Aphasia Rapid Test: Translation, Adaptation and Validation Studies for the Portuguese Population

Aphasia Rapid Test: Estudos de Tradução, Adaptação e Validação para a População Portuguesa

ARTIGO ORIGINAL

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ABSTRACT

Introduction: Classical aphasia evaluation scales are too long to use in the context of acute stroke or as a monitoring tool. The Aphasia Rapid Test is a 26-point scale developed as a bedside assessment to rate aphasia severity in acute stroke patients in less than 3 minutes. We aimed to adapt and validate this scale for European Portuguese.

Material and Methods: We evaluated 56 acute stroke patients in the first and in the seventh days post-stroke. In the seventh day, patients were evaluated by two independent raters, to evaluate inter-rater agreement. To study concurrent validity, the Lisbon Aphasia Examination Battery was applied to a subset of 20 patients. The predictive ability of the Aphasia Rapid Test was assessed at six months, by the aphasia subscale of the National Institutes of Health Stroke Scale.

Results: Translation to European Portuguese was based in the French and English versions, considering the words' utilization frequency. The Chronbach's alpha was 0.796. The concordance coefficient between the two raters was excellent (0.985). Correlation between Aphasia Rapid Test and the Lisbon Aphasia Examination Battery was strong (r = -0.958, p < 0.001). The study through Bland-Altman graphs corroborated the good inter-rater agreement and concurrent validity of the test. The Aphasia Rapid Test score in the first day is an independent predictor of long-term outcome.

Discussion: This study provides reliable results for European Portuguese, with adequate internal consistency, inter-rater agreement and concurrent validity.

Conclusion: The Aphasia Rapid Test is a good tool for the evaluation and monitoring of aphasia in stroke patients.

Keywords: Aphasia/diagnosis; Neuropsychological Tests; Portugal; Stroke; Treatment Outcome

RESUMO

Introdução: As baterias clássicas de caracterização de afasia são demasiado longas para serem utilizadas no contexto do acidente vascular cerebral agudo ou como ferramenta de monitorização. O *Aphasia Rapid Test* é uma escala de 26 pontos desenvolvida como teste de cabeceira para avaliar a gravidade da afasia num doente com acidente vascular cerebral em menos de três minutos. O objetivo do estudo é adaptar e validar a escala para o português europeu.

Material e Métodos: Foram avaliados 56 doentes com acidente vascular cerebral no primeiro e sétimo dia pós-acidente vascular cerebral. Ao sétimo dia, foram avaliados por dois avaliadores independentes para avaliar o acordo interavaliadores. Para estudar a validade concorrente, a 20 doentes foi aplicada também a Bateria de Avaliação de Afasias de Lisboa. A capacidade preditiva do *Aphasia Rapid Test* foi avaliada aos seis meses, através do valor da subescala de afasia do *National Institutes of Health Stroke Scale*.

Resultados: A tradução para o português europeu baseou-se nas versões francesa e inglesa, respeitando a frequência de utilização das palavras. O α de Cronbach foi de 0,796. O coeficiente de concordância entre examinadores foi excelente (0,985). A correlação entre o *Aphasia Rapid Test* e a Bateria de Avaliação de Afasias de Lisboa é forte (r = -0,958, p < 0,001). Os gráficos de Bland-Altman corroboram as boas concordâncias interavaliadores e validade concorrente. O *Aphasia Rapid Test* no primeiro dia é preditor independente do resultado a longo prazo.

Discussão: Este estudo apresenta resultados confiáveis para o português europeu, com valores de consistência interna, concordância interavaliadores e validade concorrente adequados.

Conclusão: O *Aphasia Rapid Test* é um bom instrumento para avaliação e monitorização da afasia em doentes com acidente vascular cerebral.

