Distractibility and Symptoms in Schizophrenia

Jean Addington, PhD[1], Donald Addington MD[1], Lisa Gasbarre, BSc[2]

[1]Department of Psychiatry, University of Calgary, Calgary, Alberta, Canada

[2]Medical Sciences, Faculty of Medicine, University of Calgary, Calgary, Alberta, Canada

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Distractibility was assessed in 59 inpatients with a relapse of schizophrenia and 3 mo later during a period of relative remission. Distractibility was measured with a digit span task and symptoms with the Positive and Negative Syndrome Scale (PANSS). Although positive and negative symptoms improved significantly, the schizophrenia subjects' performance on the digit span task remained stable over time. There was no relationship between attention and symptoms. The possibility of distractibility being a vulnerability indicator for schizophrenia is discussed.

Key Words: schizophrenia, distractibility, positive symptoms, negative symptoms

INTRODUCTION

Since the earliest clinical descriptions of schizophrenia, distraction has been seen as a problem associated with this illness. Bleuler (1950) states that "the selectivity which normal attention ordinarily exercises among the sensory impressions can be reduced to zero so that almost everything reaches the senses." In a comprehensive review, Spring and others (1991) present many studies that confirm the magnitude of attentional impairments in schizophrenia. According to Spring, "selective attention refers to the mechanisms that regulate the reception and utilization of stimuli, such that some information is registered and analyzed whereas other potential information is excluded from processing" (Spring and others 1991, p 371).

One of the principal paradigms for assessing selective attention involves requiring subjects to attend selectively to 1 channel of information that is predesignated as relevant while excluding other potential information that is irrelevant and thus distracting. Such tasks were originally used to test hypotheses relating to filtering structures or mechanisms that allow certain stimuli to enter into awareness and not others. This would be considered a structural model of information processing. Newer models focus on the allocation of generalized cognitive resources. This model implies that there is an abnormal reduction in the availability of resources (cognitive processes and skills) at a given moment for the successful performance of specific information-processing tasks (Nuechterlein and Dawson 1984; Granholm and others 1996).

One research strategy (Spring and others 1990) has been to separate information-processing deficits that are episode indicators (that is, deficits which appear with an increase in symptoms and normalize when the symptoms dissipate) from more lasting characteristics which are vulnerability indicators (that is, deficits which are evident in high-risk groups, actively psychotic, and remitted schizophrenia patients). For example, it has been suggested that deficits on information-processing tasks, such as the Continuous Performance Test, Span of Apprehension Task, and backward masking tasks,

Address for correspondence: Dr J Addington, Department of Psychiatry, Foothills Hospital, 1403 29th Street NW, Calgary, AB T2N 2T9.

may be vulnerability indicators of schizophrenia which are negative symptom-linked (Asarnow and others 1991; Nuechterlein 1991; Cornblatt and Kelip 1994; Addington and Addington 1997).

In contrast, Spring and others (1990) state that distractibility deficits meet many of the criteria for positive symptom-linked vulnerability markers. Positive symptom linkage criteria include correlation with positive symptoms, an improvement with neuroleptics, and episodic fluctuations with positive symptom exacerbation and remission. If the deficit is also a marker of vulnerability to positive symptoms, the criteria would include persistence of the deficit in remitted patients and deviation in relatives of patients with marked positive symptoms. This may seem paradoxical, but according to Spring and others (1991), for positive symptom-linked vulnerability indicators, an improvement in the deficit, a clinical improvement, and a persistence of the deficit are expected. The deficit lessens as the positive symptoms improve, but a small impairment persists. Such an impairment is less than that produced by the double influence of vulnerability and an acute psychotic episode.

A review of the literature confirms that subjects with schizophrenia performed more poorly on distraction tasks than did normal controls (Oltmanns 1978; Green and Walker 1986; Rund 1989). No differences were observed in studies that compared subjects with schizophrenia with those diagnosed with bipolar disorder (Oltmanns 1978; Green and Walker 1986), but there were differences longitudinally between patients with schizophrenia and those with depression (Frame and Oltmanns 1982). Cross-sectionally, deficits on the Digit Span Distractibility Test (Oltmanns and Neale 1975) have been shown to be associated with positive symptoms (Oltmanns and others 1978; Green and Walker 1986; Harvey and others 1988; Harvey and Pedley 1989; Harvey and Serper 1990) and to covary with the severity of positive but not negative symptoms (Cornblatt and others 1985; Spring 1985). The longitudinal relationship between distractibility and positive symptoms is unclear. Two longitudinal studies found little change in distractibility over time (Frame and Oltmanns 1982; Rund 1989).

