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ORIGINAL PAPER

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Divided and selective attention in panic disorder

A comparative study of patients with panic disorder, major depression and healthy controls

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Abstract *Objective* While depression is definitely a condition with diminished attentional functioning, there is little evidence as to whether attention is also disturbed in panic disorder. In the present study patients with panic disorder and with depression were compared by means of neuropsychological tests which assess selective and divided attention. *Method* Twenty-one inpatients with a Panic Disorder, 21 inpatients with a Major Depressive Disorder (DSM-IV diagnoses) and 20 healthy control subjects were investigated drug free. Neuropsychological standard tests were used to measure selective attention (Signal Detection, Wiener-Testsystem) and divided attention (Gesichtsfeld-/Neglectprüfung, TAP), which allow the discrimination between left and right visual field stimulus processing. *Results* Patients with panic disorder and depression responded significantly slower than healthy control subjects in the test for divided attention, while no differences were found between the two groups of patients. In contrast, there were no differences among the groups of patients and control subjects in regard to reaction time in the test for selective attention. Stimulus presentations in the left and right visual fields did not affect the reaction times differently. *Conclusions* Patients with panic disorder appeared as disturbed in their attentional functioning as patients with depression. Therefore, ignoring attentional deficits in patients with panic disorder is not justified.

Key words panic disorder · depression · selective attention · divided attention

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Introduction

The basic attentional functioning of patients with panic disorder has hardly been investigated. Hence, it is still unclear whether this cognitive function has to be considered when diagnosing and treating patients with panic disorder or when looking for pathogenetic factors of this disorder. In contrast, attentional biases in panic disorder have been assumed to be of importance by many research groups, leading to a great number of studies in which the biasing influences of anxiety-related stimuli on the speed of processing and on the distractibility were investigated (e. g., Ehlers et al. 1988; MacLeod et al. 1986; Becker and Rinck 2000). Therefore, we still do not know whether a panic disorder patient can focus, split and shift attention as reliably and flexibly as healthy individuals do, but we do know that a panic disorder patient is more easily distracted by an anxiety-related item.

The few neuropsychological studies, which, among other cognitive functions, have focused on attention, are quickly summarized. Asmundson et al. (1994) studied 18 patients with panic disorder, 18 patients with social phobia and 16 healthy individuals. They found the panic disorder patients impaired in measures of verbal learning and verbal recall, but not in those of visual memory, psychomotor speed, cognitive flexibility and concentration. In a study of Gladsjo et al. (1998) on 69 patients with panic disorder and 19 normal individuals, there were no group differences in many neuropsychological domains including attention, learning, memory, visuospatial functioning and psychomotor speed. Purcell et al. (1998), whose main interests were the neuropsychologi-

cal deficits in obsessive-compulsive disorder patients (n = 30), also examined 30 patients with panic disorder, 20 patients with unipolar depression and 30 healthy control subjects using a neuropsychological test battery, which assessed executive, visual memory and attentional functions. They could not observe neuropsychological deficits in the panic disorder patients. Recently, Dupont et al. (2000) published a pilot study on 12 patients with panic disorder and agoraphobia and 22 normal controls. There were, at worst, mild attentional deficits in the patients assessed in a visual target discrimination task.

The overall impression from these studies is one of no major attentional problems in panic disorder. Although this might be true, such a conclusion seems to be premature for two reasons. First, many of the panic patients studied were only slightly to moderately ill. It is well known that many neuropsychological alterations become manifest only in severe forms of the respective mental disorder. Hence, in the present study we investigated an inpatient sample of panic disorder patients in order to assess individuals with severe syndromes. The German health care system offers inpatient treatment only to the most severely handicapped patients with panic disorder who are no longer able to meet the demands of daily life. Second, the tests of attention, used so far in panic disorder patients, have often been part of a neuropsychological test battery. These tests focus mainly on psychomotor speed and selective attention. However, complex tasks which test the limits of attentional capacity with higher loads have not yet been frequently used in patients with panic disorder. Therefore, in addition to selective visual attention, we also studied divided attention by a visual dual-task paradigm in order to test the limits of the attentional capacity for the visual system.

Since depressed patients are known to have substantial attentional problems (Beblo and Herrmann 2000), we compared panic disorder patients with these clinical controls in addition to healthy controls. Furthermore, by taking into account that there is a right hemispheric preponderance in the control of attention (Mesulam 1985) and a right frontal hemispheric hyperactivity in panic disorder (Wiedemann et al. 1999) we used tests that allow for the discrimination between the attentional performance in the left and right visual field.

