

# Thought and language disorders in very early onset schizophrenia, schizoaffective disorder and bipolar disorder

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## Abstract

**Background:** Thought and language disorders are main features of adults with schizophrenia and bipolar disorders however studies on such abnormalities are scant in young patients with very early onset psychosis (VEOS). The aim of the present study is to assess the relationship between language and thought disorders in patients with very early onset schizophrenia (SCZ), schizoaffective disorders (SCA) and bipolar disorders (BD). **Method:** Forty-one patients (18 SCZ, 16 BD, and 7 SCA) with mean age less than 15 years old were assessed through a series of neurocognitive and psycholinguistic tests, including the Thought, Language and Communication Scale (TLC). **Results:** SCZ group performed worse in all tests as well as the TLC, followed by SCA and BD groups respectively. Thought disorders were related to deficits in executive functioning and semantic processing, and the metaphors' test was the best predictor of TLC functioning. **Discussion:** TD in SCZ, SCA and BD are one of the most important features in patients with VEOS and that the evaluation of metaphor comprehension can be an important instrument in the early detection of this disorder.

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**Keywords:** Thought disorders, language, schizophrenia, bipolar disorder, schizoaffective disorder.

## Introduction

Schizophrenia is a psychotic disorder which affects 1% of adult population and usually begins in late adolescence or early adulthood. When the disorder begins in early adolescence (under 18 years old) it is termed early onset schizophrenia (EOS), with some cases beginning even earlier (under 14 years old) and called child onset schizophrenia (COS) or very early onset schizophrenia (VEOS)<sup>1-3</sup>.

EOS is a rare condition and it is estimated to account for less than 4% of the cases of schizophrenia<sup>4</sup>. Delusions, hallucinations and thought disorders are considered prominent psychopathological features of EOS<sup>1,4</sup> similar to adult onset schizophrenia.

Particularly formal thought disorders are also considered one main characteristic of psychotic manifestations in children or adolescents<sup>1</sup>. However such abnormalities are rarely studied in pediatric psychosis, especially in patients with early onset schizophrenia (VEOS)<sup>1</sup>.

All these thought impairments are also present in patients with bipolar disorders<sup>5-7</sup> and to date there is only a few descriptions of such abnormalities in patients with early or very early onset of these disorders.

In fact thought disorders can be regarded as a failure to maintain a speech plan and thus encompassing a great number of abnormalities of logical sequencing of ideas however the connection between language and these disorders is not clearly established. Our hypothesis is that thought disorders are present in patients with VEOS and BD in different degrees of severity and are related to neuropsychological and language impairments.

The aim of the present study is to compare the performance of patients with schizophrenia (SCZ) or schizoaffective disorders (SCA) with patients with bipolar disorders (BD) in terms of thought disorders. Secondary objectives include investigating the relationship between thought disorders and neuropsychological performance, especially language disorders, using a battery of tests adapted to Brazilian Portuguese language.

## Methods

### Sample

Forty-one patients with psychotic symptoms (18 with diagnosis of the schizophrenia, 16 with bipolar disorders and 7 with schizoaffective disorder) were recruited for treatment at outpatient clinic of the Child and Adolescent Psychiatric Clinic of the Institute of Psychiatry of the University of São Paulo General Hospital (IPq) in São Paulo, Brazil. The study had the approval of the local Institutional Review Board of University of São Paulo General Hospital CAPESQ n° 0088/07 and families signed an informed consent for the participation in the study. To take part in the study patients had to be clinically stable after the medical treatment but which not received the language or cognition rehabilitation.

All the patients had between 10 and 17 years old at baseline and at the time of language and cognition evaluation. Patients were excluded if they had a previous or current history substance abuse, organic brain disease or marked intellectual impairment. For the control of the intellectual performance prior the illness all the patients had to be able to write and read and perform the four basic mathematical operations according to the school level and should not have any previous history of school performance impairment before the onset of the disorder. Additional information was obtained from chart reviews, parents' reports, school information and clinical interview.

### Clinical assessment

Patients were interviewed by experienced child psychiatrists and met DSM-IV criteria for schizophrenia, schizoaffective disorder or bipolar disorder based on an interview using the Schedule for Affective Disorders and Schizophrenia for school age Children present and Lifetime version K-SADS<sup>8</sup> adapted into Portuguese. The K-SADS was applied by well-trained researchers with expertise in this instrument.

