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The impact of neutral and emotionally negative distraction on memory performance and its relation to memory complaints in major depression

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ABSTRACT

Patients with major depression (MDD) often report relevant cognitive problems in everyday life while performance in standardised neuropsychological tests is not severely disturbed. This discrepancy may partly be due to the differences between the demands of everyday life with the presence of emotionally relevant distractors and standardised neuropsychological settings without those distractors. In the present study, we hypothesise that patients with major depression (MDD) show an increased distractibility towards emotionally negative stimuli and that this distractibility is related to complaints of cognitive functioning in everyday life. Thirty MDD patients and 48 healthy participants performed our recently developed learning paradigm with neutrally and negatively valenced distraction as well as without distraction. Both groups also performed a neuropsychological test battery as well as self- and observer ratings of impairments in memory and attention in every day life. In the MDD sample, cognitive impairments were reported by the patients and their relatives but were not found in the neuropsychological tests. We found a trend towards a poorer memory performance with negatively valenced distraction in the MDD sample when compared to the performance of healthy subjects. However, this impairment was not related to the self- and observer ratings. This result may be due to the fact that the distractors were not personally relevant to the subjects whereas everyday life implies such distractors. Further research is needed to explore everyday cognitive functioning of patients with MDD.

1. Introduction

Neuropsychological impairment is regarded as a key feature of major depression (MDD) (World Health Organization, 1991; American Psychiatric Association, 1994). Ebmeier et al. (2006) concluded that these impairments are responsible for much of the MDD morbidity and have important clinical implications including strategies for treatment. Indeed, self-reports and reports by patients' relatives indicate severe disturbances of memory and attention in MDD (Lahr et al., 2007). However, it is surprising that severe impairments are not found in neuropsychological studies using standardised tests. In meta-analyses, moderate deficits with no more than one standard deviation below the means of healthy control subjects were reported — specifically in the areas of executive functions, memory and attention (Christensen et al., 1997; Veiel, 1997). Furthermore, subjective complaints often do not predict failure in objective tests (Mowla et al., 2008). It is still a matter of debate why the reported severe dysfunctions are not confirmed with neuropsychological tests. It seems possible that patients overestimate objective deficits. An alternate explanation focusses on the differences between neuropsychological settings and the demands of everyday life.

In a previous study of our group (Lahr et al., 2007), the patients' self- reported deficits of memory and attention exceeded their relatives' ratings. This finding supports the notion that patients indeed may exaggerate their deficits. However, we also found the ratings of the patients' relatives clearly exceeded the impairments found by neuropsychological test measures. This result argues for the possibility that differences between subjective and objective measures may be explained by the differences between neuropsychological settings and the demands of everyday life.

One striking difference between everyday life and neuropsychological settings is the presence of distracting stimuli (Potter and Hartman, 2006). Whereas neuropsychological tests usually have to be presented under laboratory conditions (Lezak, 1995), distracting noise or other conflicting information are usually present in everyday life. Consequently, the success of purposive information processing also

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depends on the ability to inhibit interfering information. In accordance with this assumption, Potter and Hartman (2006) hypothesised that poorer performance on tests of executive functions, such as inhibition, would be associated with higher levels of memory complaints in everyday life. They reported that decreased response inhibition in depressed patients as assessed by means of the Stroop-paradigm predicted memory complaints, even after controlling for memory performance. The authors concluded that the memory problems reported by depressed patients are possibly related to difficulty inhibiting distraction from irrelevant information in everyday life.

With regard to inhibition, impaired performance in the Stroop task was found in MDD patients (Schatzberg et al., 2000; Harvey et al., 2004). However, many studies did not find a general inhibition problem in depressed patients (Degl'Innocenti et al., 1998; Murphy et al., 1999; Markela-Lerenc et al., 2006). There is some evidence that cognitive changes in depression are more obvious with affectively meaningful stimuli (Erickson et al., 2005). Lau et al. (2007) concluded that inhibitory dysfunction in MDD patients is most likely valence-specific. In their study, patients with MDD, healthy controls and a clinical control group (non-depressed, anxious patients) were compared with regard to a measure of cognitive inhibition (Prose Distraction Task, PDT), and a measure of motor response inhibition (Stop-Signal Task, SST). Both tasks were modified in order to present emotionally valenced semantic stimuli. No group differences were revealed in the SST but participants with MDD demonstrated impairments on the PDT, and these impairments were most pronounced for negatively valenced adjectives. Similarly, Goeleven et al. (2006) found that depressed patients showed a specific problem inhibiting negative information in a priming task with pictures of sad and happy facial expressions. A specific inhibition problem with negative distraction is in accordance with an attentional bias towards negatively valenced information in MDD patients. This bias may also lead to an enhanced memory for negatively valenced emotional material (Leppanen, 2006).

In the present study we hypothesise, first, that the everyday problems reported by MDD patients and their relatives exceed their impairments in neuropsychological tests and that self-reports indicate greater disturbances than their relatives' ratings. Second, we are interested in the investigation of inhibitory functions in MDD patients. We hypothesise that patients with MDD when compared to healthy control subjects show poorer performance in a recently developed learning paradigm (Beblo et al., 2006) when emotionally negative distractors are presented. By contrast, we expect the MDD patients' performance to be unimpaired when learning stimuli are presented with neutral or no distraction. Third, we hypothesised that the problems of MDD patients with inhibiting negatively valenced, irrelevant information is related to self-reported cognitive impairments in every day life.

