Self-interruptions in Breast Cancer Patients Who Complain of Anomia

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ABSTRACT

Patients with cancer and cancer survivors sometimes complain of cognitive difficulties related to the cancer and its treatments. Even though one of their most frequent complaints is anomia, currently used neuropsychological tests are unable to detect word-finding difficulties.
The aim of this study was to explore the relationship between pauses at minor boundaries and their right contexts to better describe pauses associated with subtle anomia.
The spontaneous speech of seventeen patients with breast cancer was recorded. Pauses in suspensive interruptions (i.e., the phrase continues after the pause) and disfluent interruptions (i.e., the phrase is modified after the pause) were analysed as well as their right contexts (i.e., lexical-semantic content, independent phrases, or tool words).
The main result showed that suspensive pauses are more likely to be followed by lexical content. This finding suggests that the analysis of pauses in syntactic disruptions could provide evidence about subtle anomia.

Keywords: Breast cancer, pauses, anomia, disfluencies.

1. INTRODUCTION

Patients with cancer and cancer survivors sometimes complain of cognitive changes, called Cancer-Related Cognitive Impairment (CRCI). CRCI negatively affects patients' quality of life by limiting their social participation, and in some cases compromising their return to work. Patients complain of difficulties in the domains of memory (forgetting names and dates) [1], executive functioning (trouble multitasking) [2], attention (distractibility), and language [3]. One of the most frequent language complaints is anomia. According to self-report studies, difficulties with word-finding or word-retrieval in everyday speech could concern between one third and up to 100 percent of patients with CRCI [4], [5].

While the cognitive complaint can be reliably identified using validated questionnaires, neuropsychological tests struggle to detect many difficulties [6]. This discrepancy between subjective and objective assessments may be due to a lack of sensitivity and/or ecological validity of the latter [7]. Indeed, the tasks currently in use were originally designed for use with more severe disorders like aphasia, and do not correspond to the subtle nature of most cancer patients' difficulties [6]. Hence, there is a need for new diagnostic methods.
One solution, with high sensitivity and ecological validity, could be phonetics and discourse analysis. This approach has already been used in research on Mild Cognitive Impairment (MCI) [8], [9], and although MCI patients have a very different aetiology and evolution, their language complaint resembles that of patients with CRCI. These studies on MCI have shown differences between speech in patients and healthy controls at a prosodic level (e.g., a higher number of pauses) [10].
Everyday language contains speech errors called disfluencies. These include pauses, breaks, or repetitions, and one study with Alzheimer's Disease (AD) patients found an association between the number of disfluencies and word finding difficulties. These patients also produced more pauses at minor syntactic boundaries than healthy controls [11]. The authors interpreted these results as evidence of difficulties with lexical retrieval and planning. Based on these results, the current study investigated whether similar phenomena exist in breast cancer patients who complain of anomia. The goal of this research is to explore the relationship between pauses at minor syntactic boundaries and their right context with the aim of better describing pauses associated with subtle anomia. This exploratory study is part of a larger project aimed at developing a language-based diagnostic tool for CRCI.

2. METHOD

Twenty-three women participating in a physical reconditioning program for patients with breast cancer took part in the study. This rehabilitation program is offered by the Henry Gabrielle hospital

(Saint-Genis-Laval, France) to patients who are at least 6 weeks post-treatment (chemotherapy, radiotherapy, and surgery).
All patients were French native speakers or fluent in French. Patients with a history of neurological or psychiatric disorders, those taking medications that can affect consciousness, and/or having a diagnosed speech language impairment were not included. Patients were included if they reported language difficulties when questioned by a speech and language therapist. In total, seventeen patients were eligible for the study. Six patients were not included due to psychiatric conditions (2), vascular disease (1), language impairment history (2), or no language complaint (2). Since the study design was exploratory, we did not include a control group.
This research is part of the ActiCog study at the Hospices Civils de Lyon.