Methods

Subjects

The participants of the study were 21 inpatients with a current Panic Disorder either with (n = 16) or without (n = 5) Agoraphobia, 21 inpatients with a current Major Depressive Disorder (diagnoses according to DSM-IV; American Psychiatric Association, 1994) and 20 healthy control subjects. The panic disorder patients with and without agoraphobia were not tested for differences because of the low number of the latter.

The patients were consecutively recruited at admission for inpatient treatment in a psychiatric hospital. The patients were diagnosed by an experienced psychiatrist by applying the International Checklists for DSM-IV (Hiller et al. 1997). One major focus of the diagnostic procedure was to exclude a present or life-time co-morbidity of panic disorder and depression in every case. Furthermore, any indication of a change in the diagnosis during the inpatient treatment led to a-posteriori exclusion. Further exclusion criteria were present or life-time diagnoses of additional mental disorders. All patients studied were drug-free. In case of prior medication, a drug washout period of a minimum of 6 days was conducted, the exact duration of which was at least three times the half-life of the respective drug and its active metabolites. All patients were studied within two weeks after admission. Patients, potentially suitable for inclusion, were referred to the investigator from all wards for verification of the diagnosis and explanation of the study. Two thirds of the pre-selected patients approached were either not suitable due to additional or unclear diagnoses or refused to participate in the study. The same exclusion criteria as used for the panic disorder and depressed patients were applied by the same rater for the healthy control subjects; this time, of course, the presence of Major Depressive Disorder or Panic Disorder also led to exclusion. The healthy control subjects were staff members and were paid for participation.

Sixty-six percent of the panic disorder patients, 57 % of the depressed patients and 60 % of the healthy controls were women; these frequency differences between groups were far from being significant (Chi-Square = 0.422, P = 0.810). The mean ages were 30.05 years (SD = 7.65) for the panic disorder group, 39.00 years (SD = 9.81) for the depressed patients and 34.60 years (SD = 9.05) for the healthy control group, which differed significantly ($F_{2/59} = 5.339$, P = 0.007). The difference was due to the fact that the panic disorder patients were significantly younger than the patients with major depressive disorder (t = 3.298, P = 0.002). The severity of the two disorders was quantified by the Hamilton Anxiety Scale (HAMA; Hamilton, 1959) and by the Hamilton Depression Scale (HAMD; Hamilton 1960). The mean scores for the total HAMA were 32.38 (SD = 9.08) for the panic disorder patients and 21.19 (SD = 9.24) for the depressed patients, which differed significantly from each other (t = –3.957, P < 0.001). The mean scores for the HAMD were 17.48 (SD = 6.90) for the panic disorder patients and 23.57 (SD = 6.37) for the depressed patients, which also differed significantly (t = 2.976, P = 0.005) but in the opposite direction. For the quantitative assessment of symptoms related to panic disorder and agoraphobia, the Panic and Agoraphobia Scale (PAS; Bandelow 1997) was used in the form of an observer rating. The mean scores for the PAS were 30.62 (SD = 8.96) for the panic disorder patients and 2.90 (SD = 4.00) for the depressed patients, which differed significantly (t = –12.939, P < 0.001).

The protocol was approved by the ethics committee of the medical faculty of the University of Marburg; all subjects gave written informed consent.

Apparatus and procedure

The sessions started at 3.00 p. m. First the subjects filled out questionnaires not reported on here. The attention tests always followed in the order divided attention before selective attention. The tests were presented on a 17 inch computer screen. The subjects sat upright in front of the screen on a chair, which was adjusted to a level which insured that the nasion was at a distance of 50 cm from the center of the screen. The screen was set on a table, on which the two response panels for the two tests were positioned so that the subjects could easily handle the response buttons by using the dominant hand.

Divided attention

The test used is part of the "Testbatterie zur Aufmerksamkeitsprüfung" (TAP; Zimmermann and Fimm 1993) and called "Gesichtsfeld-/Neglectprüfung". It is a dual-task paradigm. Task 1 requires the subjects to read aloud changing letters presented just in the center of the computer screen. Task 2 requires the subjects to monitor the screen for a flickering stimulus. The stimulus consists of rapidly changing numbers (time of presentation: 10 ms), which are presented in one of the four quadrants of the screen. The quadrant of presentation alternates randomly in a way that all four quadrants are used with the

same probability. Consequently, the 44 stimuli are presented with an equal frequency of 11 in each quadrant. The site of presentation in each quadrant varies, too. The stimulus of changing numbers is embedded in a mask of not changing numbers all over the screen. The subjects are required to press a response button as quickly as possible when the flickering starts. The stimulus is on for a maximum of three seconds.