2. Methods

2.1. Subjects

Thirty patients with MDD and 48 healthy control subjects were included in the study. Patients were treated for MDD as inpatients in the Clinic of Psychiatry and Psychotherapy Bethel, Ev. Hospital Bielefeld. All patients met the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) criteria of MDD as assessed by trained psychotherapists within the first week of admission. Healthy subjects were recruited by advertisement in a local newspaper.

Exclusion criteria for participation in the study were co-morbid Axis I disorders, apart from anxiety disorders and somatisation. In addition, patients with MDD with psychotic symptoms and patients with borderline personality disorder were excluded as well as patients with severe somatic disorders such as neurological disorders with central nervous system involvement or mental retardation. Healthy control subjects were free of any Axes I and II morbidity. None of the subjects had abused drugs or alcohol within the 6 months before testing. After complete explanation of the study, written informed consent was obtained from all subjects. The study was accepted by the IRB (University of Muenster Ethics Committee).

2.2. Instruments

2.2.1. Clinical examination

Psychiatric diagnosis was made using the Structured Clinical Interviews for DSM IV, SCID I for Axis I disorders, and SCID II for personality disorders (Wittchen et al., 1997). The interviews were given by trained psychotherapists. Severity of depressive symptoms was assessed by means of the Beck Depression Inventory (BDI, Beck and Steer, 1994).

2.2.2. Inhibition

Trained neuropsychologists administered the neuropsychological tests (2.2.2. and 2.2.3.) during the same week subjects underwent psychiatric examination.

2.2.2.1. Learning performance with neutral and emotional distraction (Beblo et al., 2006). Subjects learned three lists (A, B and C) of 15 simple words, taken from the Auditory Verbal Learning Test (AVLT; Rey, 1964; Spreen and Strauss, 1998). Each list was presented three times and each learning trial was followed by an immediate free recall. Subjects had to learn the lists under three different conditions. The assignment of the 3 learning conditions (1 to 3) to the three word lists (A to C) was randomised and the word lists were displayed in the same order (A–B–C).

First condition (standard condition): subjects learned a word list (e.g., word list A) without distraction.

Second condition (neutral distraction condition): target words of a different list (e.g., word list B) were presented alternating with irrelevant words of neutral valence (distractors). Target words were spoken by a female voice, distractors by a male voice. Subjects were instructed to ignore the distracting words as best they could. For the three learning trials, 45 different neutrally valenced distractors were used (15 distracters for each learning trial).

Third condition (negative distraction condition): condition 3 corresponded to condition 2, but a different list (e.g., word list C) and 45 different distractors with negative emotional valence were used.

The duration of one learning trial in each condition was 30 s. Words were presented via ear coils from a standard portable compact disc (CD) player.

Pre-tests with the three word lists showed similar results. The distractors were taken from Borsutzky et al. (unpublished). This study provides statistical norms of 551 German nouns, considering the word's familiarity, emotional valence, imagery and frequency. Based on norm data, we tested the valence (subjective emotional valence, raging from “very negative = 1” to “very positive = 5”) of the selected 45 negative and 45 neutral words. The 45 negative distractors were identified as obviously negative in the pre-test ($M = 1.43$, S.D. = 0.12), while the 45 neutral distractors were judged as neutral ($M = 2.97$, S.D. = 0.03). Both word types clearly differed with regard to their valences ($t_{88} = -78.3$; $P < 0.001$).

2.2.2.2. Working memory performance with and without distraction. Immediate memory spans were assessed by the Digit Span Forward of the Wechsler Memory Scale — revised (Wechsler, 1987). In this test, subjects have to repeat a series of digits in a given order. The number of correctly recalled digit spans is assessed. For assessing working memory including distracting stimuli that must be suppressed, we administered the Digit Suppression Test (DST; Beblo et al., 2004). In the DST every second digit of a series of orally presented digits has to be reproduced, beginning with the first digit. The number of correctly recalled digit spans is then assessed.

Immediate nonverbal memory spans were assessed by the Corsi Block Tapping Test (Corsi, 1972). In this test, subjects have to repeat a series of blocks tapped by the examiner. These blocks are irregularly arranged on a board. For assessing nonverbal working memory including distracting stimuli that have to be suppressed, we administered a modified version of the Corsi Block Tapping Test, the Block Suppression Test (BST; Beblo et al., 2004). Subjects are asked to reproduce every second block, of a series of blocks tapped by the examiner, beginning with the first block.

2.2.3. Further neuropsychological assessment

2.2.3.1. Memory. For the additional assessment of verbal memory, the subtest “Logical Memory” of the Wechsler Memory Scale — Revised (Wechsler, 1987; Haerting et al., 2000) was administered. In this test, the subjects have to recall two short stories as accurately as possible. Recall performance is assessed immediately after each story is given (immediate recall) and after 20 min (delayed recall). For nonverbal memory, the Complex Figure Test (Rey, 1941) was applied. In this test, subjects have to recall and to draw a complex figure which they had been shown and had copied by the subjects 30 min prior.

2.2.3.2. Attention. Reaction time was assessed by means of the subtest “Alertness” of the computerised “Test-Battery of Attentional Performance” (Testbatterie zur Aufmerksamkeitspruefung, TAP; Zimmermann and Fimm, 1992). In this test, subjects have to press a button as fast as possible when a cross appeared on the screen. The subtest “Go–Nogo” assesses response selection and response inhibition. Two different crosses — one target and one distractor — are presented in random order. The subjects have to respond to the target as quickly as possible. For the assessment of divided attention, in the subtest “Divided Attention” subjects have to respond to visually and auditory presented targets. Visuomotor tracking was assessed by means of the Trail Making Test (TMT), part A (Reitan, 1992). In the TMT A subjects have to connect 25