One of the problems with studies examining selective attention is that they tend to have small sample sizes. In the review of Spring and others (1991), 1 of 26 studies had 39 subjects with schizophrenia, 15 studies had between 24 and 12 subjects with schizophrenia, and 10 studies had 12 or fewer subjects. The studies varied in the methods used to assess selective attention. Some studies used a shadowing task, while others used a selective listening task. This made comparison of results across studies difficult.

Studies examining the relationship of information-processing tasks to positive symptoms are less frequently reported than those examining negative symptoms and information processing. There is also increasing evidence in the literature that deficits in a wide range of neurocognitive functioning are unrelated to positive symptoms (Addington and Addington 1995; Green 1996). Thus the purpose of this study was to examine longitudinally, in a sample of individuals with schizophrenia, distractibility deficits that are potential indicators of vulnerability to schizophrenia and the relationship of these potential vulnerability indicators to schizophrenia symptoms. The relationship between positive and negative symptoms and measures of distractibility was initially assessed at hospitalization and again 3 mo later during a period of relative remission. It was hypothesized that the deficits in distractibility would be stable over time. Based on more recent literature, however, it was predicted that, longitudinally, distractibility would not be consistently related to positive symptoms.

METHODS

Subjects

Seventy-two schizophrenia subjects who were consecutive inpatient admissions to 2 psychiatric units in a general teaching hospital were recruited to the study. Fifty-nine (40 men and 19 women) participated in the 3-mo follow-up. Reasons for attrition were refused (n = 6), moved away (n = 2), could not be traced (n = 2), and moved to longer-term care facility because of continued psychosis (n = 3). There were no differences in symptoms, attention, or demographics between those who remained in the study and those who dropped out. Analyses were conducted on the 59 subjects who completed the study. Subjects had an average age of 33 y (SD = 8.6), 11.5 y of education (SD = 2.2), and had 5 previous admissions (SD = 5.3). On average, onset of the illness occurred at 22.5 y (SD = 5.8) and 1st admission at 24.8 y (SD = 7.3). Most of the subjects were single and received government financial support. All subjects except for 1 were taking neuroleptics at follow-up. At hospitalization, the mean dose in chlorpromazine equivalents was 509.96 mg (range 20 to 1761) and at follow-up the mean dose was 392.60 mg (range 0 to 1528).

Diagnoses according to DSM-III-R criteria (American Psychiatric Association 1987) were made using the Structured Clinical Interview for DSM-III-R (SCID) (Spitzer and others 1990). Diagnoses were made by the principal investigators (DA and JA). Interrater reliability was determined in a separate sample of 10 subjects by 100% agreement on the diagnosis and at least 80% agreement for symptom presence. Exclusion criteria included: 1) evidence of an organic central

Table 1

Changes in symptoms and attention between time 1 and time 2

Variable	Time 1 (mean ± SD)	Time 2 (mean ± SD)	*t* value
Attention			
TPC distracter	49.67 ± 32.29	54.71 ± 33.90	ns
TPC neutral	62.57 ± 30.00	69.98 ± 24.00	ns
INT distracter	5.08 ± 5.65	4.97 ± 4.28	ns
INT neutral	3.71 ± 3.95	2.81 ± 3.13	−2.25[a]
Symptoms			
PANSS positive	19.66 ± 5.49	13.20 ± 5.12	8.43[b]
PANSS negative	21.33 ± 5.11	18.78 ± 5.47	3.97[b]

[a]$P < 0.05$.
[b]$P < 0.001$.

nervous system disorder, 2) significant and habitual drug or alcohol abuse in the past year, 3) mental retardation, 4) age under 18 y, and 5) age over 65 y. The study was described verbally and in writing to each subject, and written, informed consent was obtained from each participant. Assessments began as soon as the patients were fit to give consent and were sufficiently stable to participate in the assessments (3 to 7 d after admission).

Symptom ratings

The PANSS (Kay and others 1987) was used to obtain symptom ratings. This scale was administered by DA and a research nurse. Interrater reliability was determined in a separate sample of 5 subjects. Criteria for reliability were that the scoring of each symptom was within 1 point and that there was at least 80% agreement on the total score for the scale and on each of 3 subscales.

