Intellectual functioning and memory deficits in schizophrenia

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Abstract

Background: There is converging evidence about the existence of different subgroups of patients with schizophrenia in relation to intellectual ability (intelligence quotient [IQ]). Studying cognitive deficits in such patients in relation to IQ, and more specifically to memory, could help determine the patterns of preserved and impaired functioning in cognitive abilities in association with patterns of preserved and compromised intellect. This information could serve to delimit the possibilities of treatment and rehabilitation in those patients.

Methods: A total of 44 patients with schizophrenia completed a cognitive battery that included executive functioning, attention, speed of information processing, working memory, explicit memory, implicit memory, and everyday memory. Their IQ was also measured to identify 2 subgroups with an IQ of 85 as the cutoff point. Then, differences between the groups in the neurocognitive measures were studied.

Results: Performance in executive functioning, attention, working memory, and everyday memory, but not that in speed of information processing, explicit memory, and implicit memory, was associated with intellectual functioning. Patients performed at the same level in perceptual implicit memory but at a lower level in conceptual implicit memory as did healthy control subjects.

Discussion: Cognitive deficits in schizophrenia are associated with intellectual functioning. Implicit memory should not be considered as a unique entity. It is suggested that conceptual implicit memory deficit may be a core feature of schizophrenia.

1. Introduction

Memory deficits have been considered as a specific dysfunction in schizophrenia [1,2]. Most empirical evidence on such deficits come from studies that compared the performance of patients with schizophrenia with that of healthy control subjects in explicit verbal and nonverbal recall and recognition, working memory, and semantic memory. Their neural mechanisms have also been established [3]. More recently, a specific pattern of dissociations in schizophrenic memory functioning has been found with impairment in episodic long-term memory and working memory coupled with preservation in areas such as short-term memory, especially verbal short-term memory, and procedural memory [2,4].

However, the literature has given less attention to the study of everyday memory impairment and implicit memory deficits in these patients.

According to McKenna et al [4], poor performance in some memory forms could reflect the schizophrenic tendency to general intellectual impairment. In fact, memory deficits in schizophrenia commonly occur within some degree of general intellectual impairment when intelligence is measured using traditional psychometric instruments (ie, an intelligence quotient [IQ] test). Consequently, the scores on all cognitive tests could be depressed to some extent and the memory performance pattern could be obscured.

However, results about the magnitude of intellectual deficit in patients with schizophrenia do not show a clear pattern. Some studies have reported that patients with schizophrenia have a lower IQ in comparison with healthy control subjects, whereas other studies have shown that intellectual decline after the onset of schizophrenia is not general and that a relevant proportion of patients have a normal IQ [5,6]. For example, in a cognitive evaluation of 221 patients with schizophrenia, Goldstein and Shemansky [7] observed that 26% of the sample showed a normal IQ. Similarly, Weickert et al [8] reported that, of 11 patients with
schizophrenia consecutively admitted to a mental health center, 24.8% had an IQ within normal limits. More recently, in a sample of 109 patients, Badcock et al [9] found that 41% had preserved intellectual functioning.

Parallel literature had also shown that patients with a normal IQ also have substantial cognitive deficits [10], although results do not always coincide. For example, Rund et al [11] found that a high intellectually functioning group of patients with schizophrenia who have IQ scores between 100 and 125 scored lower than did control subjects in executive functioning, visual memory, and verbal memory. However, Weickert et al [8] only observed “mild impairment in executive function and, possibly, attention and encoding.”

The heterogeneity of results observed in the general intellectual functioning of patients has been afforded through 2 strategies. The first strategy involves controlling the influence of IQ on memory impairments using only subjects with intact cognitive functions. Although this strategy helps eliminate the effect of intellectual functioning on different cognitive functions, it does not indicate how memory deficits are related to intellectual deficit in schizophrenia [10,11]. The second strategy is establishing different subgroups of subjects using IQ level as the criterion. This procedure could help elaborate the role that intellectual functioning plays in cognitive functioning and particularly in memory impairments [11]. If memory performance is related to IQ, then we can expect different scores on memory tests from patients who have a low IQ and from those with a normal IQ. Studying these differences could make determining which memory aspects are jointly impaired and which are uniquely affected for each IQ group possible.