## Neuropsychological and linguistic assessment

All patients were evaluated through a battery comprising semantic and syntactic psycholinguistic tests, measures of executive functions and tests of general neurocognition. Such tests were usually performed within a week to the clinical interview for the DSM-IV and K-SADS diagnosis and administered by the same professional blind to the diagnosis. The battery was standardized to ensure the appropriate use of time, avoid tiredness of the patient and the application took approximately two sessions of 45 minutes.

### Semantic tests

#### *MT-86b modified*<sup>9</sup>

The protocol consists of different linguistics verbal, reading and writing tests to evaluate linguistic levels with or without visual images:

- Written comprehension: comprehension by the visual way – word and phrases and the subsequent visual identification of this objects and situations;
- Reading: the patient must decode the words and talk them out loud.

#### *Peabody Picture Vocabulary test*<sup>10</sup>

Oral comprehension: The subject is required to indicate which one of four pictures best describes a word spoken by an examiner. It is a thus of the comprehension of single words that refer to things or actions.

#### *Boston Naming Test*<sup>11</sup>

Is a test of visual confrontation naming in which the subject must retrieve (name).

#### *Semantic fluency*<sup>12</sup>

The patient must produce as many examples as possible of animals (90 seconds). A score of “semantic efficiency” is related with the organization of semantic storage in the brain and the working memory tasks.

#### *Lexical decision*<sup>13</sup>

The patient distinguishes orally real words from nonexistent words with the oral and writes presentation.

#### *Metaphor's comprehension*<sup>14</sup>

Tests of oral comprehension of phrases with high symbolic significance.

### Syntactic tests

#### *Syntactic Awareness*<sup>15</sup>

The protocol consist of the differences abilities for evaluated syntactic awareness.

- Grammatical judgment: the patients should tell if there was something wrong in the phrases presented.
- Grammatical correction: the patients should to correct the phrases with wrong syntactic.
- Grammatical correction than phrases with grammatical and semantics inaccuracies: in this test the patients should to correct just the grammatical phrases but originally the phrases were with semantics inaccuracies which shouldn't be correct.
- Word's categorization: The patients should categorize the words in: substantive, adjective or verb.

### Executive function tests

#### *Stroop test*<sup>16</sup>

In the word task, the response is shown a card with the words BLUE, ROSE, GREEN and BROWN (printed in contrasting colors) arranged in four columns and six lines, to be read as quickly as possible ignoring their color. In the color task, a similar set of words is shown to the respondent who must how identify the color in which each word is printed. The Stroop effect is the difference (in seconds) between the time to complete the two tasks.

#### *Phonological fluency*<sup>17</sup>

In this test the respondent should produce as many words as possible beginning with the letters T (90 seconds). This test is thought to depend on the integrity of the left frontal lobe. The score is the total number of words generated excluding repetitions.

### More general cognitive function

#### *Forward and reverse digit span*<sup>18</sup>

Forward digit span assess short-term memory. Respondents must repeat progressively longer sequences of digits read aloud to them at a rate of one digit per second. Span is defined as the longest string of digits correctly recalled at least once. Reverse span is administered in similar fashion but respondents must now reproduce the sequence in the reverse of the presentation order. This task involves manipulation of information as well as simple reiteration of it, and is often cited as a measure of working memory<sup>19</sup>.

### Speed processing

The time for realization of each linguistic test (semantic and syntactic) was measured and added.

#### *Thought, Language and Communication Scale (TLC)*<sup>20</sup>

The Thought, Language, and Communication Scale (TLC) was used for language and thought evaluation. All the patients completed a detailed clinical interview lasting approximately 1 hour.

#### *Data analysis*

The descriptive statistics for continuous variables were mean and standard deviation; and for categorical variables, proportions. The relationship between the groups and categorical variables were analyzed by Chi Square Tests. For the continuous variables, the groups were compared using a series of ANOVA and Post Hoc Tests (Tukey), with normality tested using the Kolmogorov-Smirnov and Levene tests. The relationship between TLC and the others tests was explored by linear regression. The relationship among the tests was analyzed by Pearson coefficient. The significance was set to 0.05.

## Results

### Demographic and Clinical characteristics between the groups SCZ, BD, SCA

There were no significant differences between groups in respect of age, gender, years of education and number of previous hospitalization. However in terms of duration of illness there was a significant difference between groups ( $F = 3.77$ ,  $p = 0.03$ ), with bipolar patients showing an earlier age of onset (Table 1).

