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CANTAB explicit memory is less impaired in addicted schizophrenia patients

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Abstract

It has been suggested that in order to sustain the lifestyle of substance abuse, addicted schizophrenia patients would have less negative symptoms, better social skills, and less cognitive impairments. Mounting evidence supports the first two assumptions, but data lack regarding cognition in dual diagnosis schizophrenia. Seventy-six schizophrenia outpatients (DSM-IV) were divided into two groups: with ($n = 44$) and without ($n = 32$) a substance use disorder. Motor speed and visuo-spatial explicit memory were investigated using CANTAB. As expected, dual diagnosis patients showed a better cognitive performance. Our results suggest either that substance abuse relieves the cognitive deficits of schizophrenia or that the patients with less cognitive deficits are more prone to substance abuse.

Keywords: Schizophrenia; Substance use disorders; Explicit memory; Psychomotor processing; Subjective cognition; CANTAB; SSTICS

1. Introduction

Epidemiological studies show that the lifetime prevalence of substance use disorders (SUD) is close to 50% among schizophrenia patients. Psychoactive substances (alcohol, cannabis, and cocaine) exert a negative impact on the course of the pathology. Compared to abstinent patients, addicted schizophrenia patients relapse more frequently, they are more depressed and suicidal, they engage more often in criminal activities, and they are more frequently homeless and unemployed (Mueser, Drake, & Wallach, 1998).

It has been suggested that in order to find, acquire, and sustain alcohol and/or drug use, schizophrenia patients would have better social skills, less negative symptoms, and better cognitive functioning than abstinent patients (Joyal, Hallé, Lapierre, & Hodgins, 2003). Supporting this assumption, it has been shown that schizophrenia patients addicted to cannabis or cocaine have less severe negative symptoms (Bersani, Orlandi, Kotzalidis, & Pancheri, 2002; Serper et al., 1995). When compared to abstinent ones, dual diagnosis patients also appeared to have a better pre-morbid adjustment (Arndt, Tyrrell, Flaum, & Andreasen, 1992). They also seemed to have better social functioning (Côté, Lesage, Chawky, & Loyer, 1997). Further, it has been shown that the DSM-IV deficit syndrome of schizophrenia is related to less substance abuse (Kirkpatrick et al., 1996).

Regarding cognition of dual diagnosis schizophrenia, robust evidence is lacking. Recently, Carey, Carey, and Simons (2003) have shown that dual diagnosis patients

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suffer from less global cognitive impairments. Joyal et al. (2003) obtained similar results but their sample size was small (total $n = 30$). The current study was undertaken in order to further strengthen the preliminary evidence supporting the hypothesis of a better cognitive functioning in dual diagnosis patients. To find, acquire, and sustain alcohol and/or drug use, we hypothesised that dual diagnosis patients would have less deficits in explicit memory. A fronto-temporal function, explicit memory is significantly impaired among schizophrenia patients, and it is an important predictor of their social and occupational functioning (Hoff & Kremen, 2003).

2. Methods

2.1. Participants

Recruited from a convenient sample, participants were 76 outpatients with schizophrenia (SCZ) or schizoaffective disorder (SA), diagnosed using the Structured Clinical Interview for DSM-IV (SCID-IV). The assessment was approved by the local ethics committee. All subjects gave informed consent.

The study was cross-sectional. According to DSM-IV criteria, participants were divided into two groups: with and without a current SUD (last 6 months). Forty-four patients were included in the dual diagnosis (DD) group and 32 patients were included in the single diagnosis schizophrenia (SCZ) group. Patients ($n = 44$) from the DD group suffered from one or more of the following SUD (abuse/dependence): alcohol (20 patients), cannabis (28 patients), cocaine (12 patients), other substance (five patients), and poly-addiction (17 patients). The two groups of patients were matched for age, sex, diagnosis subtype, ethnicity, education level, and duration of illness. However, the two groups differed in terms of antipsychotic medication. Patients in the DD group were more frequently treated with typical antipsychotics, compared to patients from the SCZ group (Table 1).

The Positive and Negative Syndrome Scale (PANSS) (Kay, Fiszbein, & Opler, 1987) was administered in order to measure severity of symptoms. Compared to patients from the SCZ group, DD patients showed more severe positive, general and total symptoms. But no differences emerged for negative symptoms (Table 1).