To draw more firm conclusions regarding the magnitude and specificity of memory dysfunction in schizophrenia, we analyzed the role of IQ in these deficits, assessing a wide range of memory areas and the cognitive domains of executive functioning, attention, and speed of information processing. We examined the profile of the performance of patients with schizophrenia evaluating different forms of explicit and implicit memory. A battery of memory tasks was administered, including explicit tests on working memory capacity, recall and recognition tasks, implicit memory tests such as word-fragment completion and word production from semantic categories, and a memory test to detect and monitor everyday memory problems.

The general intellectual functioning of patients was also measured using the Wechsler Adult Intelligence Scale (WAIS-III). The IQ scores were used to classify subjects in 2 groups: patients who were intellectually intact by having IQ levels within 1 SD of the population mean (IQ scores ≥85) and those who were intellectually impaired by having IQ levels lower than 85. To determine the possible influence of IQ on memory performance, we compared the patterns of results of both patient groups on the different cognitive and memory measures.

2. Subjects and methods

2.1. Participants

Forty-four outpatients from the Center for Rehabilitation and Social Integration in Valencia, Spain, participated in the study. They had a diagnosis of schizophrenia according to Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition criteria. All the subjects provided written informed consent before participating in the study. The demographic and clinical characteristics of the patients are shown in Table 1. All the patients were treated with typical or atypical antipsychotic medication. A short form of the Spanish version of the WAIS-III with documented psychometric properties was administered to estimate their current IQ level. This short form [12] includes the following subtests of the full scale: information, block design, arithmetic, and digit symbols. Two groups were formed according to the participants’ IQ: an IQ of 85 was used as the cutoff point. Twenty-three subjects scored lower than this point (mean IQ = 73.09; SD = 8.92), and 21 scored higher than it (mean IQ = 98.38; SD = 10.14).

2.2. Cognitive assessment

All the participants completed a battery of neuropsychologic tests that had been selected to assess executive functioning, attention capacity, speed of information processing, working memory, explicit and implicit memory, and everyday memory. All these tests were administered and scored by trained psychologists.

The Wisconsin Card Sorting Test (WCST) [13] was administered as a test of executive function. The variables analyzed from this test were the number of categories achieved, total trials to resolve the task, total errors, and perseverative errors. Attention and speed of information processing were assessed using the digit symbol substitution and picture completion subtests of the WAIS-III. These tasks require some level of attention, motor coordination, and visual tracking.

The arithmetic calculation and digit span (forward and backward) subtests of the WAIS-III were administered as tests of working memory.

Explicit memory was measured with tests that assess acquisition, storage, and retrieval deficits. The acquisition mechanism was assessed with a general learning paradigm (the immediate and delayed free recall of a short story) using the immediate and delayed subtests of the Rivermead

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Sociodemographic characteristics of all patients</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>IQ &lt;85 (n = 23)</td>
</tr>
<tr>
<td>Sex (male/female)</td>
<td>20:3</td>
</tr>
<tr>
<td>IQ (mean ± SD)</td>
<td>73.09 ± 8.92</td>
</tr>
<tr>
<td>Age (y; mean ± SD)</td>
<td>34.30 ± 7.84</td>
</tr>
<tr>
<td>Education (y; mean ± SD)</td>
<td>6.57 ± 4.91</td>
</tr>
<tr>
<td>Duration of illness (y; mean ± SD)</td>
<td>15.39 ± 8.71</td>
</tr>
</tbody>
</table>
Table 2
Patients’ test scores in the neurocognitive measures and results of comparisons between the whole group, the low IQ subgroup (IQ < 85), and the high IQ subgroup (IQ ≥ 85) with normative data mean values