Selective attention

The test used is part of the "Wiener Testsystem" and called "Signal-Detection". A varying pattern of dots is presented on the computer screens. A small portion of all dots disappears on one site and reappears on another at intervals of 750 ms. This leads to a stepwise change of the pattern of dots. The target stimulus is a square of dots within the overall pattern of dots; all other dot configurations are non-target stimuli or noise. The target stimuli are presented in each quadrant of the screen with the same probability. The subjects are required to respond as quickly as possible to the target stimulus, that is to the formation of a square. There are 60 presentations of the target stimulus.

Statistics

As measures for the two attention tests the median of the reaction times over the trials and the number of correct responses were calculated separately for the stimulus presentations in the left and right visual fields. In speed tests with a low task difficulty, like those used in the present study, the measure of interest is the reaction time. Accordingly, the number of correct responses is used only for descriptive statistics.

Differences among all three groups (panic disorder, depression, healthy control) and the two visual fields (left, right) were evaluated by two-factorial analyses of variance with one group factor and one factor of repeated measurements. t tests were used to compare two groups (independent sample) or visual fields (dependent sample). Two-tailed tests were used throughout. The α-level was set at 0.05.

Results

The basic statistics of the reaction time and the number of the correct responses are given in Figs. 1 and 2 and in Table 1. The patients with panic disorder reacted slightly faster than the patients with a major depressive disorder but clearly slower than the healthy controls in the test for divided attention ($F_{2/59} = 6.12$, $P = 0.004$; Fig. 1). The panic disorder patients differed from the healthy controls in their reaction times both for the left ($t = 2.121$, $P = 0.040$) and for the right ($t = 2.188$, $P = 0.036$) visual field but were not different compared to the depressed patients (left field: $t = 1.417$, $P = 0.165$; right field: $t = 1.427$, $P = 0.161$). The depressed patients were also significantly slower than the healthy control subjects (left field: $t = 3.123$, $P = 0.004$; right field: $t = 3.807$, $P = 0.001$). There was no difference between the reaction times for stimulus presentations in the left and right visual fields ($F_{1/59} = 0.02$, $P = 0.882$). The interaction 'group x visual field' was also not significant ($F_{2/59} = 0.15$, $P = 0.863$).

In contrast, the three groups (panic disorder, depression, healthy control) appear very similar in their reaction times in the test for selective attention, as seen in Fig. 2. This impression is corroborated by the lack of significance for the group factor ($F_{2/59} = 2.07$, $P = 0.136$).

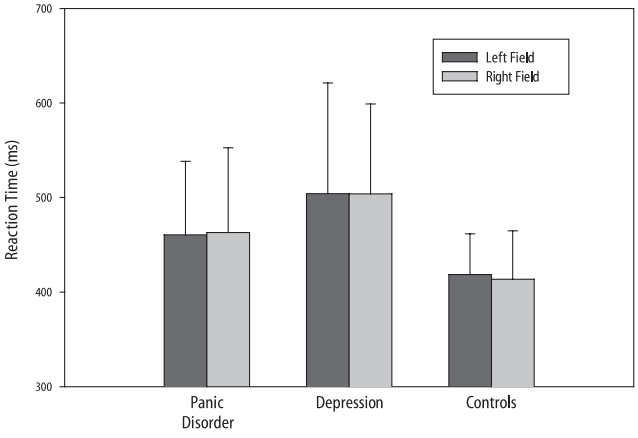

Fig. 1 Mean (+ SD) of the reaction times in the test for divided attention for the patients with panic disorder (n = 21) and major depressive disorder (n = 21) as well as for healthy controls (n = 20)