**Table 1.** Demographic and clinical characteristics of the three diagnostic groups

	SCZ (N = 19)	BD (N = 16)	SCA (N = 7)	Test, p
Age – Mean (SD)	15,9 (1,63)	14,7 (2,47)	15,8 (1,87)	F = 1.67, 0.20
Gender	11(M)	10 (M)	5 (M)	X <sup>2</sup> = 0.401, 0.818
Male (M), female (F)	8 (F)	6 (F)	2 (F)	
Years of education	7,47 (2,04)	7 (1,83)	7,29 (1,7)	F = 0.27, 0.77
Age of onset	11,37 (3,34)	8,37 (4,65)	12,43 (3,04)	F = 3.77, <b>0.032</b>
Duration of illness	4,58 (2,89)	6,37 (3,94)	3,40 (1,99)	F = 2.44, 0.10
Antipsychotic 1 (Main)				
First-generation	0	0	1 (14.3%)	X <sup>2</sup> = 21.18, p = <b>0.048</b>
Second-generation	19 (100%)	16 (100%)	6 (85.7%)	
Antipsychotic 2 (add-on)				
First-generation	1 (5.3%)	0	0	X <sup>2</sup> = 17.48, p = 0.064
Second-generation	1 (5.3%)	3 (18.8%)	3 (42.8%)	
Antipsychotic monotherapy	17 (89.5%)	13 (81.3%)	3 (42.8%)	
Mean dose (in Chlorpromazine equivalents)	647 mg (sd 530)	322 mg (sd314)	454 mg (sd 199)	F = 2.52, p = 0.094
Mood stabilizer 1				
Lithium	1 (5.3%)	5 (31.3%)	1 (14.3%)	X <sup>2</sup> = 10.13, p = <b>0.04</b>
Anticonvulsant	4 (21%)	6 (37.5%)	0	
Mood stabilizer 2 (add-on)				
Lithium	0	0	0	X <sup>2</sup> = 2.43, p = 0.3
Anticonvulsant	0	1 (6.3%)	1 (14.3%)	
Mood stabilizer monotherapy	5 (26.3%)	10 (62.5%)	0	
Antidepressant monotherapy				
SSPA	3 (15.8%)	2 (12.5%)	3 (42.8%)	X <sup>2</sup> = 5.96, p = 0.20
Dual agent	1 (5.3%)	0	1 (14.3%)	

SCZ: schizophrenia; BD: bipolar disorder; SCA: schizoaffective disorder.

The medications in use by the subjects were classified according to the following psychopharmacological characteristics: antipsychotics (first and second generation) with their respective total mean dose expressed in chlorpromazine equivalents, types of mood stabilizer (lithium or anticonvulsants) and antidepressant prescribed (selective serotonin receptor agonist or dual agent). All the patients of the sample were receiving antipsychotics regardless of the diagnosis. The majority of the subjects were treated with antipsychotic monotherapy, with a second generation antipsychotic as the main or secondary treatment. The mean dose of antipsychotics (expressed in Chlorpromazine equivalents) was not significantly different between the groups ( $F = 2.52, p = 0.094$ ), but mood stabilizers were predominantly used by patients with BD than patients with SCZ or SCA ( $X^2 = 12.74, p = 0.047$ ). The three groups showed no difference in terms of use of antidepressants ( $X^2 = 5.96, p = 0.20$ ) (Table 1).

We found no significant differences between groups in respect of the frequency of symptoms such as affective blunting, delusions, olfactory hallucinations, tactile hallucinations, disorganized speech and disorganized behavior. Patients with SCZ showed significantly higher frequencies of visual and auditory hallucinations when compared with SCA or BD (Table 2).

### Language and thoughts outcomes

Table 3 displays the multiple comparisons of semantic and syntactic tests between diagnostic groups showed that, when compared with patients with BD, patients with SCZ showed a significantly poorer performance in terms of written comprehension ( $p = 0.006$ ), oral comprehension ( $p = 0.041$ ), naming ( $p = 0.001$ ), semantic fluency ( $p = 0.006$ ), lexical decision ( $p = 0.003$ ), metaphor ( $p = 0.000$ ), grammatical judgment ( $p = 0.030$ ), grammatical correction with semantics inaccuracies (0.005) and word's categorization

( $p = 0.000$ ). In terms of reading abilities and grammatical corrections both groups showed no significant differences. Patients with diagnostic of SCA had no substantial differences in terms of the tests previously described when compared with patients with BD or SCZ.