<table>
<thead>
<tr>
<th>Executive functioning</th>
<th>Whole group</th>
<th>Low IQ subgroup (IQ &lt; 85)</th>
<th>High IQ subgroup (IQ ≥ 85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCST categories</td>
<td>5.57</td>
<td>3.84 ± 2.11</td>
<td>5.37 ± 0.01</td>
</tr>
<tr>
<td>WCST number of trials</td>
<td>84.22</td>
<td>113.40 ± 21.48</td>
<td>8.91 ± 0.01</td>
</tr>
<tr>
<td>WCST total errors</td>
<td>17.05</td>
<td>45.16 ± 26.32</td>
<td>7.01 ± 0.01</td>
</tr>
<tr>
<td>WCST perseverative</td>
<td>8.78</td>
<td>25.86 ± 18.85</td>
<td>5.94 ± 0.01</td>
</tr>
</tbody>
</table>

Attention and speed of information processing

| WAIS-III picture completion | 10.7 | 8.00 ± 3.18 | 5.64 ± 0.01 | 6.43 ± 2.59 | 7.90 ± 0.01 | 9.76 ± 2.68 | 1.60 ± 0.125 | 0.05 ± 0.17 |
| WAIS-III symbol substitution | 10.6 | 6.75 ± 2.19 | 11.66 ± 0.01 | 5.52 ± 1.95 | 12.48 ± 0.01 | 7.76 ± 2.02 | 6.43 ± 0.01 | 0.01 ± 0.01 |

Working memory

| WAIS-III arithmetic calculation | 10.4 | 7.98 ± 2.88 | 5.59 ± 0.01 | 6.30 ± 1.69 | 11.62 ± 0.01 | 9.57 ± 2.50 | 1.52 ± 0.145 | 0.03 ± 0.03 |
| WAIS-III digits (forward and backward) | 10.3 | 8.82 ± 3.00 | 3.27 ± 0.02 | 7.17 ± 2.33 | 6.44 ± 0.01 | 10.57 ± 2.84 | 0.44 ± 0.666 | 0.01 ± 0.01 |

Explicit memory

| RBMT immediate verbal recall | 1.81 | 1.67 ± 0.65 | 1.43 ± 0.16 | 1.52 ± 0.73 | 1.89 ± 0.07 | 1.84 ± 0.50 | 0.28 ± 0.783 | 0.17 ± 0.01 |
| RBMT delayed verbal recall | 1.88 | 1.79 ± 0.47 | 1.30 ± 0.21 | 1.70 ± 0.47 | 1.88 ± 0.07 | 1.89 ± 0.46 | 0.14 ± 0.890 | 0.02 ± 0.02 |
| RBMT immediate nonverbal recognition | 1.90 | 1.86 ± 0.35 | 0.78 ± 0.440 | 1.83 ± 0.49 | 0.72 ± 0.478 | 1.84 ± 0.37 | 0.67 ± 0.509 | 0.52 ± 0.02 |
| WAIS-III nonword recognition | 10.5 | 9.70 ± 3.22 | 1.64 ± 0.108 | 7.43 ± 2.23 | 6.59 ± 0.01 | 12.00 ± 2.45 | 2.81 ± 0.011 | 0.01 ± 0.001 |