Table 1
Comparative sociodemographic data

	DD group ($n = 44$)	SCZ group ($n = 32$)
Age (years)	31.4 ± 11	34.3 ± 11.1
Females	8	7
Males	36 (81.8%)	36 (81.8%)
Diagnosis subtype		
Schizophrenia	34 (77.7%)	26 (81.2%)
SA disorder	10	6
Ethnicity		
Caucasian	41	32
Other	3	0
Education level (years)	11.4 ± 2.2	11.3 ± 2.3
Duration of illness (months)	90.9 ± 104.5	109.6 ± 117.4
Antipsychotics		
Atypical	38 (86%)	32 (100%)
Typical[a]	18 (40.9%)	6 (18.7%)
PANSS		
Positive[b]	16.7 ± 6.3	13.4 ± 4.9
Negative[c]	17.8 ± 7.3	17.2 ± 6.8
General[d]	37.8 ± 13	30.4 ± 8.2
Total[e]	72.2 ± 24.4	61 ± 16.6

SA, schizoaffective.
[a] $\chi^2 = 32$; $p = .0001$.
[b] $t = 2.540$; $p = .013$.
[c] $t = 0.354$; $p = .725$.
[d] $t = 3.015$; $p = .004$.
[e] $t = 2.378$; $p = .020$.

2.2. Assessments

DD and SCZ patients were assessed using the Cambridge Neuropsychological Test Automated Battery (CANTAB) (Fray, Robbins, & Sahakian, 1996), a series of computerised tasks. The tests were run on computers with touch-sensitive colour monitors. Patients were asked to respond by simply touching the screen with a finger. Patients first completed a motor screening task (MOT), an index of psychomotor speed, which familiarised them with the testing procedure. In this screening task, patients are asked to place a finger on a flashing cross. After completion of this task, patients completed the paired associates learning (PAL) task.

The PAL task is designed to assess visuo-spatial explicit memory. During the PAL task, patients are asked to remember up to eight pattern–location associations. Patients are instructed that the white boxes presented on the screen will open up one by one, in a random order. Their task is to look for coloured patterns in the boxes, and to remember which pattern belongs in which box. On the first stage, only one box contains a coloured pattern. This initial stage is followed with another stage with one pattern, then two stages with two patterns each, two patterns with three patterns each, one stage with six patterns, and a last stage with eight patterns (one pattern by box). On each trial of every stage, if the patients' choices are incorrect, the boxes are re-opened successively. For each stage, patients are allowed up to nine reminding phases. If they fail all the phases (for a given stage), the task is stopped.

Performance was scored using five indices: (i) *First trial memory score*: the total number of patterns correctly located, on the first trial, summed across the eight stages (range: 0–26); (ii) *Stages completed* (range: 1–8); (iii) *Stages completed on first trial* (range: 1–8); and (iv) *Total errors*: the total number of incorrect placements,

summed across the eight stages; *Total trials* (maximal score = 10 trials by stage).

The patients' cognitive complaints were assessed with the Subjective Scale to Investigate Cognition in Schizophrenia (SSTICS) (Stip, Caron, Renaud, Pampoulova, & Lecomte, 2003). The questionnaire was developed to explore the subjective appreciation of patients for cognitive domains that have been repetitively shown to be impaired in schizophrenia. The 21 Likert-type questions of the scale cover four cognitive areas: attention, executive functions, memory, and praxis. Each question describes a specific cognitive problem, and the patients are instructed to indicate the frequency with which it occurs in their life (4 = very often; 3 = often; 2 = sometimes; 1 = rarely; 0 = never).

2.3. Statistical analysis

The patients' cognitive performance on the CANTAB PAL and MOT tasks, as well as on the SSTICS, were analysed using one-way analyses of variance (ANOVA) with group as the independent variable. Unpaired *T* tests were used to analyse potential socio-demographic differences between the DD and the SCZ groups. Dichotomous variables were evaluated using χ^2 tests. A posteriori correlation analyses were performed using Pearson's test. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS), version 10.

3. Results

Patients in the two groups (DD and SCZ) did not differ in age, sex, diagnosis subtype, ethnicity, education level, and duration of illness. Overall, patients in the DD group had a better cognitive performance (Table 2). On the PAL task, the DD patients had a better "first trial memory score" ($F(1,74) = 4.167$, $p = .045$). They also completed a greater number of stages on the first trial ($F(1,74) = 5.682$, $p = .020$). However, the groups did not differ in the other PAL scores. DD patients also showed a better performance on the MOT task. The mean time required to attain the target on the screen was smaller in the DD group ($F(1,74) = 4.849$, $p = .031$). On the SSTICS, a non-significant trend was observed, where DD patients seemed to report greater cognitive complaints than patients in the SCZ group.

3.1. A posteriori analysis: DD subgroups

Considering the negative cognitive impact of cocaine in schizophrenia (see discussion), we carried an a posteriori analysis. Patients in the DD group were divided into two subgroups: with ($n = 13$) and without ($n = 31$) cocaine abuse/dependence. The cocaine (COC) and the non-cocaine (NCC) groups were compared with each other on the PAL task, before being compared to the SCZ group. This procedure leads to three general observations: (i) patients in the NCC group displayed less errors than patients in the COC group (NCC = 20.4 ± 18.5; COC = 35.5 ± 25.2; $F(1,42) = 4.961$, $p = .031$); (ii) patients in the NCC group had a better "First trial memory score" than patients in the SCZ group (NCC = 17.7 ± 5.4; SCZ = 14.8 ± 4.9; $F(1,61) = 5.142$, $p = .027$), and they completed more stages on first trial (NCC = 5.7 ± 1.2; SCZ = 4.9 ± 1.1; $F(1,61) = 7.838$, $p = .007$); (iii) however, patients in the COC group did not perform better than patients in the SCZ group.