### Neurocognitive, executive function and psycholinguistic tests

As can be observed by Table 4 the performance between the groups SCZ, BD and SCA showed no statistical significant differences in terms of the Stroop factor, phonological fluency, digit spam – forward and speed processing. However significant statistical differences between groups were found in terms of the of the TLC scale ( $F = 18.73, p = 0.000$ ) and digit spam – reverse ( $F = 5.46, p = 0.008$ ). The multiple comparisons between the three groups showed that the SCZ had a poorer performance as compared with patients with BD in terms of the TLC ( $p = 0.000$ ), phonological fluency ( $p = 0.056$ ) and digit-spam reverse ( $p = 0.019$ ). No significant differences between the performance of the comparison between BD and SCA group as BD and SCA group.

### Predictors of TLC

The relationship between total thought disorder, as measured by the TLC scale, and semantic, syntactic, neurocognitive, executive and psycholinguistic functions and was further examined using multiple regression. Separate stepwise analyses were performed with total TLC as the dependent variable and each of the above tests as predictor variables. As can be seen in Table 5 no relationship was found between TLC and any of linguistic or neurocognitive test except for the metaphor which showed to be the strongest predictor of thought disorder impairment in this population.

**Table 2.** Frequency of K-SADS Psychopathology by diagnostic groups

	SCZ	BD	SCA	Chi Square, <i>p</i>
Affective blunting	1	0	1	2.21, 0.33
Delusions	9	3	3	3.28, 0.19
Auditory hallucinations	17	7	6	9.74, <b>0.008</b>
Visual hallucinations	14	4	5	9.25, 0.01
Olfactory hallucinations	1	0	0	1.24, 0.54
Tactile hallucinations	1	0	0	1.24, 0.54
Disorganized speech	6	3	3	1.54, 0.46
Disorganized behavior	1	1	0	0.44, 0.80

SCZ: schizophrenia; BD: bipolar disorder; SCA: schizoaffective disorder.

**Table 3.** Comparison of semantic and syntactic tests between diagnostic groups (post-hoc analysis)

		Mean (SD)	F, <i>p</i>	Group Diagnostic	Mean Difference	Sig.
Writing Comprehension	SCZ	9,26 (3,16)	5.98, <b>p = 0.005</b>	SCZ X BD	-2,61	<b>0,006</b>
	BD	11,88 (1,31)		BD X SCA	0,45	0,906
	SCA	11,43 (0,98)		SCA X SCZ	2,17	0,102
Reading	SCZ	13,53 (4,79)	2.71, <i>p</i> = 0.079	SCZ X BD	-2,54	0,101
	BD	16,06 (2,11)		BD X SCA	-0,08	0,999
	SCA	16,14 (1,35)		SCA X SCZ	2,62	0,230
Oral Comprehension	SCZ	17,05 (4,06)	3.21, <b>p = 0.051</b>	SCZ X BD	-2,64	<b>0,041</b>
	BD	19,69 (2,06)		BD X SCA	1,12	0,706
	SCA	18,57 (1,27)		SCA X SCZ	1,52	0,511
Naming	SCZ	11,37 (2,19)	7.34, <b>p = 0.002</b>	SCZ X BD	-2,51	<b>0,001</b>
	BD	13,88 (1,25)		BD X SCA	1,73	0,134
	SCA	12,14 (2,48)		SCA X SCZ	0,77	0,642
Semantic Fluency	SCZ	11,63 (4,65)	5.87, <b>p = 0.006</b>	SCZ X BD	-5,81*	<b>0,006</b>
	BD	17,44 (5,55)		BD X SCA	1,01	0,905
	SCA	16,43 (5,91)		SCA X SCZ	4,80	0,107
Lexical Decision	SCZ	13,05 (2,46)	8.319, <b>p = 0.001</b>	SCZ X BD	-2,20	<b>0,003</b>
	BD	15,25 (1,07)		BD X SCA	-0,32	0,920
	SCA	15,57 (0,79)		SCA X SCZ	2,52*	0,009
Metaphor	SCZ	3,21 (3,63)	9.60, <b>p = 0.000</b>	SCZ X BD	-6,04*	<b>0,000</b>
	BD	9,25 (4,30)		BD X SCA	2,25	0,454
	SCA	7,00 (4,87)		SCA X SCZ	3,80	0,105
Grammatical Judgment	SCZ	16,83 (3,68)	3.64, <b>p = 0.036</b>	SCZ X BD	-2,42	<b>0,030</b>
	BD	19,25 (1,18)		BD X SCA	0,75	0,825
	SCA	18,50 (1,23)		SCA X SCZ	1,67	0,385
Grammatical Correction	SCZ	6,94 (3,12)	1.22, <b>p = 0.030</b>	SCZ X BD	-1,49	0,279
	BD	8,44 (2,48)		BD X SCA	0,60	0,894
	SCA	7,83 (2,56)		SCA X SCZ	0,89	0,780
Grammatical correction with semantics inaccuracies	SCZ	6,39 (2,85)	5.99, <b>p = 0.006</b>	SCZ X BD	-2,49*	<b>0,005</b>
	BD	8,88 (1,41)		BD X SCA	0,54	0,859
	SCA	8,33 (0,82)		SCA X SCZ	1,94	0,148
Word's categorization	SCZ	6,61 (4,41)	11.611, <b>p = 0.000</b>	SCZ X BD	-6,20	<b>0,000</b>
	BD	12,81 (3,31)		BD X SCA	0,65	0,938
	SCA	12,17 (4,02)		SCA X SCZ	5,56	0,013