Palavras-chave: Acidente Vascular Cerebral; Afasia/diagnóstico; Portugal; Resultado do Tratamento; Testes Neuropsicológicos

INTRODUCTION

Approximately 21% to 38% of the patients with an acute stroke had aphasia at admission,[1] with a relevant impact on the quality of life,[2] affecting not only patient's professional and social activity,[3] as also patient's family and caregivers.[4]

Classical stroke-related aphasia assessment scales are too long and therefore less suitable for patients with an acute stroke[5] or even as a monitoring tool. In an acute setting with temporal variation, such as in stroke, the aim is using a

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rapid assessment method within the initial medical evaluation at the emergency room and sensible to the time course of aphasia. Some rapid bedside scales have been used in this context, even though with a limited or unassessed ability to work as a monitoring instrument.[6-8]

Currently, the relevance of neurological impairment in stroke is routinely assessed by the National Institute of Health Stroke Scale (NIHSS),[9] which is a rapid, easy and reproducible bedside scale, with enough sensitivity as to detect for small changes in patient's neurological status and is a good predictor of functional outcome,[10] even though language is only superficially assessed. The Aphasia Rapid Test (ART)[11] has been recently proposed as a bedside scale for grading the severity of aphasia, based on the neurological parameters that are usually assessed in stroke. The ART was developed in France by C. Azuar *et al.*[11] and is available both in French and in English and, according to the authors, is a simple and rapid instrument easily handled by health professionals upon a short training period and requiring no specific support material, allowing for an early detection and grading of the severity of aphasia throughout patient's stay at the hospital, allowing for a more informed referral for a speech-language pathology program.[12,13]

Our study aimed to the use of this scale in Portugal. Therefore, upon the adaptation and transcultural validity of the test to European Portuguese, the scale's psychometric characteristics and potential to predict long-term outcome of aphasia have also been studied.

MATERIAL AND METHODS

Participants

Patients with acute stroke consecutively admitted to the Department of Neurology of the *Centro Hospitalar e Universitário de Coimbra* between 1 July 2014 and 31 December 2014 were included in the study. Verbal consent has been obtained from all the participants or, whenever unavailable, from the patient's nearest relative. The study was approved by the Ethics Committee and all data were anonymous at the time of collection, therefore complying with confidentiality. All study procedures were carried up according to the 1975 Helsinki Declaration.

Patients within the following inclusion criteria were selected:

a) European Portuguese as patient's first language (patients with a more usual and current use of another language for over a 10-year period were excluded from the study);
b) Right-handed patients (assuming a usual pattern of hemisphere dominance);
c) Diagnosed by the assistant neurologist with stroke and language impairment;
d) Presence of an acute ischaemic lesion in head CT-scan.

These were the exclusion criteria:

a) Presence of impaired consciousness;
b) Previous stroke;
c) Physical inability making any tasks related to the application of the scale impossible, namely the presence of endotracheal intubation or any other physical barrier preventing from the production of speech sounds.

Method of data collection

Material

The ART[11] aimed to rate the level of aphasia in patients with acute stroke, including six sub-scales for the assessment, in at least three minutes, of the main four parameters found in a language study: comprehension, repetition, naming and semantic fluency. The patient is initially asked to perform two simple (maximum 2 points) and one complex order (3 points), allowing for the evaluation of simple and complex verbal comprehension, followed by the repetition of three words (6 points) and one sentence (2 points). The patient is subsequently asked to name three everyday objects (maximum 6 points) while semantic fluency (4 points) is assessed by a 1-min verbal semantic fluency task. Apart from the assessment of the main four parameters, dysarthria (0 to 3 points) is also rated, according to a scoring system similar to the NIHSS.[12] The ART has a 0-26 scoring range, with the poorest performance corresponding to the highest score.

Procedures

The Portuguese version of the ART and the NIHSS[9,10] were included into the assessment protocol and both were applied to all the patients, by this sequence and by the same examiner (stroke neurologist). The time of administration of the ART was recorded from the beginning of the first task up to the end of the last one and all the items have been administered to all the participants, including those patients with severe comprehension impairment.

The patients were assessed at different post-stroke moments: within 24 h of stroke onset (± 1 day) – D1, within the seventh post-stroke day (± 1 day) - D7- and also at the follow-up medical assessment (within 6 to 12 months of stroke onset). The study of the scale's psychometric properties was focused on the assessment at D7 and a patient subgroup was examined by two independent examiners for the assessment of inter-examiner agreement and both evaluations were always made at a maximum interval of 12 hours. As regards convergent validity, four tasks of the *Bateria de Avaliação de Afasia de Lisboa (BAAL)*[13-15] were administered to a patient subgroup (10 patients at D7, 10 patients at six months post-stroke).

