*
Letters M, N and U (scores 0 and 1)	83	88	98	5.56	**.04**	RBD < NHC*
Graphic space (scores 0 and 1)	75	84	94	5.23	**.03**	RBD < NHC*
Respect horizontality (scores 0 and 1)	79	88	98	7.18	**.02**	RBD < NHC**
Grammatical adequacy (scores 0 and 1)	25	32	51	5.40	.07	
Signature						
Adequate use of graphic space (scores 0 and 1)	83	92	100	8.07	**.00**	RBD < NHC**
Automatism (scores 0 and 1)	92	92	100	4.74	.06	

Note. RBD = Patients with right hemisphere brain damage; LBD = Patients with left hemisphere brain damage; NHC = Neurologically normal control group; * = $p \leq .05$; ** = $p \leq .01$; *** = $p \leq .001$.

According to Table 3, both brain damaged groups had lower rate of occurrence of inferential processing, but there was no difference among the three groups regarding the timing the inference was processed, predominantly occurring during the first reading of the text ($X^2 = 5.86$; $p = .34$). The search strategy used in the Verbal Fluency task was similar in the three groups, with a predominance of the categorical strategy ($X^2 = 4.03$; $p = .36$).

Furthermore, both brain damaged groups performed worse in narrative discourse skills in the comprehension questions when compared to the healthy controls, but not when compared to each other. LBD patients showed more difficulty in providing an adequate title to the text, but both groups had difficulties in processing the inference related to the story, directly affecting performance on comprehension questions. According to Tompkins, Blake, Baumgaertner and Jayaram (2004), although the most common measure of evaluation of the inference process is through comprehension tasks, these have questionable validity as they do not allow verificationof the time at which the inference occurred and the influence of mnemonic abilities, such as working memory (Tompkins, Lehman-Blake, Baumgaertner & Fassbinder, 2001).

In connection with the inferential processing, the assessment of pragmatic processing demonstrated significantly lower performance in patients with RBD and LBD in relation to the healthy controls on most variables. In a study of metaphoric processing conducted by Gagnon et al. (2003), both RBD and LBD groups showed a similar difficulty in processing the meaning of metaphoric words, which contradicts the hypothesis that the RH is more important for this ability. However, according to the results of the present study, even though both brain damaged groups presented metaphoric interpretation disturbances, only the LBD group benefited from clues provided (response alternatives) to clarify their responses, thus showing more difficulty of RH for new metaphors, in accordance with the findings of Mashal and Faust (2008).

Performance on the interpretation of direct and indirect speech acts of RBD and LBD groups was inferior to healthy controls. The patients presented more difficulty in comprehending the messages that different characters tried to express in short stories. Some studies state that there is a connection between the pragmatic skills and the theory of mind (Champagne-Lavau & Joanette, 2009). However, some limitations have been pointed out about the tasks that assess pragmatic skills, since often the stimuli do not consider psycholinguistic aspects of utterances and other underlying cognitive functions that might modulate the communicative performance such as deficits in attention, working memory, and executive functions.

Patients showed a poorer performance on the lexical-semantic processing (verbal fluency and semantic judgement tasks) in comparison to the healthy controls. Both clinical

groups evoked less words and used less search strategies on the first task, whilst only the RBD patients exhibited more perseverations, considering the types of errors during the lexical evocation.

According to Kahlaoui, Scherer and Joanette (2008), both the RH and LH are essencial for semantic processing, since they are involved in different ways to do this processing. The verbal fluency task is one of the most used for semantic skills assessments, and can be used in different modalities, since RBD patients have lower performance on tasks with semantic, but not orthographic criterion (Kahlaoui et al., 2008). However, performance on these tasks (semantic and/or orthographic modalities) can vary, according to the production level of the chosen criterion (Beausoleil et al., 2001), unlike the free verbal fluency. In this study, the presence of non-aphasic patients in the LBD group might have contributed to a performance similar to the RBD group in terms of the total number of words and the amount of search strategies used.

In the semantic judgment task, only RBD patients had poorer results than healthy controls when they needed to explain the type of relationship between pairs of words. The difficulty did not lie with the identification of the categories, but with a less specific level of explanation, in other words, a more tangential one. Difficulties in establishing categorical relationships seem to be more common in LBD patients (Nocentini, Goulet, Roberts & Joanette, 2001).

Regarding the evaluation of emotional prosody, the results are consistent with the literature. Whereas the LH is more involved in the modulation of the propositional components of language, the RH is related to the modulation of affective components (Wymer, Lindman & Booksh, 2002), especially negative emotions (Abbassi et al., 2011).

When compared to the healthy controls, RBD patients did not differ on the reading processing task, but their performance was worse in writing. The poor performance was due to improper use of the graphic space, both for writing a phrase and for the signature, as well as the for writing incomplete letters. This result may have occurred due to the visual hemineglegence condition, present in 20% of the RBD adults. Visual hemineglect is a failure or slowness to respond, guide or initiate actions to contralateral stimuli to the brain injury (Goedert et al., 2012), which happens more often in RBD patients (Joanette et al., 2008), mostly when the parietal lobe has been damaged (Molenberghs & Sale, 2011), and can affect the reading and writing process.

Other hypothesis that might explain the similarity in the communication skills among groups should be highlighted. The first of them is about the concept of hemispherical specialization. Functional neuroimaging studies in healthy participants seem to show greater activation of RH processing of communicative components, but do not exclude the participation of LH (Prat, Mason, & Just, 2011; Rousseaux et al., 2010). Additionally, the concept of inter-hemispheric cooperation seems to be more appropriate when considering a greater influence of a particular hemisphere on some cognitive processes, at the same time that other contralateral regions can contribute to this end, according to the level of complexity of the examined function.

In conclusion, the present study identified the presence of communicative performance differences between adults with RBD and healthy controls, but not among adults with RBD and LBD. It is necessary to evaluate in future studies the impact of sociodemographic characteristics on communicative performance of adults who have suffered a stroke. There is also a need to use shortened instruments for performance assessment, with clinical tasks containing the highest number of items, and also including ecological tasks that simulate more efficiently the daily demand for communication and cognition in patients with cerebrovascular disease.

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