SCZ: schizophrenia; BD: bipolar disorder; SCA: schizoaffective disorder.

**Table 4.** Comparison of selected neurocognitive, executive and psycholinguistic tests between diagnostic groups (*post-hoc* analysis)

		Mean (SD)	F, p	Group Diagnostic	Mean Difference	Sig.
TLC	SCZ	32,47 (12,37)	18.73, p = 0.000	SCZ X BD	20,54*	0,000
	BD	11,94 (7,73)		BD X SCA	-14,06*	0,009
	SCA	26,00 (5,97)		SCA X SCZ	-6,47	0,316
Stroop Factor	SCZ	16,11 (13,98)	1.72, p = 0.193	SCZ X BD	2,61	0,770
	BD	13,50 (8,54)		BD X SCA	6,50	0,409
	SCA	7,00 (5,80)		SCA X SCZ	-9,11	0,166
Phonological Fluency	SCZ	6,89 (4,83)	3.13, p = 0.055	SCZ X BD	-3,86	0,056
	BD	10,75 (4,73)		BD X SCA	0,61	0,957
	SCA	10,14 (4,67)		SCA X SCZ	3,25	0,283
Digit Spam – forward	SCZ	5,00 (1,03)	1.78, p = 0.183	SCZ X BD	-0,69	0,157
	BD	5,69 (1,08)		BD X SCA	0,41	0,684
	SCA	5,29 (1,11)		SCA X SCZ	0,29	0,819
Digit Spam – reverse	SCZ	2,39 (1,38)	5.46, p = 0.008	SCZ X BD	-1,24*	0,019
	BD	3,63 (1,31)		BD X SCA	-0,23	0,914
	SCA	3,86 (0,69)		SCA X SCZ	1,47*	0,034
Time Processing	SCZ	404,84 (173,37)	2.45, p = 0.100	SCZ X BD	123,28	0,085
	BD	281,56 (155,06)		BD X SCA	-86,44	0,488
	SCA	368,00 (166,99)		SCA X SCZ	-36,84	0,870

SCZ: schizophrenia; BD: bipolar disorder; SCA: schizoaffective disorder.

**Table 5.** Regression Analysis: Thought Language and Communication Scale (TLC) vs. tests (predictors)

Tests	Beta	t	p
Writing Comprehension	-0.008	-.051	0.960
Reading	0.055	0.375	0.710
Oral Comprehension	-0.064	-0.448	0.657
Naming	-0.181	-1.185	0.244
Semantic Fluency	-0.252	-1.715	0.095
Lexical Decision	0.123	0.802	0.428
Grammatical Judgment	-0.208	-1.449	0.156
Grammatical Correction	0.107	0.634	0.530
Grammatical correction with semantics inaccuracies	-0.221	-1.354	0.184
Word's categorization	0.116	0.592	0.558
Stroop Factor	-0.182	-1.449	0.156
Phonological Fluency	0.045	-0.275	0.785
Digit Spam – forward	-0.252	-1.941	0.060
Digit Spam – reverse	0.085	0.596	0.555
Time processing	0.040	0.252	0.802
Metaphor	-0.626	-4.951	0.000

Model = F = 24.514, p = 0.000.