Implicit memory

| WCFT studied word fragments | 62.18 | 57.14 ± 18.14 | 1.57 ± 0.121 | 53.91 ± 18.55 | 1.92 ± 0.666 | 60.90 ± 17.92 | 0.29 ± 0.772 | 0.23 ± 0.004 |
| WCFT nonstudied word fragments | 32.14 | 27.44 ± 12.23 | 1.72 ± 0.090 | 22.28 ± 10.47 | 3.23 ± 0.002 | 32.33 ± 11.87 | 0.06 ± 0.955 | 0.07 ± 0.006 |
| WCFT priming             | 30.04 | 29.70 ± 15.18 | 0.10 ± 0.019 | 31.63 ± 15.00 | 0.42 ± 0.079 | 28.57 ± 15.39 | 0.37 ± 0.713 | 0.52 ± 0.028 |
| WPSCT exemplars from old categories | 20.42 | 10.16 ± 9.20 | 4.82 ± 0.001 | 9.30 ± 7.19 | 4.55 ± 0.001 | 11.25 ± 11.31 | 3.17 ± 0.002 | 0.51 ± 0.005 |
| WPSCT exemplars from new categories | 4.70 | 1.58 ± 3.68 | 2.26 ± 0.280 | 0.79 ± 2.51 | 2.86 ± 0.006 | 2.53 ± 4.61 | 1.32 ± 0.191 | 0.15 ± 0.006 |
| WPSCT priming            | 15.72 | 8.58 ± 8.04 | 3.66 ± 0.001 | 8.51 ± 7.85 | 3.00 ± 0.004 | 8.72 ± 8.65 | 2.74 ± 0.008 | 0.93 ± 0.102 |
| RBMT total profile score | 22.19 | 18.47 ± 4.11 | 5.99 ± 0.001 | 17.39 ± 3.73 | 5.67 ± 0.001 | 19.53 ± 4.39 | 2.65 ± 0.016 | 0.10 ± 0.006 |
| RBMT orientation         | 1.88 | 1.47 ± 0.83 | 3.33 ± 0.002 | 1.09 ± 0.95 | 4.01 ± 0.001 | 1.89 ± 0.32 | 0.20 ± 0.841 | 0.06 ± 0.006 |

WFCT indicates word-fragment completion test; WPSCT, word production from semantic categories test.

* Normative data from a previous experiment presented at the VII International Symposium on Schizophrenia (March 17-18, 2005; Bern, Switzerland; Soler MJ, Ruiz JC, Fuentes I, Tomás P. Implicit memory in patients with schizophrenia) comparing patients with schizophrenia (n = 29) and control subjects (n = 34).

* Between the subgroups.

Behavioral Memory Test (RBMT) [14]. The storage mechanism was assessed using the information subtest of the WAIS-III. This subtest is a recall test of information learned over a delayed period. Finally, the retrieval mechanism was measured using the immediate nonverbal recognition task of the RBMT.

Implicit memory was assessed using a perceptual test (word-fragment completion) and a conceptual test (word production from semantic categories). In these tasks, participants have to process a stimulus called a prime (e.g., to judge the familiarity of a list of words using a scale). Then, they are told to perform another task (e.g., to complete word fragments or to generate words belonging to a specific category) that makes no reference to the first phase of the test. The variables of interest in those memory tasks were the proportion of correctly answered stimuli that are seen in the first phase and the proportion of correctly answered stimuli that are not seen in the first phase. The difference between these 2 proportions is the priming score, which reflects implicit memory.

Finally, everyday memory aspects were measured with the RBMT. Performance on this test yields a total profile score (range = 0-24), which weights each subtest equally in relation to the others to provide comparable scores across
the battery of tests. The total profile score and the scores on the subtest of orientation of the RBMT (this subtest is a battery of 10 questions that make reference to aspects such as the date of the day, the name of the patient, or the age of the patient) were used to give objective measures of everyday memory.

3. Results

Analyses were conducted using the SPSS statistical package for Windows (version 11, SPSS, Chicago, Ill). All statistical analyses were based on 2-tailed tests of significance. The Bonferroni method was applied to control for multiple comparisons; thus, the adjusted critical P value was .008 (.05/6), because implicit memory was scored using 6 measures, with the cognitive domain having the greater number of measures.

The 2 groups of patients with schizophrenia showed significant differences in age ($t = 2.79; P = .008$) and intelligence ($t = 8.80; P = .001$). There was no statistically significant difference between the 2 groups in length of illness and level of education (Table 1). Because the 2 groups differed in age, this variable was entered as a covariate in the analysis of between-group differences in scores on the neurocognitive tests.