ART's prediction of 6-12-month aphasia outcome has been obtained and compared to the NIHSS ($NIHSS_{aphasia}$), with an ART score ranging between 0 and 3. Patients were divided into two groups, using the scores obtained with this sub-scale: those scoring 0 or 1 (corresponding to a good outcome) and those with 2 or 3 (poor outcome).

Data analysis

The statistical analysis was made by using the *Statistical Package for the Social Sciences* (SPSS, *version 20*.0)

software (IBM SPSS, Chicago, IL). The characteristics of our group of patients and the time of administration of the scale were analysed by using descriptive statistics. Cronbach's alpha was considered as an indicator of internal consistency of the instrument and Pearson's correlation coefficients were used to examine its construct validity (inter-subtest and subtest and total score correlations). Inter-examiner agreement was analysed by using intra-class correlation coefficient and weighted kappa (considering the distance between the results obtained by the two examiners and not only the simple univocal agreement between them). The same kappa was obtained for each subtest. Bland-Altman plots have also been obtained in order to exclude possible systematic differences between examiners and outliers. Convergent validity was assessed by using correlation coefficients between the scores obtained with the administered tasks and a simple linear regression and the analysis of scoring linear relationship. The ART score variation between D1 and D7 (D1 ART and D7 ART) was compared in groups with different aphasia outcomes ($NIHSS_{aphasia}$ of 0-1 *versus* 2-3) through Mann-Whitney's test, in order to determine the scale's sensitivity. The scale's prediction (D1 ART) of 6-12-month $NIHSS_{aphasia} \geq 2$ was analysed through an age-adjusted binomial logistic regression as well as adjusted for patient's educational level and $NIHSS_{motor}$ at D1 (this value was obtained from the NIHSS - the items possibly affected by language impairment were excluded: items regarding command achievement (item 1b), language (item 9) and dysarthria (item 10) – as we wanted to study ART's value in prediction of aphasia apart from other impairments and not as an alternative to the NIHSS and also to avoid considering some language impairments twice, which would increase co-linearity and reduce the scale's value).

RESULTS

Transcultural adaptation to the Portuguese population

Approval for studying the adaptation and validity of the ART to the Portuguese population was given by the authors of the 2014 original version and the procedure recommended by Herdman *et al.*[16] has been followed: translation, retranslation, analysis of semantic equivalence and experimental application. The translation of the scale for European Portuguese was completed by a trilingual linguistic translator experienced in the adaptation of neuropsychological tests, based on the original French scale as well as on the translation into English obtained by the authors. The frequency of use of words in the original scale has been complied with (upon consultation of the LEXIQUE,[17] SUBTLEXus[18] and the language dictionary),[19] regarding repetition and naming. Retranslation into English has been obtained, due to a greater experience of the expert panel and due to the fact that this is the most widely used scale. The analysis of semantic equivalence was made by a three-expert panel (two neurologists and one neuropsychologist) and the option for naming of everyday objects easily available at the hospital has been made, in order to allow for the application of the scale without the need for any specific support material.

Socio-demographic and clinical characteristics

A total of 56 admitted patients with acute stroke and aphasia (36 female; mean age 78.5 ± 10.3 years; 3.2 ± 2.9 years of education, on average) were included in the study. A mean ART score of 13.0 ± 9.0 and NIHSS score of 9.6 ± 8.3 were obtained at baseline.

Time for administration

Time for the administration of the scale (including the 60-second fluency task) was recorded in the first 25 patients (14 female; mean age of 71.9 ± 14.4 years; 4.4 years of education, on average) and a mean two-minute 34.8-second (standard deviation = 50.4 s) time has been recorded.

Psychometric characteristics

Total ART scores at D7 were considered for the analysis of the internal consistency and a Cronbach's alpha of 0.796 has been obtained, which did not increase upon the exclusion of any item of the test.