2.1. Speech samples

Patients were interviewed individually by a speech and language therapist. Each interview lasted approximately 30 minutes and consisted of a brief language examination (to verify the absence of any language impairment prior to the cancer diagnosis) followed by three tasks. In the first task, patients were asked to narrate a story based on five images. In the second task, they were asked to recall as many details as possible from a 5-paragraph text read by the speech and language therapist. Finally, they conversed with the investigator about the destination for their next holidays. The investigator intervened rarely, providing backchannels and questions when necessary, in order for the conversation to continue. Data presented in this study come from the spontaneous discourse related to their next holiday destination.
Interviews were recorded using a Rhode Lavalier Go™ omnidirectional microphone linked to a computer.
Patients completed a brief cognition function screening test (Montreal Cognitive Assessment, MoCA) and a speed of processing test (Symbol Digit Modalities Test, SDMT). They also completed auto-questionnaires about their perceived cognitive function (Functional Assessment of Cancer Therapy-Cognitive Function – Cognitive Function, FACT-Cog), their fatigue (FACIT-F, Functional Assessment of Chronic Illness Therapy – Fatigue), and their anxiety/depression (Hospital Anxiety and Depression Scale, HADS).

2.2. Linguistic features

All interviews were manually transcribed and annotated using PRAAT [12]. Silent pauses over 200 msec, filled pauses such as “euh” (“uh”), and lengthening over 200 msec [13] with a flat F0 contour were all annotated.
Interruptions were labelled using the annotation system proposed by Pallaud and colleagues [14] based upon their analysis of auto-interrupted utterances in spontaneous conversations of French speakers. In their study, Pallaud and colleagues identified two kinds of self-interruptions: suspensive and disfluent. In suspensive interruptions, the utterance continues after the pause without any change in the phrase. In contrast, disfluent interruptions are characterised by a morpho-syntactic disruption whereby the interrupted utterance is modified or left unfinished.
The right context of the pauses was analysed to investigate the type of content following the pause. Three content types were defined: Lexical Phrases (LP) such as nouns, noun phrases, or verbs, Independent Phrases (IP) such as verb phrases, and Tool Phrases (TP) such as grammatical words or locutions.

The extracted variables were Pause type (Suspensive Pause and Disfluent Pause) and right context type (Lexical Phrase, Independent Phrase, and Tool Phrase) were extracted. For each variable, we measured the rate (i.e., number of occurrences / 100 words).

2.3. Statistical analyses

A D’Agostino & Pearson’s test was run to test whether the data follow a normal distribution.
Pearson’s correlations were conducted to investigate the relationship between average pause rate and questionnaire and test scores.
Pause rate data were entered into a two-way ANOVA with factors pause type (Suspensive vs Disfluent) and right context type (LP, IP, and TP) with Bonferroni post hoc tests. Finally, for each pause type and for each patient we plotted pause rate as a function of right context type.

3. RESULTS

3.1 Sample characteristic

The mean age of the 17 patients included in this study was 49.7 (± 9.5).
The neuropsychological assessments did not detect any cognitive problems, whereas the FACT-Cog questionnaire revealed a cognitive complaint (score of < 60 on the perceived cognitive impairment subscale [15]) in 13 /17 patients.
One patient did not complete the anxiety, depression, and fatigue questionnaires. Anxiety and depression scores were low for 13 of the remaining 16 patients.

There was no correlation between pause rate and scores on the HADS anxiety subscale (ρ = - .39, p = .12) and depression subscale (ρ = 0.03, p = .91). Patients reported a moderate level of fatigue but there was no correlation between pause rate and scores on the FACIT-F self-report fatigue questionnaire (ρ = - 11, p = .68).

To ensure that our data set did not include data from patients who made a small number of very long pauses, we calculated the correlation between the number of the pauses and average pause duration. The relationship between these two variables was highly correlated (ρ = 0.72, p <.0001), which attests to the quality of our dataset which did not include data from a small number of very long pauses.