Test scores on the various cognitive tasks for the whole group of patients are presented in Table 2. These scores were compared with general population norms provided that such normative data exist using $t$ tests. As expected, the results revealed that, in most of the measures, patients with schizophrenia show performance levels lower than the normative mean values for the same age group; this was the case for the executive function, attention, speed of information processing, working memory performance and capacity, conceptual implicit memory (word production from semantic categories test), and everyday memory total scores and orientation subtest score. There was no difference in the explicit memory tasks of immediate and delayed verbal recall, immediate nonverbal recognition, general information, and perceptual implicit memory task (word-fragment completion test).

3.1. Group comparisons

Once the general neurocognitive profile of the group of patients was established, data were analyzed looking for differences within the group associated with IQ. The 2 IQ groups were compared with the normative data and with one another on the different measures using the $\chi^2$ test or $t$ tests depending on the nature of the variable measured or using analyses of covariance when age was correlated with the dependent measure considered. The mean values and standard deviations for the 2 groups on the various cognitive measures are presented in Table 2. The low intellectually functioning group performed at levels lower than normative data in the executive functioning ($P = .001$), attention and speed of information processing ($P = .001$), working memory ($P = .001$), WAIS-III information measure ($P = .001$), conceptual implicit memory ($P = .004$), and everyday memory ($P = .001$) scores. The high intellectually functioning group showed significant differences in the number of trials ($P = .002$) and total errors ($P = .007$) of the WCST; in the digit symbol substitution ($P = .001$) of the WAIS-III, and in the conceptual implicit memory measure ($P = .008$).

When both groups were compared, significant differences appeared in the 4 subscales of the WAIS-III that were used to evaluate working memory performance and capacity, attention, and speed of information processing ($P \leq .005$). In 2 WCST scores, differences between the groups were significant: the number of categories achieved ($P = .006$) and the number of trials ($P = .002$). The comparison in explicit memory measures only showed differences in the WAIS-III information score ($P = .001$). Both groups performed at the same level in the 2 implicit memory tasks,
except in one measure, the proportion of nonstudied word fragments completed in the perceptual implicit memory task ($P = .007$). The patterns of results were quite similar in everyday memory. Differences only appeared in the orientation scale when it was measured using profile scores ($P = .006$).

### 3.2. Correlations between IQ and cognitive measures

Pearson’s correlations were calculated between IQ and the cognitive measures for the whole group of patients (Table 3). The results showed that IQ was related to all WCST scores: categories ($r = 0.47; P = .002$); number of trials ($r = −0.63; P < .001$); total errors ($r = −0.51; P = .001$); and perseverative errors ($r = −0.47; P = .001$). Level of IQ and the attention measures correlated significantly: WAIS-III picture completion scores ($r = 0.67; P = .001$) and WAIS-III digit symbol substitution scores ($r = 0.62; P = .001$). The same pattern of results was observed in the working memory measures: WAIS-III arithmetic calculation ($r = 0.81; P = .001$) and WAIS-III digit symbol substitution scores ($r = 0.62; P = .001$). The case of explicit memory, IQ was correlated with WAIS-III information scores ($r = 0.85; P = .001$). Implicit memory did not correlate significantly with IQ. Two of the measures used to explore everyday memory also correlated significantly with IQ: orientation ($r = 0.34; P = .028$) and total profile score ($r = 0.33; P = .036$).

Pearson’s correlation coefficients were also computed to explore the relationship between IQ and the cognitive measures in each patient group (Table 3). There was no difference between the correlations obtained in both groups when the correlations were compared using a Z test. The absence of differences between groups in the correlations obtained could probably be a result of the small sample size of the groups.

### 4. Discussion

Schizophrenia and memory dysfunction are significantly associated. Numerous studies have demonstrated that memory deficits are core features of schizophrenia. The evidence is so clear that the MATRICS group included memory deficit among the 7 separable fundamental dimensions of cognitive deficit in schizophrenia [15]. In contrast, the nature of the disorder with respect to general intellectual functioning is more heterogeneous. Patients with schizophrenia could show intact, mild, moderate, or severe intellectual impairment. As a consequence, many studies have been conducted to clarify the profile of cognitive deficits associated with the different intellectual impairment levels shown by patients with schizophrenia. In general, results show that even intellectually intact patients have deteriorated performance in some cognitive areas: executive functioning, attention, speed of processing, and memory.