Table 1 – Correlation coefficients between ART subtests and ART total score

	Simple orders	Complex orders	Word repetition	Sentence repetition	Naming	Dysarthria	Fluency
Complex orders	$r = 0.80$*						
Word repetition	$r = 0.80$*	$r = 0.76$*					
Sentence repetition	$r = 0.76$*	$r = 0.78$*	$r = 0.88$*				
Naming	$r = 0.71$*	$r = 0.76$*	$r = 0.91$*	$r = 0.87$*			
Dysarthria	$r = 0.68$*	$r = 0.67$*	$r = 0.78$*	$r = 0.71$*	$r = 0.77$*		
Fluency	$r = 0.60$*	$r = 0.79$*	$r = 0.73$*	$r = 0.64$*	$r = 0.81$*	$r = 0.59$*	
Total	$r = 0.83$*	$r = 0.87$*	$r = 0.96$*	$r = 0.91$*	$r = 0.96$*	$r = 0.83$*	$r = 0.83$*

* $p < 0.001$

As regards construct validity, positive and statistically significant correlation coefficients between the scores obtained in subtests (ranging between 0.601 and 0.908) and between subtest scores and total ART score (ranging between 0.832 and 0.960) were found (Table 1).

A strong inter-examiner agreement has been found, with an agreement coefficient of 0.985 between both examiners [95% CI = (0.974, 0.991); $p < 0.001$, Fig. 1A], a 0.712 k_w [95% CI = (0.676, 0.748); $p < 0.001$] and the k_w for each subtest ranged between 0.811 (comprehension of complex orders) and 0.956 (naming). Bland-Altman plot (Fig. 1B) showed a stable reproducibility of the ART at all levels of severity of aphasia and showed that a difference of >3.5 points was significant for the classification of the severity of aphasia.

Concurrent validity has been studied in a 20-patient subgroup (12 female; mean age of 72.2 ± 13.8 years; 4/5 years of education, on average), half of these presenting with chronic aphasia (ongoing impairment six months post-stroke). Total scores with ART and BAAL are shown in Fig. 2A and 2B. Linear regression has shown a 0.92 R^2, β_a = -0.958, $p < 0.001$. The correlation between both scales was r = -0.96 ($p < 0.001$).

Patients presented with an average score of 14.7 (± 8.7) with ART, ranging between 2 and 26. A mean 51.8 (± 36.8) BAAL ratio has been found, ranging between 0 and 98.44.

Moderate to very strong significant correlations have also been found in terms of the dimensions that were evaluated: comprehension (r = -0.76, $p < 0.001$), repetition (r = -0.98, $p < 0.001$), naming (r = -0.86, $p < 0.001$) and fluency (r = -0.62, p = 0.003).

Long-term outcome of aphasia

A complete longitudinal assessment has been obtained (D1, D7 and chronic stage) regarding 42 patients (26 female; mean age 78.3 ± 11.8 years). At baseline (D1), ART scores statistically correlated with the NIHSS score (r = 0.86, $p < 0.001$), but not with gender (r_{pb} = -0.17, p = 0.281), age (r = 0.19, p = 0.238) or educational level (r = -0.09, p = 0.624).

A statistically significant difference (p = 0.001) between both groups of patients with different outcome of aphasia ($NIHSS_{aphasia}$ = 0 - 1, $NIHSS_{aphasia}$ = 2 - 3) has been found when D1 and D7 ART score variation (Fig. 3) has been compared, changing from a 7.0 median score (IQR = 6.5) at D1 to 3.0 (IQR = 5.0) in D7 in the group of patients with the best outcome ($NIHSS_{aphasia} \leq 1$) and from 26.0 (IQR = 2.0) to 26.0 (IQR = 3.0) in the group of patients with the poorest outcome (35.7% of the sample).

A binomial logistic regression (adjusted for patient's age, educational level and $NIHSS_{motor}$) has been obtained, in order to assess the predictive ability of the scale. In this model, D1 ART score was an independent predictor of poor long-term outcome ($NIHSS_{aphasia}$ = 2 - 3) [OR = 1.291, 95% CI = (1.047, 1.591), p = 0.017, acuity = 87.9%].

DISCUSSION

The ART has been designed for the quantification of aphasia severity in patients with an acute stroke and for the assessment, in less than 3 minutes, of comprehension, repetition, naming and verbal fluency. The short duration of its application is in part explained by the simplicity of the tasks and also by the quick scoring in patients with acute aphasia who fail most of the items. As NIHSS, it is a bedside test that can be used by non-specialized professionals and no specific material is required.

