EFFECT OF COGNITIVE FLUCTUATION ON HANDWRITING IN ALZHEIMER’S PATIENT: A CASE STUDY

EMANUELA ONOFRI1, MARCO MERCURI1, TREVOR ARCHER2*, MAX RAPP RICCIARDI1, FRANCESCO MASSONI1, SERAFINO RICC1
1Department of Anatomy, Histology, Legal Medicine and Orthopaedics, Sapienza University of Rome, Italy - 2Department of Psychology, University of Gothenburg, Gothenburg, Sweden

ABSTRACT

Introduction: The older population is rapidly growing in the European states and across the globe; and in aging we notice a cognitive declines, a decrease in memory and decision-making abilities.

Characteristics of the cognitive fluctuations occur infrequently in the elderly, but they are present in patients with dementia. Fluctuating cognition and abilities have been described as periods of behavioral and thought confusion, inattention, and incoherent speech alternating with episodes of lucidity. It is common in Dementia with Lewy bodies (DLB), however, the role of fluctuations in Alzheimer’s disease (AD) has not been much considered.

Case presentation: The present study examines the relationship between cognitive status and handwritten scripts, presented as ‘letter-writing’ in AD patient, as oscillations of the symptoms phase.

Discussion: We present evidence that the deficits of attention and its fluctuations and the cognitive impairment are related with the handwritten expression.

Key words: Alzheimer disease; correlations; cognitive fluctuation; handwriting.

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Introduction

The aging of the population, is associated with an increase in illnesses such as dementia and Alzheimer’s disease (AD). The reports from the National Epidemiologic Bulletin (Ben) have projected that Alzheimer’s disease represents 54% of all dementia. The prevalence of this pathology is increasing with age and the increase seems to be higher among women. Within the age span of 65-69 years 0.7 of the female population has the disease, compared to 23.6% of the women that had aged beyond 90 years. The corresponding figures for males are 0.6 (65-69 years) and 17.6 for those who passed 90 years of age.

Alzheimer’s disease is a neurodegenerative disorder that results in progressive cognitive, functional, and behavioral changes; in addition it is identified as one of the “mental disorders that may affect decision-making capacity” (1).

ADIs of interest not only for the individuals who are victims of the disease, but it involves family members and caregivers as well. The disease has a dramatic impact on public health, as well as the financing of health care. From this perspective it represents pathology of interest from a social medicine perspective.

The cognitive impairment in Alzheimer’s patients was investigated using psychomotor speed (2), verbal ability and reasoning (3) and visuospatial abilities (4). In addition, a positive correlation was observed between the severity of the dementia and spelling/writing measures (lexical and allographic). Agraphia or dysgraphia, observed in early AD (5) encompasses a progressive disorganization and
degeneration of the various components of handwriting such as the complexity of the structure of sentences the diversity and the accuracy of words used, the production of grammatically incorrect sentences (6,7) the length of the sentences the amount of written information the morphology of the letters and spelling graphic and spatial layout of letters and their arrangement in texts. Also strong relationships was observed between dysgraphia and cognitive performance (PQ1) in AD patients the marked deterioration (8).

Between the two extremes corresponding to an acceptable health condition or an absolute cognitive impairment, there is a series of intermediate states with alternating phases of aggravation with loss of cognition and remission phases in which remains an ability to be conscious of external reality.

Fluctuating cognition occurs in all the major dementias and it is characterized by periodic shifts in the level of arousal, ranging from episodes of lucidity to reduced awareness and even stupor (9,10). The purpose of the present study was to examine the relationship between cognitive impairment and handwritten scripts presented as ‘letter-writing’in AD patient, as oscillations of the symptoms phase.

Case presentation

The patient, female and age 93 years was followed by Neuropsychology Service at the Policlinico Gemelli in Rome as suffering from degenerative dementia of Alzheimer type in progressive character. The reported memory disorders (consisting of the difficulty to remember recent conversations, events and the previous positioning of objects and mood (depression, anxiety manifested as irritability, outbursts of aggression, feelings of persecution, repetitive behaviors), which occurred for about 4 years, were further worsened with the onset of slurred speech and behavior.

The patient did not respond appropriately to the different situations and interpreted the audio or visual stimuli incorrectly. The patients disorders were also manifested home doing domestic work and taking care of themselves on an everyday basis.

The behavioral and cognitive disorders were poorly responsive to drug therapy.

From the data of the computerized axial tomography (CT), result was a marked atrophy of the brain, particularly evident from the left side, in the occipital region.

During the multidimensional and neuropsychological evaluation she showed sufficient cooperation and a ‘floating attention’, together with presence of confabulation and perseveration.

In all tests administered, with the exception of a test of verbal short-term memory (digit span forward and backward), the performances were below the standards they appear from the table 1.

Mini-mental State Examination (MMSE) presents a brief 30-point questionnaire test to screen for cognitive impairment and dementia. It estimates the severity of disorder and follows the course of cognitive changes in an individual over time, thereby allowing effective monitoring of an individual’s response to treatment (11).

Activities of Daily Living (ADL) are activities in which people engage on a day-to-day basis. These are everyday personal care activities that are fundamental to caring for oneself and maintaining independence (12).

Instrumental Activities of Daily Living (IADL) are activities related to independent living conditions and are valuable for evaluating persons with early-stage disease, both to assess the level of disease and to determine the person’s ability to care for himself or herself (13).

