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Case Report

CIUs as a Measure of Communicative Performance in a Persian Speaker with Anomic Aphasia

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Abstract

Purpose: The main characteristic of anomic aphasia, which is an acquired neurological language disorder, is word-finding difficulty. Connected speech provides valuable information about the patients' communication status and is considered an important measure for assessment, treatment planning and progress. In this paper we intend to report a Persian patient's word retrieval problems based on samples of his connected speech using Correct Information Method (CIU) method, which is a measure for assessing the communicative performance of connected speech and language in aphasic patients.

Materials and methods: We present a 30-year-old right-handed Persian monolingual man with right-sided hemiparesis due to brain tumor surgery. His aphasia was evaluated by Persian Diagnostic Aphasia Battery (bedside version) and Persian Naming Battery. Furthermore, after adapting the Persian version of CIU, we measured language performance in spontaneous and semi-spontaneous samples.

Results: Assessment results indicated mild aphasia (AQ1= 80%) and mild anomia (77%) in the Persian Naming Battery. 31 Spontaneous and 27 semi spontaneous speech samples were collected and analyzed. The number of words and the number of CIUs were counted and words per minute, percent CIUs, and CIUs per minute measures were also calculated.

Conclusions: According to the results, the patient showed moderate to severe anomia in connected speech. The findings provide support to the use of CIUs as a valuable measure of communicative informativeness and efficiency in Persian aphasic patients.

Key words: communication, naming, anomic aphasia, CIU, connected speech

Introduction

Aphasia is an acquired neurological language disorder, primarily due to brain injury caused by stroke, which affects language comprehension and production. Anomia is a type of aphasia, which according to American Hearing and Speech Association (ASHA) is defined as a mild form of aphasia with word-finding difficulty being the main characteristic. Individuals with anomic aphasia have relatively preserved speech fluency, repetition, comprehension, and grammatical speech but sometimes have difficulty with word retrieval (Dronkers & Baldo, 2010). The clinical features generally include only limited receptive or expressive difficulty, but spontaneous speech is usually fluent yet interrupted by word-finding difficulties (Webb & Adler, 2016). The well accepted tool for assessing single word retrieval in Persian speakers is the Persian Aphasia Naming Test (R. Nilipour, Pourshahbaz , A ., Ghoreyshi, Z. & Yousefi,A., 2014). This test assesses single picture naming skills. Mayer and Murray (2003), specify and endorse the limited evidence indicating a discrepancy between word retrieval performance in single confrontation naming versus connected speech. They also confirm that despite several established existing measures for assessing word retrieval in single naming context, selecting reliable measures for assessing word retrieval in connected speech has been disparate and inconclusive (Mayer & Murray, 2003).

A primary objective in aphasia intervention is to enhance the efficiency of day-to-day communication and encourage participation in functional conversational exchanges. A vast majority of such interactions takes place through connected speech, which is an important mean of verbal communication, allowing the use of language in context for conveying a range of interactive wants and needs, initiating and taking part in ongoing conversations and conveying information to listeners. According to McCullough, K.C et al. (2017), connected speech is also considered a valuable measure for assessment, intervention planning as well as the evaluation of the treatment progress in individuals with aphasia (McCullough et al., 2017). Dipper et al. (2021) indicated that assessing discourse is a close manifestation of communication within

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everyday living activities as well as the clients' overall quality of life (Dipper et al., 2021), where performance is nearly related to the participation level of the International Classification of Functioning, Disability and Health (ICF) ((WHO), 2022).

In 1993, Nicholas and Brookshire introduced "Correct information unit" (CIU) as a rule-based scoring system for assessing the communicative performance of connected speech and language in individuals with aphasia." (Nicholas, Brookshire, & Research, 1993). They also reported that, in contrast to other rule-based systems such as Yorkston and Beukelman (1980) (Yorkston, Beukelman, & disorders, 1980), their method can be used reliably for measuring different ranges of stimuli. Nicholas and Brookshire (1993) indicated that for better assessment of performance in connected speech, analysis could include the counts of number of words and number of CIUs as well as three calculated measures of words per minute, percent CIUs, and CIUs per minute (Nicholas et al., 1993).This classification which was set upon two important aspects of "Communicative informativeness and Communicative efficiency "has been considered and applied within various studies in English speakers with aphasia (Conner et al., 2018; Hoover, DeDe, Maas, & Research, 2021; Leaman & Edmonds, 2019; Webster & Morris, 2019).