As regards transcultural adaptation to the Portuguese context, our study was based on the model of assessment

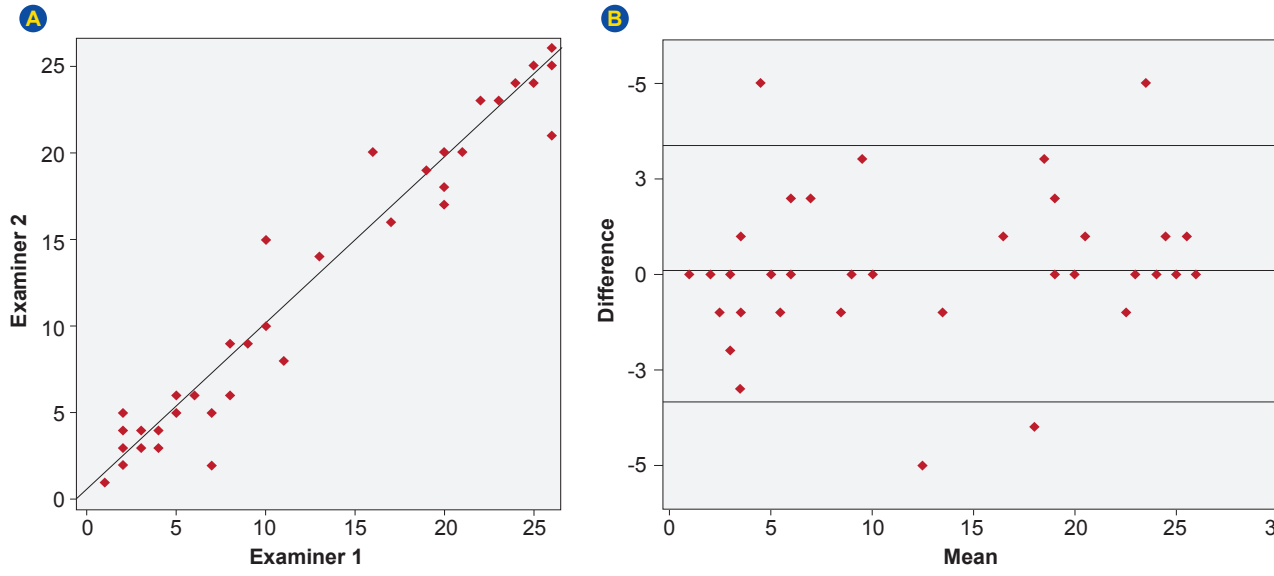

Figure 1 – (A) Distribution of ART scores for each patient, according with examiner 1 and examiner 2, showing a strong inter-examiner agreement of the ART, with a 0.985 agreement coefficient; (B) Bland-Altman plot showing inter-examiner agreement of the ART.