Rey-Osterreith Complex Figure (Rey-O) is made up of two subtests, the copy and immediate recall tests. Both are measures of planning, visual memory, and perceptual organization. In the Rey-O copy test, participants are directed to copy a picture of a complex figure that is displayed before them. In the Rey-O immediate recall test, participants are directed to reproduce the complex figure without it being displayed before them; thus, they must rely on visual memory (14).

The Stroop Color and Word Test (Stroop’s test) is used to examine the effects of interference on reading ability. The Stroop contains three parts: word page (the names of colors printed in black ink), color page (rows of X’s printed in colored ink) and word-color page (the words from the first page are printed in the colors from the second page; however, the word meanings and ink colors are mismatched), each with 5 columns containing 20 items. The subject’s task is to look at each sheet and move down the columns, reading words or naming the ink colors as quickly as possible, within a given time limit (45 seconds) (15).

Praxis construction is the patient’s capacity to copy geometric form of varying difficulty, from a simple circle on the much complex cube.
The first day we invited the patient, to sit in a comfortable position and to write a list of things to buy. We gave her a pen and paper sheet. (fig. 1A). After 3 days we repeated the exercise. We invited the patient to write letter to a family’s member. The letter was addressed to a living brother which the patient was deeply connected with (fig. 1B).

**Discussion**

The first day, the patient wondered where she was and what day it was, who the physician was and she often rested the pen. We invited her to write, she resumed but with the above evident results (fig. 1A).

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**Table 1:** Clinical characteristics of the patient in the present study.

<table>
<thead>
<tr>
<th></th>
<th>MMSE 12.85 (14)</th>
<th>IADL 2/8</th>
<th>ADL 2/6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>raw score (corrected)</td>
<td>cut-off</td>
<td></td>
</tr>
<tr>
<td>Rey’s test immediate recall</td>
<td>19 (24.6)</td>
<td>28.52</td>
<td></td>
</tr>
<tr>
<td>Rey’s test learning curve</td>
<td>3 3 4 5 4 X 2 1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rey’s test delayed recall</td>
<td>100%</td>
<td>&lt; 19% &gt; 61%</td>
<td></td>
</tr>
<tr>
<td>Digit span forward and backward</td>
<td>6 vs 3</td>
<td>7&lt;2.5&gt;2</td>
<td></td>
</tr>
<tr>
<td>Spatial span forward and backward</td>
<td>2 vs 0</td>
<td>7&lt;2.5&gt;2</td>
<td></td>
</tr>
</tbody>
</table>

**Visual-spatial analysis and attention**

| MFTCa | it is unenforceable | acc 93% time 133″ |
| Praxis construction | Copy of free figures | 3 (2.7) | 7.18-61.85 |

**Language**

| Words generation on semantic judgment | 7 | 12 |
| Words generation on phonological judgment | 19 (14.3) | 17.35 |
| Oral denomination of objects-reduced | 6 (12 vis, 3 sem, 1 vis/sem) | 22 |

**Front test**

| Stroop's test | She does not include delivery | It >36.92 Ie < 4.24 |

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Fig. 1A – Writing 1° day. Fig. 1B - Writing 3° day.

The differences in the handwriting can be noticed. The handwriting is understandable in 1B, which took place 3 days after the test. It could be noticed that the handwriting has changed in various ways: a) the width, b) the space between the words and the alternation of the letters written in italics and captions.
In fig. 1A there are graphic difficulties and spatial organization alteration of writing with little control of the movement. The paper appeared inconclusive, alternating cursive with print letters handwriting.

After 3 days the patient had the ability to maintain and monitor the processes of thought and the degree of consciousness was ascertained through the determination of the individual’s memories, attentional faculty, and intelligent responses in following the questions: What is your name? When were you born? Who am I? What year is it? What season are we in? What month is it? What is the date today? What day of the week is today? Is it day or night? Where are you?

We note in the tract of letters discontinuity and fragmentation, however, the script is understandable and logical that shows the full capacity to process a thought, a speech and its translation into graphic form (see fig. 1B).

All tests were performed in the first and in the third day at the same time and the patient has not changed therapy.

Fluctuating cognition and abilities have also been described as periods of behavioral confusion, inattention, and incoherent speech alternating with episodes of lucidity and capable task performance and are considered a core feature of dementia with Lewy bodies (DLB) [16].

It is unknown to what extent fluctuations occur in aging and Alzheimer disease (AD) and whether the presence of fluctuations impairs cognitive performance in AD compared with individuals who do not have features of fluctuations.

The present study confirms the hypothesis that fluctuations in cognition can be present in moderate-severe AD and it is also evident that attentional deficits and fluctuations can be related with the handwritten expression.

It is possible that, even in patients with a diagnosis of moderate-severe AD, the analysis of the graphic expression provides the degree of the remaining capacity of understanding and through handwriting intentions of the patients can be expressed correctly.

Assessment of fluctuations should be considered as an intrinsic and useful method in the evaluation of patients for cognitive disorders. The evaluation of the dementia patient may be confounded if a fluctuation occurs during the course of assessment of functional abilities and test performance [17,18].

In the perspective of the present interpretation, a more detailed evaluation of graphia can make an important contribution to the diagnostic assessment and to screen for cognitive impairment [19].

References


Corresponding author
EMANUELA ONOFRI
Department of Anatomy, Histology, Legal Medicine and Orthopaedics, Sapienza University of Rome.
viale Regina Elena, 336
00161 Roma
(Italia)