Assessing different aspects of connected speech as a functional measure of daily communicative performance and creating corresponding assessment and intervention parameters according to Persian language standards is in its infancy. However, Ghoreishi et al. (2020) conducted a study to develop and assess different parameters of connected speech comparing with normal-matched group for Persian aphasic speakers (Ghoreishi et al., 2020). CIUs also has been introduced as a parameter of assessing the communicative performance in Persian aphasic speakers in only one study conducted by Ahmadi et al. (2022) (Ahmadi, Shafiei, Ghasisin, & Husak, 2022). Based upon the theoretical framework of Nicholas and Brookshire (1993) (Nicholas et al., 1993), the current study is a case report aimed at a preliminary identification of CIUs as a measure of communicative performance in a Persian speaker with anomic aphasia.

Materials and Method

Subject:

E.G. is a 30-year-old right handed Persian monolingual male who presents with right-sided hemiparesis and anomic aphasia due to brain tumor surgery. Before the incident which happened nearly two years before the assessment, he had practiced medicine as a general practitioner at a local hospital in his home town in southern Iran and had no previous history of major illness or accidents. Brain MRI examination determined unilateral cerebral lesion in left frontotemporoparietal. He was referred to the clinic of University of Social Welfare and Rehabilitation Sciences for assessment and intervention accompanied with his parents. He walked independently with a cane. E.G. is young and educated but reportedly, he is not motivated to converse his thoughts and desires in daily interactions and does not willingly participate in social exchanges with family members, friends or others. The family's chief complaint was his word finding difficulties in conversation, despite reporting well performance in auditory comprehension.

E.G.'s type of aphasia was diagnosed by a speech language pathologist (SLP), according to the results of formal assessments comprised of Persian Diagnostic Aphasia Battery (bedside version, AQ1=80%) (R. Nilipour, Pourshahbaz, & Ghoreyshi, 2014) and Persian Naming Battery (score=77%) (R. Nilipour, Pourshahbaz , A ., Ghoreyshi, Z. & Yousefi,A., 2014) indicating mild anomic aphasia. Demographic, medical and assessment performance of E.G. is demonstrated in table 1.

Table 1: *Demographic, Medical and Assessment performance of E.G.*

Demographic	**gender**	Male
	Age	30
	education	M.D.
	Handedness	Right
	language	Persian monolingual
Medical History	**Post-onset (after surgery)**	2 years
	Site of lesion	frontotemporoparietal
	Site of lesion	Left
	Hemiparesis	Right
Assessment performance	**Persian Diagnostic Aphasia Battery (bedside version)**	AQ1=80%
	Persian Naming Battery	77%

Procedure

Sample Elicitation:

A total of 120 utterances were collected from three one-hour sessions with E.G. which were all conducted in a quiet room free of distractions, with the presence of the subject and a certified speech language pathologist.

Different types of connected speech elicitation have been suggested. Prins, R. & Bastiaanse, R. (2004) categorized spontaneous speech into "semi-spontaneous" speech inclusive of picture description, storytelling/retelling and role playing as well as "spontaneous" speech being conversations and interview with open questions (Prins & Bastiaanse, 2004). Our language sample included both "spontaneous" speech (i.e., conversations between the clinician and the subject based on ask and answer questions) and "semi-spontaneous" tasks elicited by eight narrative tells/ retells (i.e., tell me about a trip to Zahedan), a procedural task (i.e., tell me how to bake a cake) and three sequenced picture description tasks (e.g., bird nest story from the Bilingual Aphasia Test (Paradis & Libben, 1987)).

Our criterion for selecting utterances in spontaneous tasks was units of speech with a beginning and an ending thought with a clear pause, and incorporating at least one verb. For semi-spontaneous speech tasks utterances were not necessarily determined by pauses at the end. The criterion included one explicit thought containing at least one verb with a clear beginning and an end, before moving on to another new thought related or unrelated to the topic of the talk. All sessions were audio recorded and speech samples were transcribed orthographically.