3.2 Relationship between Pause Type and Right Contexts

Figure 1 shows the average pause rate separately for the two pause types and the three right contexts. For suspensive pauses, mean pause rate was highest for the LP right context and lowest for the TP right context. Whereas, for Disfluent pauses it was highest for the IP right context and lowest for the TP right context. The two-way ANOVA on these data showed a significant interaction (F(2) = 4.87, p = .009). Bonferroni post-hoc tests revealed a significant difference between LP and TP for both Suspensive (p < .001, 95% C.I. = [-2.24, -0.73]) and Disfluent Pauses (p < .05, 95% C.I. = [-1.43, 0.07]), a significant difference between IP and TP in both Suspensive (p < .01, 95% C.I. = [-1.6, -0.09]), and Disfluent Pauses (p < .001, 95% C.I. = [-1.99, -0.48]). LP and IP pause rates were also significantly different, but only for Suspensive Pauses (p < 0.05, 95% C.I. = []). There was a significant main effect of Right Context (p < .0001), but no effect of Pause Type was found (p =.52).

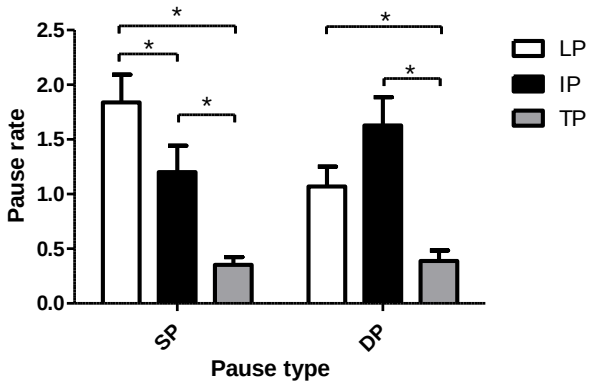

Figure 1: Comparison of mean pause rate for Suspensive and Disfluent Pauses as a function of right context: Lexical Phrase (LP), Independent Phrase (IP), and Tool Phrase (TP).

The mean pause rate data shown in Figure 1 reveal different data patterns for Suspensive and Disfluent pauses. To explore whether data from individual patients followed these same patterns, we plotted each patient's pause rate as a function of right context for Suspensive (Figure 2) and Disfluent (Figure 3) pauses. These figures show that nearly 75% of patients showed the same pattern as the mean pause rate data shown in Figure 1 (13/17 for suspensive pauses and 12/17 for disfluent pauses).

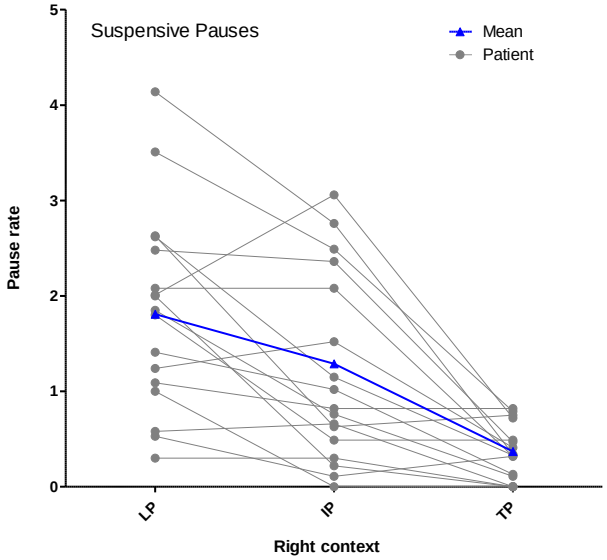

Figure 2: Right context pattern for each patient for Suspensive Pauses. Each line represents a patient, and the blue line represents the mean for all patients.