Distractibility

Distractibility was assessed with the Digit Span Distractibility Test (Oltmanns and Neale 1975). This task requires the subject to recall immediately target stimuli presented biaurally in the presence of irrelevant distracters. This test consists of neutral and distracter conditions. In the neutral condition, subjects listen to a tape and repeat a list of 6 target digits, read by a female voice. In the distracter condition, the female voice reads 5 digits and a male voice reads 4 distracter digits in each of the intervals between the target digits. Intervals (2 s) between target digits are identical in each condition of the task. Subjects are instructed to repeat the digits read by the female voice and ignore those read by the male voice. There are 2 practice trials and 7 test trials for each condition. The measures calculated from the digit span task were total proportion correct (TPC) and intrusions (INT). INT are the number of nontarget digits reported, and TPC is the number of target digits reported in the correct order minus the number of intrusions.

RESULTS

Mean symptom ratings and mean scores for performance on the digit span task assessed at hospitalization (time 1) and follow-up (time 2) are presented in Table 1. Analyses with paired *t* tests revealed that symptoms, but not digit span scores, improved significantly over time.

Subjects performed more poorly on the distracter than the neutral condition at both times (Table 2). Correlational analyses revealed that at both times there was no relationship between attention and positive and negative symptoms (Table 3).

Medication dose at time 1 was unrelated to digit span scores. At time 2, however, there were significant associations between high doses of medication and higher scores on

Table 2

Differences between distracter and neutral conditions

Test	Distracter condition (mean ± SD)	Neutral condition (mean ± SD)	*t* value
Time 1 TPC	49.67 ± 32.29	62.57 ± 30.00	−3.70[a]
Time 2 TPC	54.71 ± 33.90	69.98 ± 24.00	−4.37[a]
Time 1 INT	5.08 ± 5.65	3.71 ± 3.95	2.00[b]
Time 2 INT	4.97 ± 4.28	2.81 ± 3.13	4.43[a]

[a]$P < 0.001$.
[b]$P < 0.05$.

Table 3

Relationship between symptoms and attention

	Time 1		Time 2	
Attention	Positive symptoms	Negative symptoms	Positive symptoms	Negative symptoms
Time 1				
TPC distractible	−0.20	−0.24	−0.15	−0.11
TPC nondistractible	0.00	−0.10	−0.04	−0.04
INT distractible	−0.10	0.17	0.09	0.16
INT nondistractible	−0.04	−0.01	−0.06	−0.06
Time 2				
TPC distractible	−0.07	−0.19	−0.23	−0.29[a]
TPC nondistractible	−0.25	−0.22	−0.24	−0.21
INT distractible	0.15	0.09	0.18	0.17
INT nondistractible	0.14	0.06	0.03	0.03

[a] $P < 0.05$.

TPC and lower scores on INT in both the distracter and neutral conditions ($P > 0.05$).

DISCUSSION

Deficits on both the distracter and neutral condition remained stable over time despite highly significant improvements in both positive and negative symptoms. There was a small but significant decrease in INT in the neutral condition at the time of remission. Thus, at a time of remission, 1 part of the easier condition improved slightly, but there was no improvement on the measure when it was presented in the distracter condition. This finding supports the explanation for attentional deficits that there is an abnormal reduction in the availability of resources at a given moment for the successful performance of these tasks (Nuechterlein and Dawson 1984; Granholm and others 1996). Limited resources make a difference only when the tasks appear to require a high processing load. The digit span test with a distracter condition would qualify as a task requiring a high processing load.

There was no support for the hypothesis that distractibility may be a positive symptom-linked vulnerability marker. There were no significant relationships between positive symptoms at either time period and any of the 4 measures of attention. There was, however, a small yet significant relationship between TPC at time 2 and negative symptoms.

Previous studies that suggested that these deficits were linked to positive symptoms had smaller sample sizes and used a variety of measures of positive symptoms, sometimes considering positive thought disorder as a measure of positive symptoms. Many of the earlier studies used positive and negative symptoms as categorical variables that divided subjects into positive patients and negative patients. Many studies used shadowing tasks. Others used a digit span task but did not consider INT. The sample size in our study was large enough to achieve adequate power. Positive and negative symptoms were assessed as continuous variables using a reliable and well-established scale. Both INT and total proportion of digits correctly recalled were considered. These results, therefore, are more consistent with the recent research consistently showing a lack of association between neurocognitive functioning and positive symptoms (Addington and Addington 1995; Green 1996). Results of the present study partially support the theory that distractibility is a vulnerability indicator of schizophrenia but that it is not necessarily symptom-linked.

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