Specifically, in the neurocognitive memory domain, although memory is globally described as impaired in the literature, results are heterogeneous probably because of the different aspects or types of memory that can be measured and because of the great number of different tasks used. In this study, we focused on the evaluation of 4 dimensions of memory using different tasks for each one with the aim of clarifying which aspects of memory are and which are not deteriorated in schizophrenia. Then, the aim was to analyze how patterns of memory function differ in relation to intellectual functioning.

Standard intelligence tests place a relatively heavy emphasis on measures of memory, including semantic memory, episodic memory, and working memory. It is then expected that IQ will correlate with these memory measures, and the literature confirms this statement. Even in the case of everyday memory, a measure not included in intelligence tests, the correlation is significant [14]. In the case of implicit memory, not much is known about its relation with IQ. Precisely, one of the main interests of our study was to clarify this relation.

In the whole sample of patients, we found evidence for distinct patterns of memory dysfunction in schizophrenia. With respect to working memory, the patients with schizophrenia performed at significantly lower levels as compared with normative control subjects. Many of the studies in this area have found impairment in schizophrenia, although few patients have shown normal function or only a trend toward a poorer performance [4]. The studies that show this result of preserved working memory tend to include control subjects who are matched for IQ, age, or education; however, there are some studies that have found a working memory impairment using well-controlled designs [16].

Results showed preserved explicit memory in the group. Globally, these results are not in line with some previous results. Studies that have used explicit tests such as free and cued recall, verbal fluency tests, and semantic processing tests have reported that the performance of patients with schizophrenia is impaired [1,17,18]. However, previous work had demonstrated heterogeneity in the results displayed in schizophrenia in the wide variety of tasks used to measure memory [19,20].

Implicit memory appeared to be preserved when perceptual implicit memory was measured but appeared to be impaired when the task was conceptual. Literature always presents implicit memory as a normal cognitive function in schizophrenia [4]. However, differences within implicit memory should be considered. In a previous study, we found a dissociation in priming between healthy and patient groups depending on the task. In the word-fragment test, priming was similar in the 2 groups. However, in the word production test, the priming obtained from patients with schizophrenia was lower than that obtained from healthy control subjects. These results could be explained because there are obvious differences in task demands posed by different kinds of tests. Dissociations between implicit memory tests can be accounted for by postulating a continuum of tests, from those requiring more perceptual information (data-driven tests) to those requiring knowledge
of meaning (conceptually driven tests) [21-23]. Word-fragment completion is a data-driven task in which the fragments evoke the perceptual identification record of the target. In this test, the stimulus presented during the study phase is shown in a perceptually related form, albeit partially. The letters in the fragment, which are drawn randomly from the word, are poor cues for locating words in the lexicon. Thus, perceptual overlap between study and test stimuli is sufficient to produce priming [24].

Our data show equal priming in healthy control subjects and patients with schizophrenia (see the meta-analysis of implicit memory tasks with nonclinical populations in Reference [25]), which suggests that perceptual comparison processes are apparently not affected by the cognitive deficits of schizophrenia.

In contrast, word production from semantic categories is a conceptually driven task in which the information provided in the test phase is semantically related to the information studied and requires a response based on the meaning of the stimulus. This task involves an elaborative processing that is predominantly conceptual and, therefore, seems to be more affected by the cognitive deficits present in schizophrenia.

Everyday memory was also impaired. The distribution of profile scores for patients on the RBMT ranges from 17 to 21. This means that patients with schizophrenia have a poor everyday memory and that their performance is poorer than that of healthy normative control subjects of a comparable age range [26]. Previous studies with healthy control subjects have obtained a slight correlation between the RBMT and intelligence, although this does not account for more than approximately 10% of the variance in performance on the RBMT. The results of our study with patients with schizophrenia show that, although there was a significant correlation between intelligence and everyday memory, there was no significant difference in this form of memory when the 2 IQ groups were compared. The 2 IQ groups obtained significant differences only in the orientation subtest.