## Discussion

To our knowledge this is the first study which compared patients with very early onset schizophrenia, bipolar disorder and schizoaffective disorder in terms of language disorders and its relationship with cognitive impairment. We found that patients with schizophrenia showed the highest degree of severity of thought disorders when compared with patients with other diagnostic categories.

Our data provide evidence that in terms of neurocognitive functions patients with schizophrenia have shown the worst performance when compared with patients with bipolar disorders or schizoaffective disorders even if we consider that the population studied the onset of symptoms of each disease was higher for patients with BD than patients with SCZ or SCA. These results are in agreement with several studies which related schizophrenia and

bipolar disorders<sup>21</sup> and show a distribution as observed what is called the “continuum of the psychosis” hypothesis<sup>22</sup> with patients with schizophrenia showing the worst performance, patients with bipolar disorder with the best performance and schizoaffective disorder patients in an intermediate position.

Although patients with schizophrenia performed significantly poorly in terms of the most of the linguistic and cognitive tests as thought disorders the differences were not significant in tests of reading abilities, grammatical correction, attention, phonological fluency and digit spam probably because these abilities were learned before the onset of the illness. When considered the alteration with thought disorders the regression analyses identified the metaphor comprehension as the best predictor for this alteration.

It was observed that the metaphor comprehension is possibly associated with frontal and temporal lobe functioning and in the

left hemisphere involving activation of the prefrontal and basal frontal cortex, the middle and inferior temporal gyri, the temporal pole, the parietal cortex and the precuneus. In the language comprehension, activation is also observed in the right hemisphere: prefrontal cortex, middle temporal gyrus, precuneus and posterior cingulate gyrus<sup>23</sup>.

Our findings are thus broadly congruent with a small but growing body of evidence linking thought disorder to a combination of executive dysfunction and circumscribed semantic impairment<sup>24-26</sup> related to, but possibly not restricted to, access and adds the right hemisphere functioning as injured in the thought disorders.

It is important to observe that the metaphor's test (figurative language) has largely been ignored in the cognitive science investigation field in favor of the investigation of literal language<sup>27</sup>. The present finding that metaphor comprehension is the best indicator of the thought disorder's performance must be replicated in larger studies. A limitation of the present study is the small number of subjects due to the low prevalence of the disorders in pediatric populations. Our findings show that language disorder are directly related with thought disorders<sup>19,24,25,28-34</sup> with the relationship semantic and inter hemispheric frontal lobe.

This is important since cognitive features of these disorders, such as language and thought abnormalities, should become an important guide to new classifications about the cognitive dysfunction to understand the relation between functional capacities of these illnesses<sup>35</sup>. However, little is known about the behavior of these alterations in early-onset psychotic disorders and this study intends to bring new data on this subject.

The present paper also provides evidence that in terms of severity of thought and language disorders that the distribution of the impairments favors the idea of the so called continuum of psychosis<sup>36-38</sup>.

Caution is needed when interpreting the findings due to methodological limitations. First, the possibility of a recruitment bias stemming from the fairly demanding nature of some of the tests in our neuropsychological battery, with some patients possibly being judged as "not competent to complete" them. Secondly, the premorbid neurocognitive status could not be estimated since tests like the National Adult Reading Test (Nelson, 1991<sup>18</sup>), which estimates the premorbid IQ, are not available in Portuguese and the actual IQ was not investigated. However based on the clinical judgment patients with intelligence deficits were not included. Additionally neuropsychological functions were assessed using specific tests in Portuguese but not through a standard neuropsychological battery.

In conclusion, our data provide evidence that thought disorder in schizophrenia, schizoaffective disorder and bipolar disorder are one of the most important features in patients with VEOS and that the evaluation of metaphor comprehension can be an important instrument in the early detection of this disorder. In the present study thought disorders showed to be associated with impairment in tests such as metaphor are related to frontal lobe function as well as semantic tests which are related to dysfunction of right and left hemispheres. Further investigations of relationship between executive and semantic impairments with thought disorder in schizophrenia accompanied by neuroimaging findings in patients with very early onset psychosis are warranted.

## Declaration of interest

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