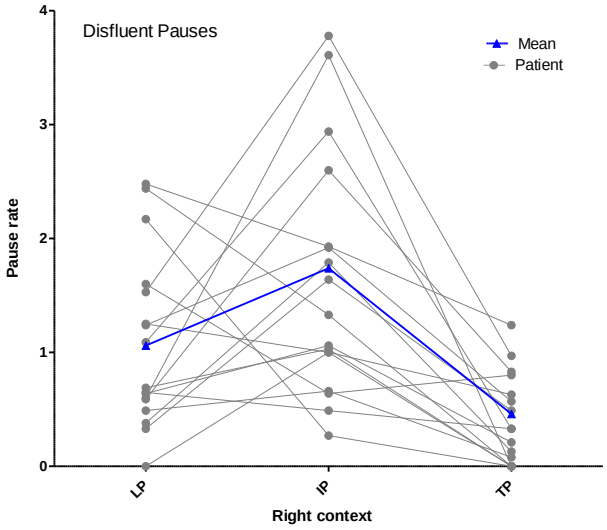

Figure 3: Right context pattern for each patient for Disfluent Pauses. Each line represents a patient, and the blue line represents the mean for all patients.

4. DISCUSSION

The spontaneous speech of seventeen women who had completed treatment for breast cancer and who complained of anomia was analysed.

4.1 Pause type

In the present corpus, pause rates showed a different pattern across right contexts for suspensive and disfluent pauses. Suspensive pauses occurred more often before lexical-semantic content than before independent phrases or tool words. In contrast, disfluent pauses occurred more often before independent phrases than before lexical-semantic content or tool words. This pattern of results suggests that suspensive pauses could be more likely to be associated with lexical retrieval processes.

Tool phrases are generally less frequent than other content type. The grammatical content analysed in the current study consisted of tool words such as determiners, or pronouns, as well as discourse markers (e.g., “voilà”, “quoi”, “en fait”). In the current study, tool words were often found before another break between two weak boundaries, suggesting that they might be part of lexical or syntactic difficulties. Discourse markers were less frequent than tool words, and often occurred before a strong boundary, suggesting that they might help the patient end her unfinished utterance.

While we deliberately separated our pauses into Suspensive and Disfluent, when the data from the two pause types are combined (the main effect of Right Context in our two-way ANOVA), lexical-semantic content and independent phrases follow pauses just as often as each other. While the interaction we observed means that these data should be interpreted with caution, they nevertheless suggest two possible hypotheses. First, anomia could be hidden in rephrasing, whereby patients who have trouble with word-finding use a new phrase to express their idea without the sought word. Second, the anomia reported by patients could arise from more global cognitive difficulties. For example, if anomia is caused by CRCI-related mechanisms then it could be a symptom of changes in cognitive functions including attention, memory, and executive functioning. Indeed, altered function in any one of these cognitive domains could have a direct impact on language. If this is the case, then patients who complain of anomia are likely to encounter trouble with phrasing or difficulties in syntactic planning.

4.2 Pause rate patterns

Nearly 75% of patients had pause rate patterns similar to the mean rate of the current sample. Research on the onset of CRCI is scarce. In contrast, we know that once cognitive difficulties have been identified they can last anywhere between two and ten years after the end of treatment [16]. Since these cognitive difficulties can compromise return to work [17] and limit social activities, there is an urgent need for early identification of patients who are potentially at risk of developing them. Comparing an individual’s pause rate pattern to patterns derived from a large population of cancer patients as well as a control population could be a reliable method for identifying those patients most at risk of developing long-lasting cognitive impairment.

4.3 Relationship between cofactors and pause rates

Consistent with the literature [6], scores on the cognitive complaint scale revealed more cognitive difficulties than the neuropsychological test scores. However, no correlation was found between pause rates and either cognitive complaint scores or neuropsychological test scores. Similarly, pause rates were not correlated with depression and anxiety or fatigue. Hence, pause rates could be independent of these psychological factors.

4.4 Strengths and limitations

This study is the first to explore pauses at minor syntactic boundaries with the goal of investigating phonetic markers of subtle anomia. Its major strength relies on the discourse type it analysed. Indeed, spontaneous speech provides the best ecological validity because of its proximity to everyday discourse.

Due to the exploratory nature of this study, no control group was included. Further investigations with healthy individuals and cancer patients with no complaint of anomia are necessary to achieve the long-term goal of developing a new method for the diagnosis of subtle anomia.

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