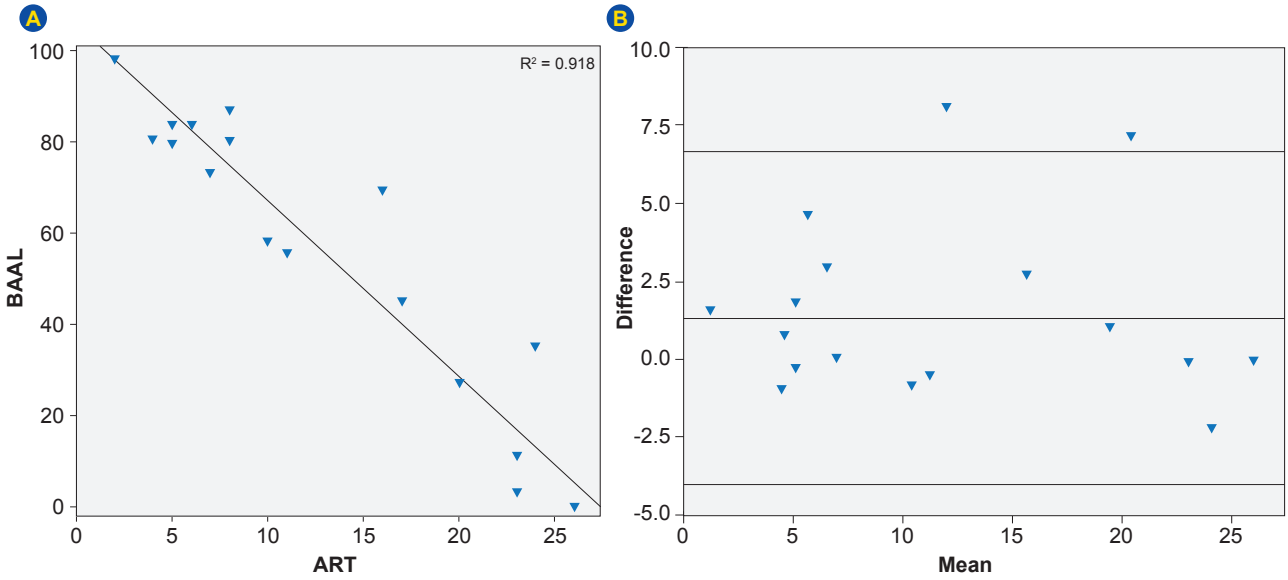

Figure 2 – (A) Distribution of the scores for each patient, comparing the scores obtained with the BAAL and with the ART; (B) Bland-Altman plot showing strong agreement between the scores obtained with the BAAL (adjusted for direct comparison) and the ART.

of the equivalence of transcultural adaptation instruments suggested by Herdman *et al.*[16] which has been widely used in different international studies. The authors have considered that the equivalence should be assessed at six levels: (i) conceptual, (ii) regarding each item, (iii) semantic, (iv) operational, (v) regarding measurement and (vi) functional; assessment strategies have been applied for each level. The adaptation procedure of the ART to the Portuguese population was made according with the different levels and therefore we may establish that the Portuguese Final Version of the ART is equivalent to the original version of the instrument.

An easy and rapid use of the scale are major characteristics in order to achieve an adequate monitoring of hospitalized patients with acute stroke who are usually submitted to different successive techniques and feel tired easily. A two-minute 34.8 second average time for the application of the scale has been found in our group of patients, ranging up to a maximum time of 300 seconds (five minutes), similar to the time that was described in the original version of the scale and also comparable to the application of the NIHSS.[5]

The analysis of the scale's major psychometric characteristics, namely internal consistency, construct validity, inter-examiner agreement and concurrent validity was involved in scale's validation. Initially, a strong internal consistency of the scale has been confirmed, shown by the high value of the Cronbach's alpha as well as by the fact that this index was not increased with the exclusion of any of the subtests, showing the relevance of the subtests that were used and their good reliability for the general assessment of the domain of the language. As these subtests have shown moderate to strong correlations between each other and with the final score, we could also confirm its construct validity.

The analysis of inter-examiner agreement has shown a good reliability (a 0.985 agreement coefficient between both examiners has been found) and inter-observer variability has shown to be independent from the severity of aphasia (Fig. 2). An excellent level of inter-examiner agreement has been found, with a 0.712 k_w and k_w in subtests have ranged between 0.811 and 0.956. The Bland-Altman plot (Fig. 1B) has shown that (i) ART reproducibility is reliable at all levels of severity of aphasia and (ii) a difference > 3.5 points meant a significant difference in the classification of severity of aphasia. This is a similar value to the one found with the NIHSS.[12]

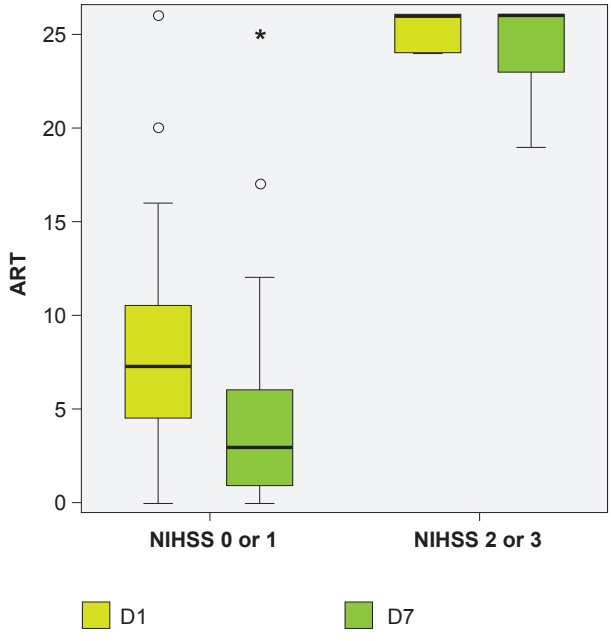

Figure 3 – Patients were divided according with the score obtained in item 9 of the NIHSS (language assessment) at 6 months post-stroke. Box plot showing the difference between ART scores at D1 (light green) and D7 (dark green) in both groups with different functional score ($NIHSS_{aphasia} \leq 1$ and $NIHSS_{aphasia} \geq 2$).