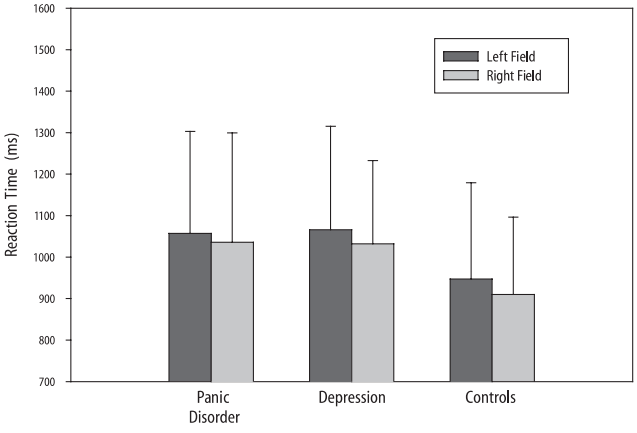

Fig. 2 Mean (+ SD) of the reaction times in the test for selective attention for the patients with panic disorder (n = 21) and major depressive disorder (n = 21) as well as for healthy controls (n = 20)

Table 1 Number of correct responses in the tests for divided and selective attention (mean ± SD) of the patients with panic disorder (PD) and major depressive disorder (MDD) as well as of the healthy controls (HC) given separately for stimulus presentation in the left and right visual field

	Left Visual Field	Right Visual Field
Divided Attention	PD: 20.14 ± 4.68 MDD: 21.24 ± 0.62 HC: 21.25 ± 0.44	PD: 20.19 ± 4.65 MDD: 21.10 ± 0.62 HC: 21.20 ± 0.41
Selective Attention	PD: 26.38 ± 4.62 MDD: 25.67 ± 3.48 HC: 28.75 ± 3.08	PD: 23.52 ± 4.80 MDD: 23.62 ± 3.41 HC: 24.95 ± 2.35

Similar to the results in the test for divided attention, neither the main effect of visual field ($F_{1/59} = 2.09$, $P = 0.154$) nor the interaction 'group x visual field' ($F_{2/59} = 0.05$, $P = 0.947$) were significant.

Discussion

The major finding of the present study is that panic disorder patients showed attentional deficits – quite similar to depressed patients – when tested by a visual dual-task paradigm for divided attention, whereas they were normal in a single-task paradigm for selective attention. One might conclude that the task-related load on the attentional capacity is of critical importance when testing panic disorder patients for attentional deficits.

The similarity of the attentional deficits in the panic disorder patients to those in the depressed patients is the more noteworthy as the panic disorder patients (average age of 30 years) were significantly younger than the depressed patients (average age of 39 years). Therefore, it is very likely that we did not overestimate the attentional problems of the panic disorder patients.

Since we used standard neuropsychological tests for selective and divided attention, which differ in more than the aspect of being single-task or dual-task paradigms, it is not compelling to state that panic disorder patients – as do depressed patients – show attentional problems in complex tasks at their limits of attentional capacity and appear undisturbed in less capacity demanding tasks. Nevertheless, it is true that the dual-task paradigm for divided attention required the subjects to monitor two visual stimuli, which attracted capacity within the same attentional system, and, thereby, very likely produced a higher attentional load than our visual single-task paradigm for selective attention.

Of course, the idea that panic disorder patients only have attentional problems, not present in healthy subjects, when tasks use a large portion of the capacity of attentional systems requires corroboration. However, this hypothesis could also explain why attentional deficits have infrequently been found in earlier studies (Asmundson et al. 1994; Gladsjo et al. 1998; Purcell et al. 1998; Dupont et al. 2000). The attentional tests used were often part of neuropsychological test batteries and had simple rather than complex demand characteristics.

Another reason for the attentional deficits found in our study in contrast to earlier investigations might be that we investigated a sample of severely ill inpatients with panic disorder. The latter can be derived from the extraordinarily high values in the Hamilton Anxiety Scale and the Panic and Agoraphobia Scale with a mean of 32.38 and 30.62 respectively, which are clearly higher than the average values of 24.5 and 28.9 given by Bandelow (1997) for outpatients with panic disorder and agoraphobia patients before treatment. Consequently, it could be assumed that only strongly affected patients with panic disorder could suffer from attentional problems, especially in complex tasks. This hypothesis, of course, also needs corroboration in further studies.

There were no differences between the two visual half fields in favoring stimulus processing, neither in general nor in any of the three groups (panic disorder, depression, healthy controls). Hence, the right frontal hemispheric hyperactivity found in some panic disorder patients (Wiedemann et al. 1999) and the left frontal hemispheric hypoactivity found in some depressed patients (Henriques and Davidson 1991) did not lead to any processing advantage or disadvantage for either of the visual half fields.

In summary, in the present study panic disorders patients showed, in a similar fashion to patients with major depressive disorder, attentional deficits which only became obvious in a dual-task paradigm for divided attention but not in a single-task paradigm for selective attention.

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