Sample Analysis:

The Persian version of Nicholas and Brookshire's (1993) guideline for scoring words and correct information units (CIUs) (Nicholas et al., 1993) was adapted for Persian language. A team of two SLPs and an experienced linguist fluent in both Persian and English discussed the guideline. This finalized version was applied for analysis of E.G.'s lan-

guage samples.

Total verbal units, CIUs, Total verbal units per minute, Percentage of CIUs and CIUs per minute were measured. A research team (of two SLPs) trained and experienced in scoring CIUs scored the speech samples. All of E.G.'s 58 utterances were reviewed one by one, disagreements and ambiguities were noted, discussed and resolved during team discussions.

Additionally, in order to accurately obtain an appropriate picture of the participant's linguistic performance in connected speech, we incorporated the following parameters with corresponding notes and guidelines to our language analysis. These parameters included: Interpretable, Grammatical Sentence, Reason for Ungrammaticality, Global coherence, Number of nouns, Number of different nouns, Number of pronouns, Number of verbs, Number of different verbs, Number of auxiliary verbs, Number of verbs conjugated correctly, Number of prepositions, Number of adjectives, Number of content words, Number of function words, NTTR, VTTR, Total verbal units. (See Appendix B for detailed description of each parameter).

Table 2: *language performance of E.G. in spontaneous and semi-spontaneous samples*

Parameter	Sample type	N	M(SD)	P-Value
Interpretable*	spontaneous	31	0.96(0.19)	0.01
	Semi-spontaneous	27	0.71(0.46)	
Grammatical*	Spontaneous	31	0.74(0.45)	0.02
	Semi-spontaneous	27	0.45(0.50)	
No. of Nouns	Spontaneous	31	1.18(0.92)	0.02
	Semi-spontaneous	27	2.0(1.61)	
No. of different Nouns	Spontaneous	31	1.07(0.83)	0.03
	Semi-spontaneous	27	1.74(1.41)	
NTTR	Spontaneous	31	0.94(0.17)	0.63
	Semi-spontaneous	27	0.92(0.21)	
No. of Verbs	Spontaneous	31	1.89(0.84)	0.07
	Semi-spontaneous	27	2.64(1.99)	
No. of different Verbs	Spontaneous	31	1.70(0.77)	0.16
	Semi-spontaneous	27	2.16(1.53)	
VTTR	Spontaneous	31	0.92(0.16)	0.43
	Semi-spontaneous	27	0.88(0.22)	
Content words	Spontaneous	31	4.37(1.78)	0.02
	Semi-spontaneous	27	6.0(3.71)	
Function words	Spontaneous	31	2.85(2.18)	0.02
	Semi-spontaneous	27	6.55(7.51)	
Total Verbal Units (TVU)	Spontaneous	31	7.89(3.3)	0.02
	Semi-spontaneous	27	13.26(10.65)	
Correct Information Unit(s) (CIUs)	Spontaneous	31	3.63 (2.37)	0.33
	Semi-spontaneous	27	4.32(2.97)	
CIUs/TVU%	Spontaneous	31	49.18(32.43)	
	Semi-spontaneous	27	46.95(29.04)	0.78
Content/ TVU%	Spontaneous	31	57.95(17.09)	0.31
	Semi-spontaneous	27	52.76(21.47)	
Function/ TVU%	Spontaneous	31	33.42(16.71)	0.07
	Semi-spontaneous	27	42.38(19.67)	
Word per minute (WPM)	Spontaneous	31	34.42 (11.72)	0.00
	Semi-spontaneous	27	23.0(7. 20)	
CIUs per minute	Spontaneous	31	15.43(1.97)	0.00
	Semi-spontaneous	27	8.0 (5.1)	

**Measures of Interpretability and grammaticality were marked based on a 0 or 1 scoring range.*

Results

Table 2 summarizes E.G.'s language performance in spontaneous and semi-spontaneous samples. An independent t-test was conducted to review and compare the speech parameters during spontaneous and semi-spontaneous samples. The Mean(M), Standard Deviation (SD) and P-value are reported. Our analysis revealed a significant difference ($p < 0.05$) between spontaneous and semi-spontaneous samples across the parameters of interpretability, grammaticality, number of nouns and different types of them, number of verbs, content and function words as well as WPM and CIUs per minute.