Finally, results in executive functioning were similar to the findings of a recent study by Hughes et al [27] with 62 patients. They found differences between the performance of patients with schizophrenia and that of control subjects in the number of categories achieved and the number of perseverative errors on the WCST (see also the review of Laws [28]). The patterns of attention and speed of information processing deficits in the whole group were also similar to those obtained in another study [8]. Patients with schizophrenia perform worse than do healthy control subjects. Taken together, these results are in line with those of authors who argue that executive deficits constitute a necessary dysfunction in schizophrenia [8,9]. Nonetheless, this statement should be taken with caution because, as our results show, executive functioning deficits appear to be associated with IQ. These results are not new, and, as Landro et al [19] indicated, significant differences between patients with schizophrenia and healthy control subjects, on the number of categories achieved and on the perseveration index of the WCST, disappear when the patients are selected with normal general intellectual function.

When the profile of memory data was analyzed separately in the 2 IQ subgroups of patients with schizophrenia, the pattern of results changed. The low intellectually functioning group performed at lower levels as compared with the healthy control subjects, and the high intellectually functioning group performed at the same level in working memory. Both groups did not show differences in comparison with normative data and with one another in explicit memory, except in the information scale of the WAIS-III. The low IQ group, but not the high IQ group, showed differences with normative data. Results in the implicit memory tasks replicated those of the whole group. Preserved perceptual implicit memory and compromised conceptual implicit memory patterns were similar in both groups. However, the patterns were different in everyday memory. The high intellectually functioning group showed a performance level similar to that of the healthy control subjects, but the performance in the low intellectually functioning group was deteriorated.

In summary, patients with an IQ higher than 85 (mean IQ = 98) perform at a standard level in working memory, explicit memory, everyday memory, and implicit memory when their performance is measured with a perceptual task. They only perform at lower-than-standard levels in implicit memory when their performance is measured using a conceptual task. The profile of results changes when the patients’ IQ is lower than 85 (mean IQ = 73). They show deficits in working memory, everyday memory, and explicit memory when their performance is measured using the information scale of the WAIS-III and in implicit memory when their performance is measured with a conceptual task. These mean that, although intellectual functioning appears to be related to working memory and everyday memory, it is not associated with explicit and implicit memory.

Despite the fact that patients with schizophrenia have key cognitive deficits, such as executive functioning, attention, and memory, their IQ seems to be related to all of them but not globally to memory. Within the memory domain, there are differences associated with the explicit-implicit dichotomy and with the specific measure used to assess memory. Our results are in line with the hypothesis of Reber et al [29], who considered that the implicit systems operate largely independently of standard measures of cognitive capability, such as intelligence. In fact, Wagner and Sternberg [30] differentiated between tacit and explicit intelligence. Although tacit knowledge is practical, informal, and usually acquired indirectly or implicitly, explicit intelligence is evaluated primarily by tasks usually found on mental ability tests.

5. Conclusions

This study presents relevant data in relation to implicit memory and everyday memory impairment in schizophrenia.
and its relation to IQ: (1) the type of implicit memory measured determines the presence or absence of a deficit; (2) perceptual implicit memory is preserved in schizophrenia independently of the intellectual functioning level of the patients; and (3) conceptual priming is deteriorated even in intellectually preserved patients. These findings suggest that, for its complete evaluation, implicit memory should be assessed with different tasks because it is not a unique entity. Everyday memory is also impaired in association with IQ. It only appears to be impaired in patients with deteriorated intellectual function.

Overall, our results have important implications for identifying suitable treatment and rehabilitation interventions. These interventions should focus on the assessment of individual cognitive functions and on the memory capacities demanded of patients.

Acknowledgment

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References