Based on these results, we may reach the conclusion that this scale can be used by different examiners throughout patient's clinical course, making patient monitoring and communication easier. The analysis of the correlation of the results obtained with the ART and the BAAL (the most widely used scale for the assessment of aphasia in clinical practice in Portugal)[20] has shown a good external concurrent validity, suggesting that a similar impairment [dys(function)] is measured by both tests. Positive and statistically significant correlations between the scores obtained in all subtests of the ART and the corresponding functions in the BAAL have been found. As regarding total scores, the weakest correlation has been found in fluency, even though it was significant and with no influence on the final score, probably due to the fact that, in BAAL, fluency is obtained differently in anterior and posterior aphasia while, in ART, it is obtained for all aphasias in a similar way. This result has validated the ART as a diagnostic measurement instrument for aphasia, even though obviously without the same diagnostic ability and comprehensiveness.

Considering a variation ≥ 4 points as significant, 45.2% of the patients have clinically improved over the first week post-stroke, in line with what has been described in literature.[21-23] ART variation over the first week post-stroke is different among the groups with different outcomes of aphasia (Fig. 3), suggesting that this is an adequate scale for monitoring of impairment in aphasia, detecting small initial changes predicting long-term outcomes with a functional relevance. In current medical practice, motor strength impairment is additionally assessed by the NIHSS and by the scale of the Medical Research Council,[24] while the assessment of aphasia has been limited to the superficial measurement provided by the NIHSS. Our results have allowed us to recommend ART as the additional assessment scale within this domain of aphasia.

The severity of initial aphasia has been considered as the best clinical predictor of long-term outcome.[25-27] Initial aphasia assessed by the ART has also been correlated in our group of patients with language impairment in chronic stages and was predictor of long-term impairment, regardless of patient's educational level, age and $NIHSS_{motor}$. A 1.291 times higher risk of poor outcome has been found for each increasing point in ART score. Therefore, the ART has an outcome value, such as it was found in the article of the original version.

Some limitations were found in our study. A wider study sample would confer stronger statistical power to the results, even though the validity of this scale for the assessment of aphasia has been confirmed. The administration of the scale by other professionals involved in the care of patients recovering from stroke would also be very relevant, namely by those working at stroke units (non-neurologist physicians and stroke specialist nurses).

As regards the limitations of the instrument, it is worth mentioning that the ART has been designed as a severity scale of aphasia, rapidly usable and applicable in emergency settings and therefore providing for an obviously superficial assessment of language impairment, not ever replacing a comprehensive evaluation using standard language scales. The fact that some relevant functions of the language as reading and writing are not included should be underlined. The ART should be valued in isolation as a diagnostic instrument in aphasia as its performance regarding certain items may be affected by non-aphasic speech impairments (namely dysarthria) and it should not be used as an instrument for the classification of the type of aphasia as, apart from the fact that its rapid use does not provide for a more comprehensive evaluation, the assessment of fluency may become affected by an impairment in other domains, even though these are unavoidable limitations and common to other instruments with the same objective.

CONCLUSION

The Aphasia Rapid Test is a bedside test with an adequate sensitivity for the assessment of aphasia severity and is an easy and rapid instrument with reproducible results, allowing for an efficient measurement and monitoring of aphasia severity both at the acute stage as in the follow-up of patients with stroke. It is worth mentioning that the ART seems as a predictor of long-term outcome of aphasia, adding to efficient and patient-tailored rehabilitation programs of stroke-related aphasia.

HUMAN AND ANIMAL PROTECTION

The authors declare that the followed procedures were according to regulations established by the Ethics and Clinical Research Committee and according to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

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