Better performance is observed in conversational samples in "interpretability" (M=0.96) and "grammaticality" (M=0.74) parameters compared to narrative samples, indicating that 96% of utterances produced during conversational samples were interpretable and 74% of them were grammatical, while these number are reduced to 71% interpretability with 45% grammatical accuracy in narrative samples.

More number of nouns (M=2.0), more different nouns (M=1.74), a greater number of verbs (M=2.64), and more content words (M=4.37) were produced in narrative samples spontaneous and semi-spontaneous samples compared to the number of nouns (M=1.8), number of different nouns (M=1.07), number of verbs (M=1.89) and number of content words (M=0.88) in conversational samples.

Total verbal units (TVU) produced across these samples was significant (p=0.02) indicating that during narrative samples each utterance contained an average of 13.26 verbal units (M=13.26), while this mean was significantly lower (M= 7.89) in conversational samples.

The percent of function words to total verbal units (Function/TVU%) was significant (p=0.07) across both sample indicating production of more function words in narrative samples (M=42.38) compared to conversational samples (M=33.42). Although no statistical difference was observed in the percent of content words to total verbal units across the sample (Content /TVU%), more production of content words was noted during conversational tasks.

A significant difference (P=0.00) is seen in production of WPM during conversational samples and narrative samples. This data suggests production of more verbal units per minute during conversational samples (M=34.42) compared to narrative samples (M=23.0). Similarly, a statistical difference is noticeable in production of CIUs per minute revealing more CIUs (M=15.43) per minute during conversations compared to narrative (M=8) samples.

No significant statistical distinction (p >0.05) was found in CIUs/TVU%, NTTR, VTTR, and different number of verbs during conversational samples as to the narrative ones. Despite this statistical insignificance, the percent of CIUs to TVUs was higher in conversational tasks suggesting producing more CIUs (M=49.18) during conversations compared to narratives (M=46.95). In addition, this data indicates that during narrative tasks, although the average of verbal units produced per utterance was 13.26, the mean production of CIUs was only 4.32 per utterance.

These findings may indicate that interpretability as an important parameter in understanding what the participant has to say about a given topic or picture was compromised due to production of more verbal units (e.g., nouns, verbs, etc.) which did not necessarily help conveying the correct amount of information to the listener (Appendix A). Ad-

ditionally, reviewing the examples of E.G.'s productions (Appendix A) together with our statistical findings (see table 2) reveal that reduced grammaticality in his output is not manifested in the language-specific symptoms of agrammatism presented in other Persian reported aphasic speakers (e.g., deletion of the ezafe linking morpheme, deletion were the postposed direct object marker /rd/ and prepositions, etc.) (Reza Nilipour & Raghibdoust, 2001) (Appendix A examples a , b and c) or , through universal features of agrammatism such as difficulty with language formulation (Hallowell, Chapey, & disorders, 2008), telegraphic speech, incorrect subject-verb agreement, absence, omission or mis-selection of function words (Goodglass, Berko, & research, 1960). It rather is represented through the E.G.'s attempts in producing more verbal units and much use of interjections and fillers to compensate for severe word finding deficits during discourse. (Appendix A , example a, b2, b4, c)

Discussion

E.G. is an interesting case of aphasia who presented with mild anomia according to the results of the bedside version of Persian Diagnostic Aphasia Battery (AQ1=80%) and Persian Naming Battery (77%.) He exhibited clinical features of anomia including well preserved comprehension, repetition and confrontation naming performance but spontaneous speech fluency was severely interrupted by word-finding problems consistent with Wanda and Webb (2017) (Webb & Adler, 2016). His CIUs/TVU% indicated moderate to severe anomia in connected speech. Our findings show that it is difficulties with E.G.'s use of language in functional context of daily living, and not in single object naming situations that disturbs his quality of life for efficient communication. This is consistent with ICF's indication of the importance of discourse in individual's participation level in daily activities and its impact on the quality of life ((WHO), 2022).