3.2. A posteriori analysis: Subjective and objective performance

Since the DD group showed a non-significant trend towards greater cognitive complaints, we investigated the interactions between objective and subjective cognition. Pearson's correlation analyses were performed between the SSTICS and PAL scores, for each groups. In the DD group, negative correlations were observed between the SSTICS and two PAL scores: "first trial memory score" ($r = -.372$; $p = .017$) and "number of stages completed on first trial" ($r = -.361$; $p = .02$). Also, a positive correlation was found between the SSTICS

Table 2
Cognitive performance in DD and SCZ patients

	DD patients		SCZ patients		*F*	*p* value
	Mean	*SD*	Mean	*SD*		
PAL						
First trial memory score	17.1	4.9	14.8	4.9	4.167	.045
Stages completed (SC)	7.7	0.6	7.5	1.3	1.506	.224
SC on first trial	5.5	1.1	4.9	1.1	5.682	.020
Total errors	24.8	21.6	26.6	22.4	0.123	.727
Total trials	14.4	5.5	15.2	4.4	0.436	.436
MOT[a]	1102.1	419.8	1308.9	381.9	4.849	.031
SSTICS[b]	31.4	10.8	26.2	15.1	2.990	.088

[a] Score expressed in milliseconds; a higher score means a slower speed processing.
[b] Data were missing for two patients in the DD group.

and PAL "total errors" ($r = .342$; $p = .029$). In the SCZ group, negative correlations were observed between the SSTICS and two PAL scores: "number of stages completed" ($r = -.419$; $p = .017$) and "number of SC on first trial" ($r = -.416$; $p = .018$). Thus, in both groups, patients reported greater cognitive complaints when their objective performance was worse.

4. Discussion

The main finding of the study regards the cognitive performance of DD patients on the CANTAB PAL task, which was better than the performance of SCZ patients. Our results suggest that DD patients are less impaired in visuo-spatial explicit memory, a fronto-temporal function, and psychomotor processing. Paradoxically, patients in the DD group tended to report greater cognitive complaints than SCZ patients. As such, our results suggest that DD patients could be more conscious of their cognitive deficits, even if they objectively perform better than SCZ patients. However, in both groups, there was a relation between subjective complaints and the actual performance: the worse the objective performance, the greater the cognitive complaints.

Our results replicate the findings of two recent studies showing that DD patients are less impaired in their cognitive functioning than SCZ patients (Carey et al., 2003; Joyal et al., 2003). To date, only a few studies have assessed the cognitive performance of DD patients, with results being far from conclusive. Some studies have failed to demonstrate any differences between DD and SCZ patients (Addington & Addington, 1997; Cleghorn et al., 1991; Pencer & Addington, 2003), while other studies have shown greater cognitive impairments among DD patients (Allen et al., 2000; Liraud & Verdoux, 2002)—mainly those abusing cocaine (Serper, Copersino, Richarme, Vadhan, & Cancro, 2000; Serper, Bergman, et al., 2002). Future studies will need to explain the contradictory nature of the results published so far. In our opinion, the type of substances abused, the length of the addiction history and compliance with medication could be key confounding factors to control in greater detail. In that regard, it is noteworthy that cocaine consumption has affected our results. Indeed, only the DD patients not addicted to cocaine showed a better cognitive performance on the PAL task, compared to SCZ patients.

The principal strength of the study lies in the use of CANTAB to assess cognition in dual diagnosis schizophrenia. CANTAB comprises a series of computerised tasks well validated and precise enough to detect subtle differences between groups of patients with neuropsychiatric disorders (Fray et al., 1996). To our knowledge, this is the first study to investigate cognition in addicted schizophrenia patients with CANTAB.

The current study has limitations. Only one cognitive function (PAL) has been assessed in the study, because it was the only function common to all participants. In addition, intelligence was not controlled. Lastly, we were not able to provide chlorpromazine equivalents for the two groups. But we established that the DD patients were more frequently treated with typical antipsychotics, which can impair cognitive performance. In the same vein, DD patients presented a more florid symptomatology, which is associated with *more*, not *less*, cognitive deficits.

The current cross-sectional study has shown DD patients to be less impaired in their cognitive functioning, compared to SCZ patients. As such, our results suggest either that substance abuse relieves the cognitive deficits of schizophrenia (self-medication hypothesis) or that the patients with less cognitive deficits would be more prone to substance abuse. However, two series observations can be objected against the self-medication hypothesis: (i) acutely, no psychoactive substance has a positive impact on explicit memory; (ii) in their chronic effects, alcohol, cannabis, and cocaine impair visual explicit memory. In the future, longitudinal data would be required to discriminate between these two interpretations.

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