Negative priming in amphetamine psychosis

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Amphetamine abuse may lead to a psychotic state, its symptomatology being very similar to what is seen in paranoid schizophrenia. Failure of attentional inhibition of irrelevant information is thought to be associated with the psychotic symptoms in schizophrenia. Negative priming (NP) paradigm is believed to measure this impairment. Several studies have shown impaired NP in schizophrenia. In the present study a spatial NP task was used to assess attentional inhibition in a group of amphetamine-induced psychosis patients. Nineteen patients with amphetamine-induced psychotic disorder and 20 healthy subjects participated in this study. Severity of psychotic symptoms was measured prior to testing using the Brief Psychiatric Rating Scale (BPRS). Patients showed no deficit in NP, and the amount of their NP effect was not significantly different from healthy subjects. Besides, we did not find any correlation between the amount of NP effect and severity of symptoms. Our results may indicate that cognitive mechanisms underlying NP might not be affected in amphetamine psychosis.

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1. Introduction

Abuse of amphetamine may lead to a psychotic state which is typically identified with persecutory delusions and/or hallucinations. Contents of these delusions and hallucinations are very similar to those seen in paranoid schizophrenia (Bell, 1965; Snyder, 1973). Cognitive abnormalities have been well researched in schizophrenia. It has been observed that schizophrenic patients seem distractible and have a hard time focusing on a stimulus. Such observations have led to a hypothesis that the symptoms of schizophrenia such as hallucinations and delusions may be due to deficits in inhibitional processes (Frith, 1979). Since then, deficits in inhibitory processing of irrelevant information have been shown by a variety of paradigms (Baruch et al., 1988; Braff et al., 1992; Elkins and Cromwell, 1994; McDowd et al., 1993; Nestor et al., 1992; Steffy and Galbraith, 1974).

One of the paradigms used to investigate these processes is called negative priming (NP) (Tipper, 1985). NP is a normal phenomenon in which responses to an object are slower when the object is previously ignored (Tipper, 1985). Depending on the type of NP task, this slowing of reaction times (RTs) can occur due to conflicts between for example locations or identities of the target and the previous distractor. In a spatial NP task, when a target is presented in the location of the distractor of the previous trial, response time to that target will increase (Tipper and Cranston, 1985).

There are many studies showing reduced NP in schizophrenia patients (Beech et al., 1989; MacQueen et al., 2003; Park et al., 1996, 2002; Peters et al., 2000; Tipper et al., 1995; Ungar et al., 2010). There are also several studies showing that such impairments are associated with positive symptomatology in schizophrenia (Park et al., 2002; Peters et al., 2000; Williams, 1996).

As mentioned earlier, the symptomatology of amphetamine psychosis is similar to schizophrenia. Besides, amphetamine acts through the neurotransmitters such as dopamine (the most important), norepinephrine, and serotonin. This hyperdopaminergic state caused by amphetamine is similar to the dopamine hypothesis of schizophrenia. Based on studies like Gray et al. (1991), it is thought that dopaminergic action in limbic system plays an important role in attentional inhibition. Hyperdopaminergic state in schizophrenia and increased dopamine neurotransmission following amphetamine (a dopamine agonist) use may lead to a reduced level of inhibition (Gray et al., 1991, 1992). Taking these similarities into account, it seems necessary to examine attentional inhibition in amphetamine psychosis.

In some earlier studies, positive effects of amphetamine on cognitive performance such as in learning have been reported (Kornetsky et al., 1959; Seashore and Ivy, 1953; Soetens et al., 1995). However, this improvement of functioning has been observed only when the subjects were functioning below their potential level (like when subjects were fatigued). Moreover, in such studies, tasks have been conducted after acute brief administration of amphetamine. Thus, the mentioned positive effects in
street amphetamine users who use amphetamine in much higher
doses are not to be expected. On the other hand, there are many
research studies that have examined cognitive deficits in amphe-
tamine abusers, and have shown that they have impaired func-
tioning in many cognitive tasks such as memory, decision making
and manipulation of information tasks (Ornstein et al., 2000;
Rogers et al., 1999; Simon et al., 2000; Volkow et al., 2001).
Nevertheless, fewer studies have assessed NP in these people.
Salo et al. (2002) and Dafters (2006) examined NP as a measure of
inhibitory processing in amphetamine users (methamphetamine
and methylenedioxymphetamine (MDMA), respectively). They
used a color-word Stroop task for this purpose and compared
two measures between patients and controls: Stroop interference
and NP. As mentioned earlier, NP is the increased response time to
a stimulus in a trial, following previous exposure to that stimulus
in the previous trial. In contrast, color-word Stroop interference
occurs when the ink color is different from the color name in
one trial; this difference results in prolonged RT. Salo compared
a group of methamphetamine dependent individuals, which were
abstinent for the last 2–4 months, to a control group. She showed
intact NP and increased Stroop interference in amphetamine
dependents. Dafters did the same comparison between 3 groups:
MDMA users, cannabis and ecstasy users, and non-drug users.
MDMA users exhibited reduced level of NP, and no difference in
Stroop interference was observed between the three groups. These
studies were both done regardless of the presence or absence of
psychotic symptoms.

In the present study a spatial NP task was used to assess
attentional inhibition in a group of amphetamine-induced psy-
chosis patients. Knowing their similarities to schizophrenia and
the dopaminergic effects of amphetamine, we hypothesized that
patients with amphetamine-induced psychotic disorder would
show some level of NP impairment.

2. Methods

2.1. Subjects

Demographic characteristics of the patients and the controls are shown in
Table 1. The patients group consisted of 19 amphetamine-induced psychosis
patients (mean age: 33.42 years (S.D. = 5.02); 15 males) (after exclusions). Diagnoses
were made by attending psychiatrists according to DSM-IV criteria (American Psycho-
iatric Association, 1994), and confirmed by Persian version of Structured Clinical Interview
on SCID (Sharifi et al., 2009). All patients were on treatment with antipsychotic agents;
fourteen on risperidone (dose range 2–4 mg/day), four on olanzapine (5–15 mg/day),
two on haloperidol (10–20 mg/day), and one on trifluoperazine (5–15 mg/day). They
were abstinent for a minimum of 7 days and a maximum of 15 days. Patients outside
the age range 18–40 were excluded from the study; any change in the diagnosis and
any use of amphetamine during the hospitalization also led to exclusion. Twenty
normal subjects (mean age: 30.85 (S.D. = 5.82); 14 males) took part as the
control group. They were recruited from medical students, service staff, and
catering staff of the hospital. Participants in the control group had to have no history
of a major psychiatric illness (based on their own report) and not to use any
substance at the time of the experiment (with the exception of nicotine or caffeine).
Two subjects from the patients group were excluded because the diagnoses at

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients (n = 19)</th>
<th>Controls (n = 20)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)*</td>
<td>33.42 (± 5.02)</td>
<td>30.85 (± 5.82)</td>
<td>0.15</td>
</tr>
<tr>
<td>Gender (male: female)</td>
<td>14: 5</td>
<td>14: 6</td>
<td></td>
</tr>
<tr>
<td>Education (years)*</td>
<td>10.32 (± 2.36)</td>
<td>12.35 (± 6.39)</td>
<td>0.20</td>
</tr>
<tr>
<td>Duration of amphetamine abuse (years)*</td>
<td>2.59 (± 2.25)</td>
<td>–</td>
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</tr>
</tbody>
</table>

* Mean (± S.D.).
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