According to Nicholas and Brookshire (1993) the average %CIUs for an individual with aphasia is within a range of 22-85 (Nicholas et al., 1993). The average %CIUs of E.G. was indicated as 49.18 during conversational tasks and 46.95 during narrative tasks. Consistent with Nicholas and Brookshire's findings, the numbers are significantly lower compared to that the average %CIUs within a range of 75-93 for an individual without brain damage (Nicholas et al., 1993). Nicholas and Brookshire (1993) also indicated that the average WPM for an individual with aphasia is within a range of 15-150 (Nicholas et al., 1993). The average word per minute of E.G. was 34.42 during conversational and 23.0 during narrative tasks. Findings are consistent with Nicholas and Brookshire's data indicating a much lower range compared to that of the average WPM for an individual without brain damage with a range of 105-202 (Nicholas et al., 1993).

E.G. produced speech characterized by reduced grammaticality, frequently interrupted by severe word finding difficulties. His speech fluency was compromised due to pauses associated with sever word retrieval difficulties. What maybe best discriminated his performance compared with other anomic aphasics was his preserved confrontation naming performance and reduced grammaticality. Additionally, reviewing E.G.'s output (Appendix A) alongside our findings show that reduced grammaticality was not represented through language specific or typical universal symptoms of agrammatic speech (e.g. difficulties, telegraphic speech, omission of function words, etc.) (Goodglass et al., 1960). These problems were rather manifested in his severe word finding difficulties in connected speech along with his attempts for producing more verbal units with higher number of function words (Appendix A, example a) to be used as fillers, resulting in empty or lower-content verbal production

Through this case study, we found mild anomia based on the results of formal assessment and moderate to severe anomia based on CIUs. The percentage of correct information units was less than 50 % of the total verbal units produced by E.G. We could therefore establish that measuring CIUs may be used as a valuable measure of language informativeness and efficiency in analyzing connected speech in Persian speakers with aphasia. We suggest that CIUs be incorporated as a valuable parameter in analyzing connected speech in assisting individuals with aphasia enhancing their functional communicative performance by producing more CIUs and communicating their intentions to the listeners more efficiently.

To our own knowledge, the findings of the current case study is within the first reports in providing preliminary support to the use of CIUs as a valuable measure of communicative informativeness and efficiency in Persian speakers with aphasia. Further studies on the use of CIUs need to be performed taking into account a larger sample with a more diverse aphasia etiology including both fluent and non-fluent aphasic speakers. Another limitation of this report was the nature of the CIU scoring. CIUs has not been introduced into analysis of connected speech in Persian, therefore there is limited number of professionals familiar with it. Single confrontation naming assessment is widely used within the Persian aphasia population, integrating connected speech into aphasia assessment and intervention planning for Persian aphasic speakers need further considerations. Currently, there are no published norms for assessing different parameters of connected speech in Persian. Additionally, CIUs guidelines and procedures (Nicholas et al., 1993) need to translated and adapted according to Persian language standards.

The primary goal in aphasia assessment is using the findings for diagnosis as well as intervention planning and monitoring. Therefore, given the results of our analysis and E.G.'s background, increasing metalinguistic awareness and skills is suggested to be incorporated in his intervention plan. Natural metalinguistic abilities are a special type of executive process, involved in controlling and manipulating language (Harley, Jessiman, MacAndrew, & Astell, 2008). According to Hernández-Sacristán et al. (2011), "Metalinguistic skills can be considered a prerequisite for the appropriate use of language in context and for functional communication". They also endorse that language intervention plans should integrate strategic and monitoring capacities that control language use (Hernández-Sacristán, Rosell-Clari, MacDonald, & Phonetics, 2011). E.G. could be an active participant in his speech and language rehabilitation process. Increasing his awareness in production of TVUs compared to CIUs and teaching him techniques to consciously manipulate these productions can be a motivational step in helping him successfully conveying correct and efficient information to the listeners while monitoring his linguistic output.

Declaration of Interest:

The authors report there are no competing interests to declare.

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